M. L. MURPHY * VOL. 1 * PH.D.


PH.D.
1999
THS
070
134

This is to certify that the

dissertation entitled

CHANGING HUMAN BEHAVIOR: THE CONTRIBUTION OF THE WHITE PAINTINGS ROCK SHELTER TO AN UNDERSTANDING OF CHANGING LITHIC REDUCTION, RAW MATERIAL EXCHANGE, AND HUNTER-GATHERER MOBILITY IN THE INTERIOR REGIONS OF SOUTHERN AFRICA DURING THE MIDDLE AND EARLY LATE STONE AGE

presented by

MICHAEL LEE MURPHY

has been accepted towards fulfillment
of the requirements for

DOCTOR OF PHILOSOPHY degree in Department of Anthropology

Lawrence H. Robbins
Major professor

Date 5/11/99

CHANG
PAINT
ITHIC I
MOBILIT

CHANGING HUMAN BEHAVIOR: THE CONTRIBUTION OF THE WHITE PAINTINGS ROCK SHELTER TO AN UNDERSTANDING OF CHANGING LITHIC REDUCTION, RAW MATERIAL EXCHANGE, AND HUNTER-GATHERER MOBILITY IN THE INTERIOR REGIONS OF SOUTHERN AFRICA DURING THE MIDDLE AND EARLY LATE STONE AGE

VOLUME I

By

MICHAEL LEE MURPHY

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Anthropology

1999

CHANG
PAINT
LITHIC F
MOBILIT

Do

behavio

of the

Current

hiatus

humans

informa

importa

of the

Th

transi

Painti

discus

assemb

lithic

assemb

differ

techni

conclu

ABSTRACT

CHANGING HUMAN BEHAVIOR: THE CONTRIBUTION OF THE WHITE PAINTINGS ROCK SHELTER TO AN UNDERSTANDING OF CHANGING LITHIC REDUCTION, RAW MATERIAL EXCHANGE, AND HUNTER-GATHERER MOBILITY IN THE INTERIOR REGIONS OF SOUTHERN AFRICA DURING THE MIDDLE AND EARLY LATE STONE AGE

By

MICHAEL LEE MURPHY

Documenting archaeological evidence of "modern" human behavior is of critical importance in examining the problem of the origins of anatomically modern humans in Africa. Current research has suggested that there is a significant hiatus between the appearance of anatomically "modern" humans and "modern" human behavior. It is clear that information from the later MSA and early LSA is of critical importance in examining this issue, yet this period is one of the most inadequately known in African prehistory.

This dissertation describes the later MSA, the transitional MSA/early LSA and the early LSA of White Paintings Rock Shelter (WPS) in the Kalahari Desert and discusses pertinent data from other regional sites with assemblages spanning like time periods. Comparison of lithic reduction strategies of the MSA and early LSA assemblages from WPS are used to assess to what degree differences and/or continuity exists in lithic manufacturing techniques between the archaeological assemblages. I conclude that continuity exists in reduction of local

quartz(i

are evide

Dur

conducted

long dis

during t

suspecte

systemat

several

explain

the Kala

networks

clarify

and exch

with pal

In

land use

Kalahari

mobility

implica

during

pattern

conclude

MSA and

Basin.

quartz(ite) raw materials, while distinct reduction patterns are evident in non-local raw material reduction.

During the last decade, archaeological research conducted in the Kalahari has indicated the existence of long distance exchange networks for lithic raw materials during the MSA and LSA, however, the characteristics of the suspected prehistoric exchange systems have not as yet been systematically and cogently studied. This study offers several hypotheses and attempts to formulate models to explain the nature as well as patterns of the evolution of the Kalahari Desert prehistoric long distance exchange networks. Using a heuristic approach this study helps clarify some of the aspects of the dynamics of past social and exchange systems in the study area and correlates them with paleoclimatic data.

In the final portion of this dissertation, I examine land use systems of MSA and early LSA peoples in the Kalahari Desert. A major objective was to assess the mobility strategies utilized through time and assess the implications in terms of hominid behavioral capabilities during the MSA and early LSA. Further, I correlate mobility patterns with the shifting paleoenvironmental conditions and conclude that the "modern" behavioral boundary between the MSA and the early LSA does in fact exist in the Kalahari Basin.

Thi
Murphy,
Murphy a
inspired
given me
children
world ha
inspirat

DEDICATION

This dissertation is dedicated to my wife Lark Ann Murphy, my son Alex Lee Murphy, my daughter Cassandra Lin Murphy and my dear friend the late Alex Matseka. Each has inspired me to achieve the most in my life. My family has given me constant support and encouragement and my children's insatiable desire to discover and learn about our world has been my biggest challenge as well as my inspiration.

The

possible

individua

members

Lawrence

William

special

introduc

unforget

and made

availabl

I

apprecia

their h

taught

along i

for Bot

treatin

memorab

I

Brook a

the de

sedime

Klein

Univer

ACKNOWLEDGEMENTS

The completion of this dissertation would not have been possible without the support and assistance of many individuals. The comments and suggestions provided by the members of my dissertation committee, consisting of Dr. Lawrence Robbins (Major Advisor), Dr. Helen Pollard, Dr. William Lovis, and Dr. William Derman were very helpful. A special thanks must be given to Dr. Lawrence Robbins who introduced me to African archaeology, took me on five unforgetable adventures to the Kalahari Desert of Botswana and made the collections on which this analysis is based available.

I would also like to express a great deal of appreciation to Alec and Judy Campbell for welcoming me into their home and treating me as one of their family. Alec has taught me so much about African archaeology and how to get along in the "bush" and he has instilled in me a real love for Botswana. I would also like to thank Naill Campbell for treating me like a brother and making my visits very memorable.

I would like to express appreciation to Dr. George Brook and Andrew Ivester of the University of Georgia for the detailed paleoenvironmental reconstruction of the WPS sediments. I would also like to acknowledge Dr. Richard Klein of Stanford University, Dr. Richard Milo of the University of Chicago, and Dr. Kathlyn Stewart of the

Canad

analy

Scien

perso

Gabor

allow

be d

Art

dese

equi

woul

laws

over

sup

thi

bec

hav

las

Cas

co

Canadian Museum of Nature, Ottawa, for the WPS faunal analysis utilized in this study.

I would like to express thanks to the National Science Foundation for funding this research and the personnel of The Botswana National Museum and Art Gallery in Gaborone for all of their assistance, especially for allowing the work upon which this analysis is based to be done under the permit of the Botswana National Museum and Art Gallery to do research at Tsodilo.

Dr. Janet Brashler of Grand Valley State University deserves special mention for providing the photographic equipment for the figures presented herein. Furthermore, I would like to give special recognition to my parents and in-laws for all the help and encouragement that they offered me over the years.

Finally, I would like to thank my wife, Lark, for supporting me throughout the analysis and preparation of this manuscript and encouraging me to pursue my dreams of becoming an archaeologist. I know in my heart that I could have never reached my goals without her (Lark, I Love You!). Lastly, I want to again recognize my children Alex and Cassandra for giving "Daddy" the time to finally finish up his study of the "Tool Stones". While this dissertation could not have been completed without the help of the aforementioned individuals, the full responsibility of what appears in this manuscript is mine alone.

Michael Lee Murphy

TABLE OF CONTENTS

CHAPT
THE N
EARLY

CHAP
SOUT
AND

CHA
CHA
MAT
AT

CHA
PRE

API
AN

AP

AP

AP

TABLE OF CONTENTS CONTINUED

APPENI

BIBLI

TABLE OF CONTENTS CONTINUED

Tabl

Tabl

Tabl

Tabl

Tab

Tab

Tab

Tab

Tab

Tal

Ta

Ta

Ta

Ta

T

T

LIST OF TABLES

Table

Tabl

Tabl

Tabl

Tab

Tab

Ta

Ta

Ta

Ta

T

T

LIST OF TABLES CONTINUED

LIST OF TABLES CONTINUED

LIST OF TABLES CONTINUED

Tabl

Tabl

Tabl

Tabl

Tabl

Tab

Tab

Tab

Tab

Tab

Tal

Tal

Ta

Ta

Ta

Ta

Ta

T

T

LIST OF TABLES CONTINUED

LIST OF TABLES CONTINUED

LIST OF FIGURES

LIST OF FIGURES CONTINUED

Figur

Figur

Figur

Figu

Figu

Figu

Fig

Fig

Fig

Fi

LIST OF FIGURES CONTINUED

Intro

inter

The r

throu

Yell

196

197

peri

cult

trad

Saha

or

unt

con

Sa

St

Ca

Af

Ea

CHAPTER I

INTRODUCTION AND BACKGROUND

Introduction:

During the last three decades there has been increasing interest in the Stone Age archaeology of sub-Saharan Africa. The region's archaeological potential has been demonstrated through work by Blumenschine et al. (1993, 1996), Brooks and Yellen (1977, 1980, 1987), Brooks et al. (1995), J.D. Clark (1969, 1974, 1975) Deacon (1984), Dunnell (1986), Isaac (1975, 1976, 1977), Toth (1982, 1987) and others. The periods represented span the entire range of hominid cultural adaptations beginning with Oldowan and Acheulian traditions, often termed Early Stone Age (ESA) in sub-Saharan Africa. This was followed by the Middle Stone Age or (MSA) and then the Late Stone Age (LSA) which continued until early Iron Age times or even to the time of European contact in some regions.

Fossil and genetic evidence suggests that modern *Homo sapiens* evolved in sub-Saharan Africa during the Middle Stone Age (Stringer and Andrews 1988; Cann et al. 1987; Cann 1987, 1988; Klein 1995). Whether or not the "Out of Africa" theory is proven correct, an understanding of the Early Stone Age/Middle Stone Age transition in Africa is critical to the explanation of the nature of the technological and behavioral changes that accompanied this important interface. The second major transition is from the M

witnes

art,

micro

of th

human

meas

occu

30,0

and

rath

Clar

Mitc

Vol

add

USA

of

Af

in

li

cr

15

the Middle Stone Age (MSA) to the Late Stone Age (LSA) which witnessed, among other features, the development of symbolic art, elaborate bone tools, items of personal adornment, microlithic tool and blade technology, and ritual treatment of the dead, which when combined, indicate truly "modern" human behavior. In southern Africa, it is difficult to measure these critical changes, as few sites have occupations dating to the intervening periods (ca. 50,000-30,000 B.P.). Those that do have them are widely dispersed and often show a gradual transition and some continuity, rather than abrupt technological change (Avery et al. 1997; Clark 1997; Deacon 1984; Kaplan 1989; Klein 1989, 1995; Mitchell 1994; Singer and Wymer 1982; Thackeray 1989; Volman 1984).

The overall "macro problem" in the region which is addressed in this dissertation is related to the MSA/early LSA transition and how this period is related to the issue of the origins of "modern" human behavior in southern Africa. The White Paintings Shelter is one of the few sites in southern Africa that affords an opportunity to shed new light on this problem as it has assemblages spanning this critical period. This dissertation focuses on the MSA/early LSA transition as witnessed at the White Paintings Shelter (WPS) and compares these data with other widely dispersed regional sites. The information presented here will provide a much needed regional synthesis, and examine the contribution that rock shelters can make to an understanding of ch

acqui

late

Kalak

This

the

Age/

Age

esti

and

inte

mat

occ

ret

fro

to

al

th

sp

th

th

s

c

c

of changing lithic reduction techniques, raw material acquisition and hunter-gatherer mobility patterns during the late MSA and early LSA time periods.

The White Paintings Shelter, located in the northwest Kalahari Desert of Botswana, shall be used as a case study. This rock shelter has an archaeological sequence spanning the Middle Stone Age, the transitional Middle Stone Age/Early Late Stone Age, the Late Stone Age, the Early Iron Age and Historic periods. This sequence, which spans an estimated 103,000 years, has the potential to help clarify and correlate data from other archaeological sites in the interior regions of southern Africa and help explain the nature of the technological and behavioral changes that occurred across the MSA/LSA boundary.

This study included a basic analysis of all the retouched tools, cores, debitage and non-chipped lithics from 21 square m of excavated area ranging in depth from 130 to 700 cm. A more detailed analysis was then performed on all lithics from the six units that sample the early LSA, the MSA/LSA transition and the Upper MSA at WPS. These specific cultural/stratigraphic units formed the core of this analysis; however, I also provide a general summary of the entire WPS sequence. All of the retouched tools were subjected to a series of standard measurements to allow comparison within the site and between WPS and other regional sites with archaeological samples from similar contexts.

behav

prefe

place

rela

indu

WPS

hori

line

stor

she

and

the

and

Afr

fi

in

be

K

19

(

T

I

The analysis focused on changes in stone knapping behavior and raw material acquisition patterns or preferences through time at WPS. Also addressed was the placement of the WPS assemblage temporally and in relationship to other known regional artifact assemblages or industries.

To examine the problem of artifact distribution, the WPS lithic material were analyzed both vertically and horizontally both within and outside of the shelter drip line. This correlated information yielded data on areas of stone knapping and other activities at the site, as well as shed new light on changes in raw material procurement, trade and tool fabrication characterizing the Middle Stone Age, the Transitional MSA/early LSA, and the early LSA at WPS and, more generally, in the interior regions of southern Africa. Finally, the WPS lithic assemblage assists in filling a gap currently found in the southern African interior and helps to tie the Kalahari together with the better documented regions of South Africa (Deacon 1984; Kline 1989; Phillipson 1985; Sampson 1974; Rightmire 1989; Volman 1981, 1984) and the Matopos Hills in Zimbabwe (Walker 1991, 1995).

The Kalahari:

The regional focus of this dissertation is the Kalahari desert of southern Africa. The Kalahari is a basin in the southern African plateau, lying between the highlands of the

Cape

Zimba

Kalah

the N

north

2000

about

the

lowe

whit

abov

Kala

and

Oka

thr

pan

int

val

i.

iw

va

ar

Ka

Se

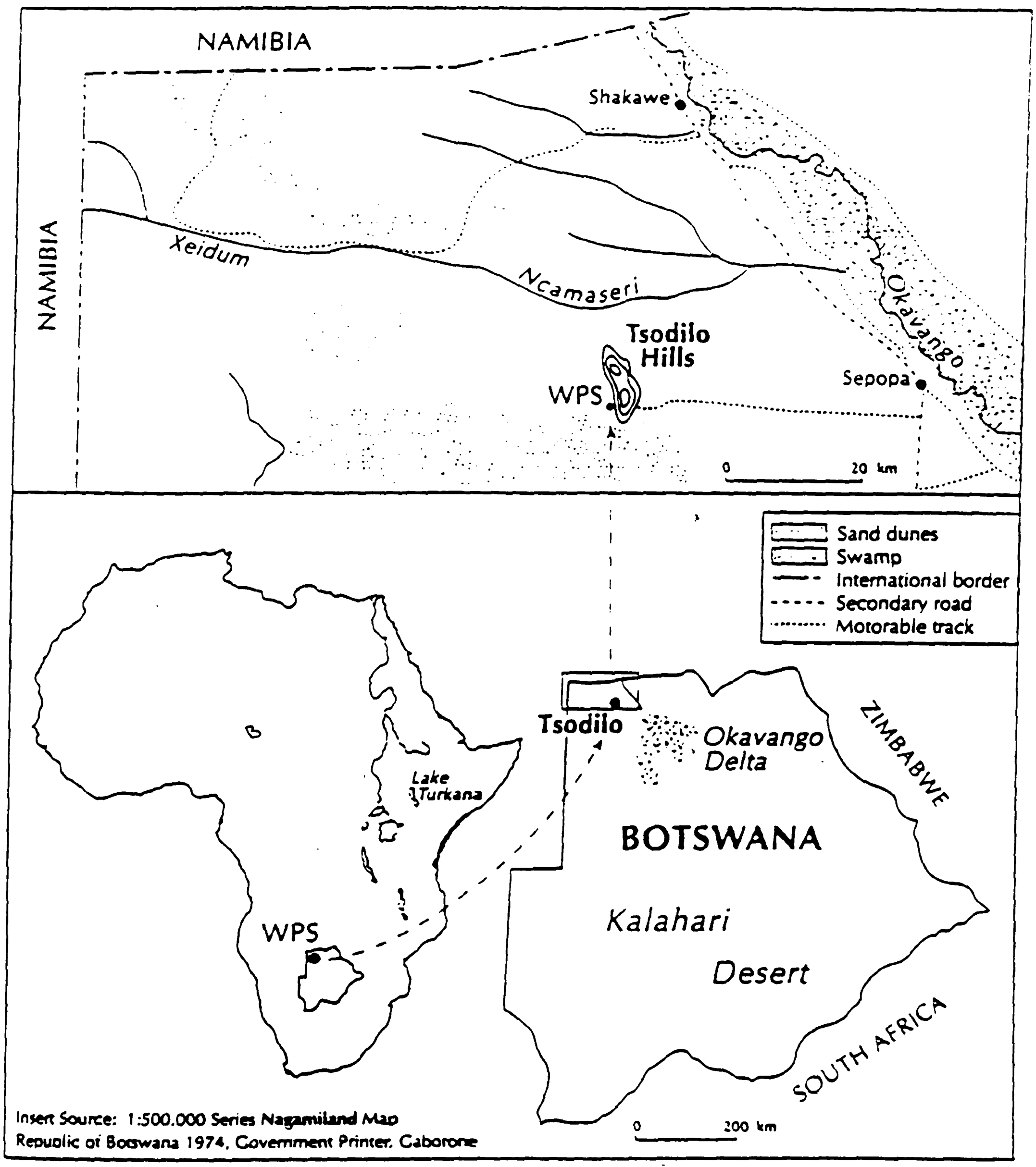
a

v

Cape Province, the Orange Free State, the Transvaal, and Zimbabwe (Figure 1.1). The highlands rise from the Kalahari's southern and eastern margins, and is bordered by the Namibian highlands to the west. The Kalahari extends northward from a location south of the Orange River, some 2000 km north to the South Equatorial watershed, and is about 1200 km at its greatest width (Wellington 1955). From the surrounding highlands the Kalahari is from 700 to 1000 m lower in elevation. It is a vast plain of red, gray, and white fine-grained sand. In rare places rocky outcrops rise above the sand mantle (Thomas and Shaw 1991).

The only permanent water sources located in the Kalahari are the Okavango-Boteti system of swamps and rivers and the Linyati-Zambezi river system in the northwest. The Okavango drains into an inland delta and occasionally through the ephemeral Boteti River into the Makgadikgadi pans. During seasonal Okavango floods, water may back up into other fossil drainages like the Ncamaseri/Xeidum river valleys located about 17 km to the north of WPS (Figure 1.1). Other semi-permanent water sources are shallow pans (waterholes) in ancient drainages, which hold water for varying periods of time depending on the seasonal availability of rainfall. The climate over most of the Kalahari in Botswana is semi-arid, however, it is not a desert devoid of vegetation. The thick sand mantle supports a varied, although sometimes sparse, cover of grasses, vines, shrubs, and trees. The Kalahari has a very seasonal

NAMIBIA



igure 1.1 Location of White Paintings Shelter, Tsodilo ills, Botswana. After Robbins et al. 1994.

climat

the su

range

per y

with

Septe

conve

22.2

summ

Rese

rar

nor

are

of

lo

sa

we

si

U

d

climate due to its altitude, latitude, and position within the subtropical high pressure belt. The mean rainfall ranges from over 650 mm per year in the northeast to 150 mm per year in the southwest. There is a distinct rainy season with most of the rain occurring in the summer months between September and April often in the form of highly localized convective thundershowers. Mean annual temperatures are 22.2 degrees C. and temperatures are highest in austural summer (Campbell 1980; Tyson 1986; Thomas and Shaw 1991).

Research Setting - The Tsodilo Hills:

Outcrops containing natural caves and rock shelters are rare in the Kalahari, therefore the Tsodilo Hills of northwestern Botswana are truly unusual. In the hills there are a number of natural rock shelters, a significant number of which contain rock paintings. The Tsodilo Hills are located 35 km west of the Okavango River and are about the same distance from Angola to the north and Namibia to the west. Tsodilo is now a national monument due to the significant concentration of rock art in the area.

Tsodilo consists of a group of three hills "composed of Upper Proterozoic Damara Sequence schists, quartzites, and dolomitic marbles that are variously metamorphosed" (Brook et al. 1992:166). The highest of the hills, locally called "Male", is 1394 m in elevation, with a relief of 410 m from the surrounding landscape (Figure 1.2). The Tsodilo Hills are geographically isolated from other hills in the region

Fig

and

The

poo

mu

co

sh

ab

r

d

a

Figure 1.2 The Female and Male Hills at Tsodilo.

and contain several permanent or seasonal water sources. The presence of permanent water in the hills in both natural pools and springs and the natural rock shelters and caves must have served as a magnet for human populations for a considerable amount of time.

The rock shelters at Tsodilo are the only natural shelters for habitation in the region and, as mentioned above, the walls of the shelters also served as surfaces for rock art. Over 3,000 individual rock paintings have been documented at Tsodilo and are under investigation (Campbell and Coulson 1988; Campbell et al. 1994). In addition, the hills contain extensive veins and outcrops of quartz

Fig

(F

ma

of

es

co

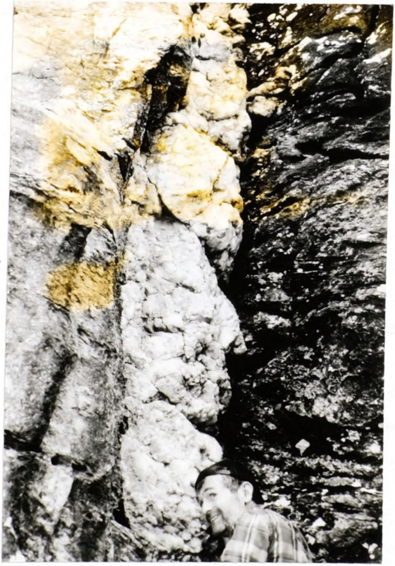


Figure 1.3 Tsodilo quartz(ite) vein

(Figure 1.3) which provided an abundant source of raw material for stone tools. Elsewhere in the region, sources of stone useful for tool manufacture are generally scarce, especially the high quality cherts and chalcedony that consistently appear in the archaeological record at Tsodilo,

but,
foun
seve

cont
prod
wild
bush
elep
gira
kudu
Roar
elep
mamm
char
incl
popu

Prev

Stor
Afri
19
in
att
hav
con

but, with the possible exception of chalcedony, are not found at Tsodilo. However, silcrete is quite common in several of the fossil river drainages in the Kalahari.

According to Campbell et al. 1994, the Tsodilo Hills contain many types of trees, some of which produce edible products. Those mentioned include morula, mongongo, baobab, wild plum, copal, mangosteen, buffalo thorn and raisin bushes. Until recent years Campbell et. al. (1994) list elephant, eland, lion, rhinoceros, buffalo, zebra, and giraffe. These have all but "disappeared leaving only, kudu, leopard, warthog, antbear, monkeys and brown hyena. Roan still live in small numbers in the vicinity and elephant are very occasional visitors" (1994:132). The mammalian fauna which inhabited the Tsodilo Hills has changed recently due to the presence of domestic stock including cows, goats and horses, as well as larger human populations.

Previous Research:

Currently, there is not a great deal known about the Stone Age archaeology of the interior regions of southern Africa, and Botswana in particular. According to Cooke (1979), the presence of stone tools in Botswana was recorded in 1930 and the first systematic collections of stone artifacts were made by E.J. Wayland in 1943. To date, there have been only a handful of archaeologists who have conducted Stone Age research in Botswana since Wayland's pione

one

larg

Dese

and

site

star

inte

1981

stud

arch

of

Mid

sit

et

Sto

ind

ext

Ebe

ca

wa

pioneering work (Robbins and Murphy 1996). In fact, when one examines the amount of data on the interior regions, a large geographical gap appears in the region of the Kalahari Desert. There have been only limited site location surveys and even fewer excavations of undisturbed archaeological sites. This lack of archaeological investigation is in stark contrast to the extensive ethnographic work from the interior regions of the Kalahari (eg. Lee 1979; Silberbauer 1981).

Although the Kalahari has often been overlooked in studies of the African Paleolithic, the region's archaeological potential has been demonstrated by the work of A.S. Brooks and J.E. Yellen, who undertook excavations of Middle Stone Age (MSA) and Late Stone Age (LSA) pan margin sites at Gi near the border of Namibia (Brooks 1984; Brooks et al. 1990; Brooks and Yellen 1986). In addition, other Stone Age sites, known primarily from surface collections, indicate that there is considerable time depth and areal extent of archaeological materials in the region (Cook 1979; ·bert and Hitchcock 1977; Robbins 1987, 1989). Recently, a ave containing Plio-Pleistocene fossils, called "Bone Cave" as examined near the Koanaka area of western Botswana Ritter and Mann 1995). This site is currently under nvestigation. Possible Oldowan artifacts reported by ickford (1990) from the general Koanaka may be the oldest aces of occupation in the Kalahari. Preliminary research the author, L. Robbins, A. Campbell and G. Brook has indi

an a

Gwet

ment

arch

the

whi

mul

exc

str

int

she

tof

roo

af

pr

No

da

de

ch

in

th

e

j

o

M

indicated an Acheulian assemblage along the Boteti river and an additional Acheulian/MSA site at Nxaishini Pan near Gweta. However, neither of these sites have been excavated.

One problem with the applicability of the above mentioned research to aid in the interpretation of the archaeological record of the Kalahari Stone Age is that these sites are generally surface or open air sites, most of which lack deep stratigraphy and may be wind-deflated or multi-component due to the desert environment. Thus, excavation of caves and rock shelters with deep stratigraphic deposits are critical to future interpretation. The relative absence of data on rock shelter or cave sites indicates that we do not know the total range of variation of sites in the Kalahari. Although rock shelters and caves have the deep stratigraphy that affords long term evidence of human activity, they contain problems in both excavation and interpretation (Clark 1969). Nonetheless, they also contain the potential to provide dated stratigraphic sequences that can be utilized to develop archaeological, palaeoenvironmental and chronological standards and as a source for local and interregional comparisons. The only excavations to date of this type of site include Robbins' (1984, 1985, 1986) excavations at the rock shelters of Manyana and Thamaga, just outside of the Kalahari in the southeastern hardveldt of Botswana, as well as the other sites listed below. Manyana contains a series of painted shelters with LSA

depo
poss
exca
She
(19
Bot
Afr
198
the
exc
Tsc

th
Ca
up
ye
Th
Th
a
s
e
P

d
i

deposits and Thamaga is a small shelter with LSA and possible MSA deposits. The only sites with deep deposits excavated in the Kalahari, other than the White Paintings Shelter, are Yellen's et al. (1987) and Robbins' et al. (1994) excavation at Gcwihaba (Drotsky's Cave) in Western Botswana, Wonderwerk Cave within the Kalahari in South Africa (Beaumont 1979b; Butzer et al. 1979; Thackeray 1981; Thackeray et al. 1981), Robbins' (1989a) excavation of the Depression Rock Shelter in addition to our recent excavations at Rhino Cave (Robbins et al. 1996) in the Tsodilo Hills in northwestern Botswana.

The first deep rock shelter excavated at Tsodilo was the Depression Shelter. Excavations in 1987 by Robbins and Campbell revealed over 5 m of archaeological deposits. The upper 2.8 m date from approximately 400 years B.P. to 19,000 years B.P. (Robbins 1990; Robbins and Campbell 1989a). Thus, the deposits below 2.8 m must be significantly older. The noteworthy archaeological findings include evidence for a relatively continuous LSA microlithic tradition of substantial time depth. Use of grinding and pounding equipment was in evidence and date back to the terminal Pleistocene.

Concerning the stone artifacts, the Depression site demonstrated important changes in artifact frequencies, including some levels in which artifacts were absent (Robbins 1990). According to Robbins (1990) there was also significant variation in raw material usage revealed by comp

lith

info

in t

exca

tell

Hold

dete

at '

ubi

the

Whi

fro

WHI

EXC

out

Mal

nor

Oka

la

and

ba

ar

an

el

comparison of frequencies of chert to quartz by depth. The lithic data from the Depression site also yielded information regarding the closing period of stone tool use in the area, as well as demonstrating the great potential of excavating shelters in the area. The site, however, lacked telling botanical or faunal elements from the early Holocene/late Pleistocene periods. Therefore, it was determined that a need existed to test another deep shelter at Tsodilo to examine if this lack of preservation was ubiquitous or if other sites contained the information that the Depression shelter lacked. The site selected was the White Paintings Shelter (WPS) located approximately 3 km from the Depression site.

WHITE PAINTINGS SHELTER: SITE DESCRIPTION AND HISTORY OF EXCAVATIONS

The White Paintings Shelter is situated beneath a large outcrop of bedrock projecting from the western base of the Male Hill in the Tsodilo National Monument in the extreme northwestern corner of Botswana and 35 km southwest of the Okavango River (21° 45'E, 18° 45'S). WPS is one of the largest shelters at Tsodilo with a 6 m overhang (Figures 1.4 and 1.5). There are approximately 70 white paintings on the back wall with at least three paintings in red pigment. The art includes numerous schematic designs, human figures, animals (Figure 1.5), and most notably a large white elephant with tail, tusks, and trunk sticking straight out

Fig
ar

Figure 1.4 Location of the White Paintings Shelter (Note arrow designating location).

Figure 1.5 White Paintings Shelter Overhang

Figure 1.6 Paintings located on the back wall of the Shelter

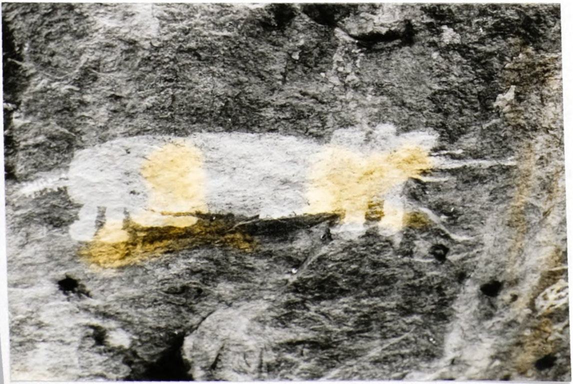


Figure 1.7 Close up of the white elephant painting at WPS

(Rob

exp
The
nat
Fur
of
Oka
poi
dec

19
Ro
fi
me
(F
f
d
b
b
p

(Robbins, 1991) (Figure 1.6).

The site is located in an advantageous position to exploit the economic resources of the surrounding sandveld. The hills near the shelter also provide a "funnel" for the natural concentration or perhaps driving of wild game. Furthermore, the site is within approximately one day's walk of the riverine and marsh environments afforded by the Okavango river and would have been a convenient stop-over point for hunter-foragers trekking from the Okavango to the deep sandveld of the northwest Kalahari.

After an initial test by N. Walker and A. Campbell in 1988, further exploration was done at WPS in 1989 by L. Robbins, A. Campbell, and G. Brook. The preliminary findings were reported at a Kalahari Symposium at the AAA meeting in Washington D.C. and in preliminary publications (Robbins 1990; Robbins and Campbell 1989b). These early findings determined that the site contained over 2 m of deposits and time spans from as recently as 50-60 years ago, based on San oral tradition, through a period of overlap between the LSA and early Iron Age, and into the LSA. These preliminary test excavations demonstrated that the preservation of all elements of material culture were much better than those encountered at the Depression site. Moreover, fauna was well preserved, including fish bones.

The lithic material obtained from WPS in 1989 were described by Robbins (1990) as abundant and characterized as microlithic featuring artifacts such as segments, small scr

ava

ma

we

ex

wi

ad

ex

ex

19

de

1.

pl

an

w

l

(

t

d

s

l

scrapers, and backed drills (Robbins 1990). Locally available quartz and non-local chert were used as raw material for these tools. The lithics tools and debitage were in pristine condition. The current analysis largely excludes the 1989 artifacts examined by Robbins (1990), but will refer to the work in a general context as needed.

Following the 1989 initial excavations of two blocks adjacent to the shelter wall and covering 8 square m in extent and reaching a maximum depth of 200 cm, more extensive excavations were undertaken in 1991, 1992, and 1993. A total of 31 m squares were excavated to various depths, with two units reaching a depth of 7 m (Figures 1.8, 1.9 and 1.10). Seven of these one-by-one squares were placed outside the shelter to test the perimeter of the site and excavated to 150 cm. These tests indicate that the site was extensive at different times in the past and reached at least 70 m from the shelter wall.

The primary excavation was a large block of 13 square m (Sqs. 10-23). Block excavation was pursued as it was felt that the excavation of contiguous units might facilitate the delineation of activity areas and aid in the analysis of a spatial distribution of the artifacts. Additionally, the block excavation enabled deep excavation by "stepping down" the units and it was our intention to be able to go as deep as possible. In hopes of recognizing vertical stratigraphy and differential artifact density at the site, and with no readily recognizable strata to guide excavation, it was

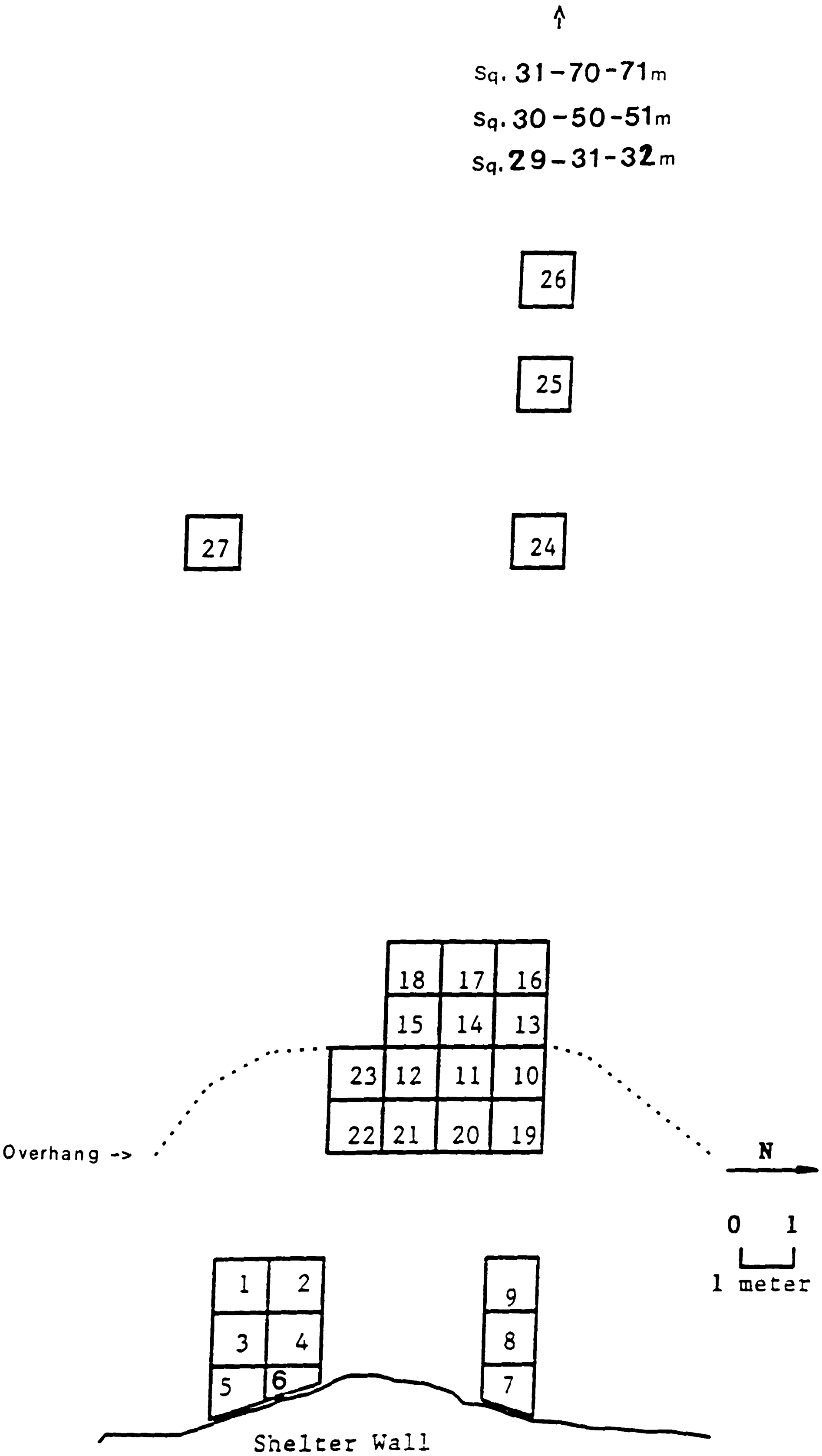


Figure 1.8 Map of the 1989-1993 excavations

Fi
ex

de

(s

va

in

w

e

s

s

f

(

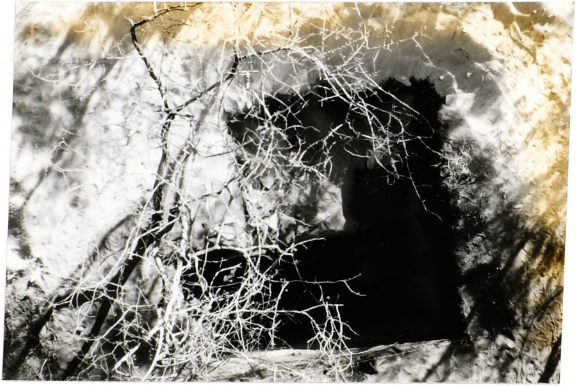


Figure 1.9 Overhead from the shelter overhang of the 1992 excavations

decided to excavate each test unit in arbitrary 10 cm levels (spits). The excavation proceeded with units abandoned at various levels to facilitate the excavation of deeper levels in relative safety. In some cases, features (hearths, etc.) were excavated as discrete units, at other times they were excavated in arbitrary levels with the remainder of the square, although the artifacts were labeled and bagged separately and the features noted, measured and described in the field notes. In some cases, flotation samples were also collected. All material was passed through 5 mm mesh screens, and the material from each level was then labeled

Figure 1.10 Alec Campbell and the author at the base of the 1992 excavations at 7 m

and bagged separately for future analysis. The flotation samples yielded little additional data. Robbins did tub float in Botswana and Dennis Cherry processed several samples in the Michigan State University flotation lab.

The WPS excavations were carried out under the National Museum permit for research at Tsodilo and funded by the

Nati

Soci

Nail

Bra

Har

And

per

vol

su

de

1.

Ta

National Science Foundation and the National Geographic Society. Crews included: Larry Robbins, Alec Campbell, Naill Campbell, Judy Campbell, Lark Murphy, Dan Robbins, Jan Brashler, Nic Walker, Alex Matseka, Jeremy Clark, Julian Harris, Mukate Samuchau, G!aux, Dennis Cherry, Troy Ferone, Andrew Ivester, George Brook, and myself, along with periodic visits from the National Museum personnel and other volunteers.

The years and depth of the various test squares are summarized in Table 1. The 1992 soil profile and a description of the stratigraphy are presented in Figures 1.11 and 1.12.

Table 1. Year and depth of WPS excavation units.

Year	Squares	Depth in cm
1989	1-4	75
	5	165
	6	172
	7-8	70
	9	200
1991	10	260
	11	480
	12	680
	13	190
	14-18	130
1992	19	340
	20	430
	21-22	620
	12,23	700
	24-29	150
1993	30-31	150
	#12 soil auger	15-290

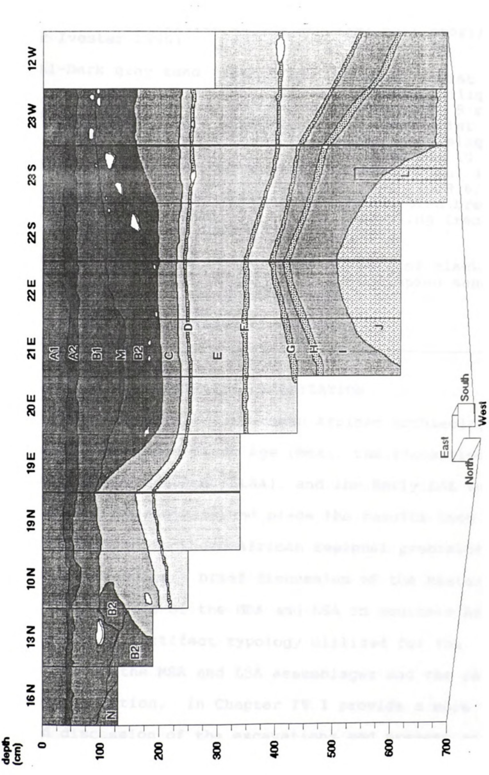


Figure 1.11 Stratigraphy of the 1992 excavations at White Paintings Rock Shelter. Square number and wall is indicated above each segment; for example, the north wall of Square 16 is labeled "16N". After Ivester (1995).

Figu
(Af

OV

st

MS

th

b

C

t

a

Figure 1.12 Description of the WPS 1992 soil profile. (After Ivester 1995)

A1-Dark gray sand (10YR 4/1)	G-Upper schist spall horizon, slightly cemented, 5 cm thick.
A2-Very dark gray, organic sand (10 YR 3/1)	H-Lower schist spall horizon, slightly cemented, 10 cm thick
B1-Dark grayish brown sand (10YR 4/2)	I-Pale brown, soft sand (10YR 6/3)
B2-Brown sand (10YR 5/3)	J-Indurated breccia
C-Pale brown, loose unconsolidated sand (10YR 6/3)	L-Sampling trench, 1992
D-Very indistinct stone line.	M-Lens of black soil
E-Pale brown sand, fairly well cemented (10YR 6/3)	N-Collapsed sand fill
F- Indistinct stone line, with quartz pebbles	

OVERVIEW: THE DISSERTATION ORGANIZATION

Chapter II describes southern African Archaeology and studies of the Middle Stone Age (MSA), the transitional MSA/Early Late Stone Age (ELSA), and the Early LSA to set the stage for my analysis and place the results into the broader issues in southern African regional prehistory. Chapter III presents a brief discussion of the history typological studies of the MSA and LSA in southern Africa and presents the artifact typology utilized for the description of the MSA and LSA assemblages and the rationale for their selection. In Chapter IV I provide a more detailed discussion of the excavations and present an overview of the main cultural/stratigraphic units at WPS and review the lithic and non-lithic data. This summary provides an overall perspective to place the detailed analysis of the MSA/LSA transition presented in Chapter V in conte

and t

MSA/e

stone

hypot

compa

a di

as w

Chap

sout

MSA/

know

curr

to

mob

sit

exc

pat

imp

context. Chapter V presents the hypotheses to be examined and the results of my analysis. Here I emphasize the MSA/early LSA transition and the detailed results of the WPS stone artifact analysis and how my results relate to the hypotheses examined. This chapter concludes with comparative regional archaeology emphasizing sites that have a direct bearing on the interpretation of the WPS results, as well as the important issues this research reveals. Chapter VI addresses the changing paleoenvironments in southern Africa and as evidenced at WPS and summarizes MSA/LSA adaptations in southern Africa as they are currently known. In Chapter VII I assess the applicability of several current models of hunter-gatherer mobility in relationship to the data obtained from WPS. Here I address changing mobility patterns related to the changing paleoenvironmental situations in the region and assess how raw material exchange systems may be reflected in shifting mobility patterns through time. Chapter VIII discusses the implications of this research and offers conclusions.

SOUT

MSA,

sit

ass

of

tra

fa

ar

th

we

Sa

re

S

t

h

CHAPTER II

SOUTHERN AFRICAN ARCHAEOLOGY: THE MSA, THE TRANSITIONAL MSA/EARLY LSA ("Magosian") AND THE EARLY LSA

In order to set the stage for my comparison of the MSA/LSA transition as witnessed at WPS with other regional sites spanning the same time period or possessing similar assemblages, it is pertinent to briefly review the history of the study of this "transition".

REMOTE BACKGROUND: THE "MAGOSIAN" CONCEPT

In the past the "Magosian" was generally viewed as the transitional period between the MSA and the LSA due to the fact that the industry had a number of backed microlithic artifacts. This type of artifact were generally lacking in the MSA (I exclude the Howieson Poort Industry here) and were a significant component of LSA assemblages in sub-Saharan Africa. However, even in the late 1940's some researchers determined that certain LSA assemblages (ie. Smithfield) lacked microlithic artifacts. To account for this, Malan (1949) suggested that the Smithfield industry had its roots in the MSA.

The idea of unilineal evolutionary development from the MSA to the "Magosian" to the LSA was basically accepted by most researchers working in southern Africa through the early 1960's, even though the "Magosian" was first defined in East Africa based on the excavations of the type site of the Magosi Rock Shelter in northeast Uganda. This site was excavated in 1925 and 1926 by Wayland and the collection

anal
1932
Clar
Shel
pred
(195

ano
mat
rec
mic
rec
te
ho
ho
ty
"
as
T
Z

analyzed and described by Burkitt (Wayland and Burkitt 1932). A more comprehensive description was performed by Clark in 1957 in which he concluded that the Magosi Rock Shelter collection was actually more recent due to the predominantly microlithic nature of the assemblage recovered (1957b).

In 1962 G. Cole returned to the type site and conducted another excavation. He concluded that Wayland's original material was from disturbed and mixed contexts. Cole recognized an upper occurrence in the sequence with microlithic artifacts similar to "Wilton" assemblages recovered from East Africa and a lower assemblage in what he termed the "Kunkar" horizon. He noted that in the "Kunkar" horizon, there were only microliths in the top of the horizon and that these were deemed intrusive. In addition, typical MSA bifacial points were only recovered from the "Kunkar" horizon. Cole concluded that the earlier "Kunkar" assemblage was similar to Magosian assemblages (now termed Tshangula) recovered from the Khami Waterworks site in Zimbabwe (Sheppard and Swart 1967, 1971).

In a very general sense the "Magosian" in southern Africa was once viewed as the final phase of the MSA which included both typical MSA macrolithic artifacts, as well as small backed tools. Outside southern Africa, for example in East Africa, certain assemblages labeled as "Magosian" were sometimes reported to have been associated with pottery. Several reviews of the literature on the "Magosian" appeared

:n the

conclu

chrono

repre

tools

envir

archa

defi

the

been

stra

what

ser

dis

Ca

su

2.

a

3

c

c

in the late 1950's and late 1960's. In one, Cole (1959) concluded that while the "Magosian" was poorly defined chronologically and typologically, that it nonetheless represented a stage in cultural development when composite tools gave the people a better adaptation to the environment. Then in 1967 Cole questioned the entire archaeological data base on which the "Magosian" was defined. In his conclusions, he reported that at many of the sites where "Magosian" assemblages were claimed to have been recovered based on either typological grounds, stratigraphic or paleoclimatological grounds or "for whatever reason or combination of reasons, vary few warrant serious consideration" (Cole 1967:159).

Today the term "Magosian" has been almost totally discarded. However, excavations at several southern African cave sites located north of the Limpopo River in Zimbabwe such as Pomongwe, Redcliff, Tshangula and Zombepata (Figure 2.1) have yielded assemblages from undisturbed contexts that are radiocarbon dated to oxygen isotope stage 2 (ca. 12-32,000 B.P.) which I will discuss below. These sites combine a microlithic component, including backed tools, and other artifacts usually considered characteristic of the MSA. These include: prepared cores; triangular flakes with faceted striking platforms; and unifacial and bifacial points. In this region some researchers (for example Cooke 1963, 1968a, 1968b, 1969; Walker 1978, 1990, 1991, 1995) identify these industries as being transitional between the

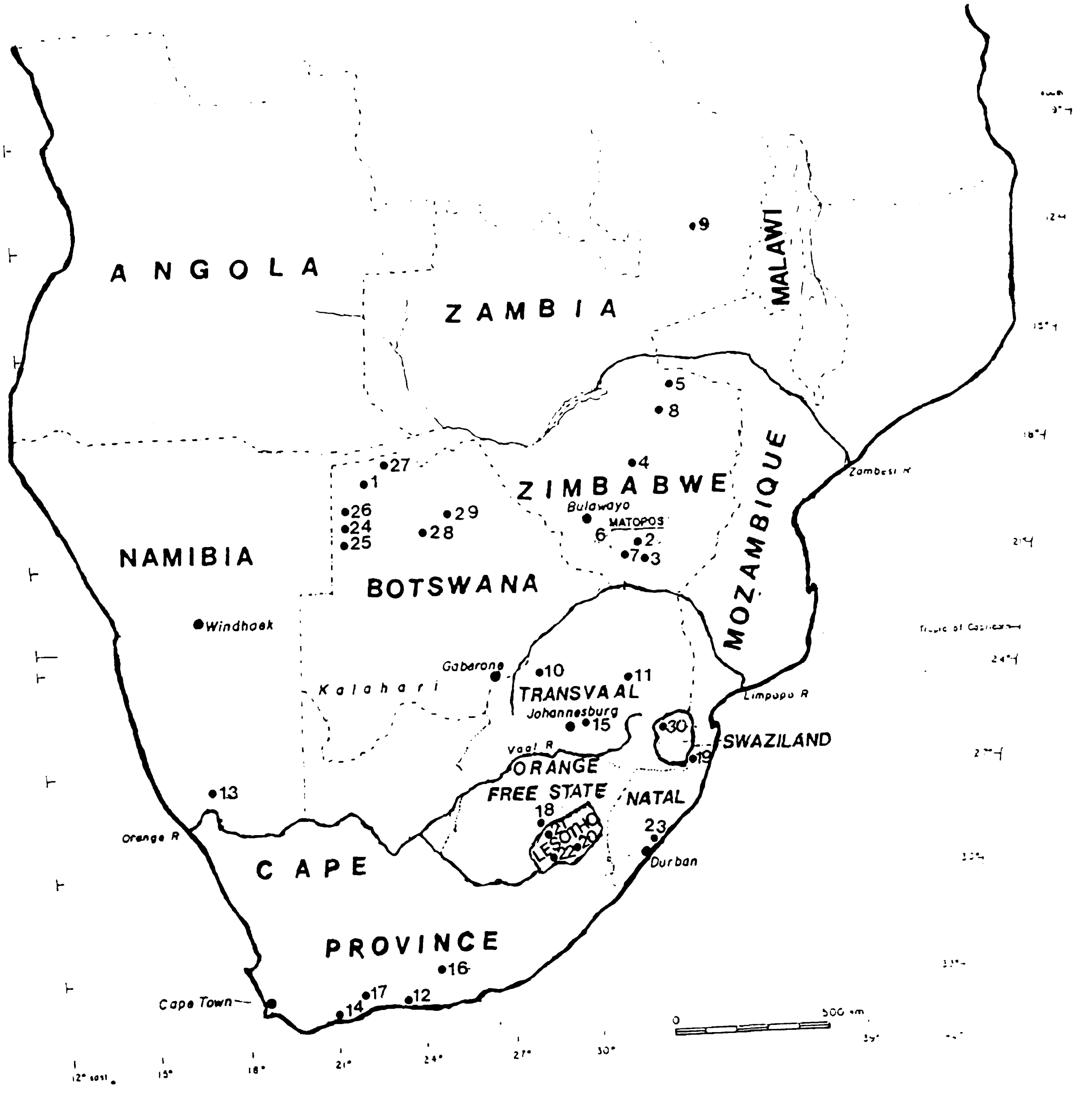


Figure 2.1 Approximate locations of southern African archaeological sites and other locations mentioned in the text.

Key:

Key:

1. Tsodilo Hills (White Paintings Shelter, Depression, Rhino Cave, Nqoma and Divuyu)
2. Pomongwe
3. Redcliff
4. Tshangula
5. Zombepata
6. Motopos Hills
7. Bambata
8. Duncombe Farm
9. Nachikufu
10. Cave of Hearths
11. Bushman Rock Shelter
12. Klasies River Mouth
13. Apollo 11
14. Blombos Cave
15. Cave James
16. Highlands Rock Shelter
17. Bloomplaas
18. Rose Cottage Cave
19. Border Cave
20. Sehonghong
21. Moshebi's Shelter
22. Melikane
23. Umhlathuzana
24. Gi
25. Aha Hills
26. Qangwa Valley
27. Shakawe
28. Boteti River
30. Gweta
31. Lion Hill Cavern

igure 2.1 Key to approximate locations of southern African rchaeological sites and other locations mentioned in the ext

MSA an

techni

latest

MSA,

Table

archa

this

that

asse

for

see

els

rev

she

wi

pr

of

of

i

w

w

MSA and LSA and at sites where MSA tools and reduction techniques were present the assemblages were considered the latest phase of the MSA and are now termed Tshangula.

In the following review, I discuss sites that have late MSA, transitional MSA/early LSA and early LSA assemblages. Table 2 summarizes these key sites, the proposed archaeological sequences and the references consulted. For this review I have concentrated on sites with assemblages that are similar to those recovered from the three assemblages examined in detail for WPS. I have also looked for assemblages that have similar raw material shifts, to see if some trends recognized at WPS are in evidence elsewhere. The reader will notice that all the sites under review, with the exception of Gi, are caves or rock shelters. This is due to the fact that the excavated sites with archaeological materials covering the transition are predominantly in caves and rock shelters. In addition, some of the work utilized was done 30 years ago or more, while others are quite recent. Finally, I have concentrated on interior sites in this review, as they appear to be the ones where transitional MSA/early LSA assemblages were recovered which were comparable to the WPS assemblages. It should be noted that the settings of the sites discussed below vary from upland to lowland and from savanna to forest settings, which makes it all the more interesting when trends are apparent which are comparable to WPS. In the following review, I have organized the discussion by region including

Table
have p

Site
Zimba
1. Po
2. R
3. T
4. Z
5. D
E
6.
7.
8.
Zam
9.
So
Tr
10
1

Table 2 Southern African sites mentioned in the text which have provided comparative MSA/early LSA samples

Site	Sequences	References
Zimbabwe:		
1. Pomongwe	Tshangula Bambata	Cooke (1963, 1971) Walker (1990, 1995)
2. Redcliff	Tshangula Bambata	Brain and Cooke (1967), Brain (1969b), Cooke (1978), Klein (1978b)
3. Tshangula	Tshangula Bambata	Cooke (1963), Sampson (1972), Walker (1978, 1995)
4. Zombepata	Tshangula	Cooke (1971)
5. Ducombe Farm	Tshangula	Hitzeroth (1973)
6. Inyanga	Bambata Rodesian Stillbay	Cooke (1979), Robinson (1958)
7. Bambata	Bambata Rodesian Stillbay	Armstrong (1931)
8. Nswatugi	Tshangula Bambata	Jones (1933) Walker (1978, 1980, 1995)
Zambia:		
9. Nachikufu	Nachikufian I-III MSA/early LSA	Clark (1950), Miller (1969), Sampson (1974), Phillipson (1976, 1977) Musonda (1985)
South Africa		
Transvaal:		
10. Cave of Hearths	ESA/MSA/LSA	Mason (1957, 1962, 1967a, 1971), Sampson (1968b, 1972, 1974)
11. Bushman Rock Shelter	MSA/LSA	Brain (1969a), Butzer and Vogel (1979), Eloff (1969), Mason (1969), Plug (1978, 1979), Protsch and de Villiers (1974), Vogel (1969)
13. Cave James	early LSA	Wadley (1987, 1989)
Cape Province:		
14. Highlands Rock Shelter	MSA/LSA	H.J. Deacon (1976)
15. Bloomplaas Cave	MSA/ELSA	H.J. Deacon (1978, 1979, 1980) Deacon and Booker (1976), Deacon et al. (1976), J. Deacon (1979a, 1979b), Klein (1978c), Avery (1979), Vogel (1979)

Table
which

Site
16. I
Cott
KwaZ
17.
Les
18.
19.
20.
Na
21
Na
22
Bo
23
24
25

Table 2 cont. Southern African sites mentioned in the text which have provided comparative MSA/early LSA samples

Site	Sequences	References
16. Rose Cottage Cave	MSA/ELSA	Malan (1946, 1952), Wadley (1991, 1996), A.M.B. Clark (1997), Beaumont and Vogel (1972), Butzer and Baeumont (1972)
KwaZulu:		
17. Border Cave	MSA/ELSA	Cooke, Malan and Wells (1945), Beaumont (1973a, 1979a, 1980), Beaumont and Vogel (1978), Beaumont et al. (1978), Klein (1977b)
Lesotho:		
18. Sehonghong	MSA/ELSA	Carter (1977), Carter and Vogel (1974), Carter et al. (1988), Mitchell (1994)
19. Moshebi's Shelter	MSA/LSA	Carter (1969, 1977)
20. Melikane	MSA/LSA	Carter (1977), Aldworth (1979)
Natal:		
21. Umhlatuzana	MSA/ELSA	Kaplan (1989)
Namibia:		
22. Apollo 11	MSA/LSA	Wendt (1972, 1974, 1976)
Botswana:		
23. Depression	ELSA/LSA	Robbins (1990)
24. Rhino Cave	MSA/LSA	Robbins et al. (1996)
25. Gi	MSA/ELSA/LSA	Brooks and Yellen 1977, 1987), Brooks (1978), Brooks et al. (1990), Kuman (1989)

Zimb

Oran

Nami

THE

dev

str

196

196

Mat

Ple

sor

by

re

we

gr

as

co

Ar

a

s

l

w

Zimbabwe, Zambia, South Africa (Transvaal, Cape Province, Orange Free State, KwaZulu, Swaziland, Lesotho, Natal), Namibia and Botswana.

THE LATE PLEISTOCENE AND EARLY HOLOCENE OF ZIMBABWE

To date, the best source of data on the cultural developments in Zimbabwe are the excavations of the stratified cave sites undertaken by C.K Cooke during the 1960's at Pomongwe, Redcliff, Tshangula and Zombepata (Cooke 1963, 1968a, 1968b, 1969) and N. Walker's work in the Matopos Hills (Walker 1978, 1990, 1991, 1995) (Figure 2.1).

Cooke (1969) clearly indicated that the late Pleistocene lithic sequences seemed to differ north and south of the Limpopo River and this conclusion was supported by Volman (1981, 1984) and J. Deacon (1984). Cooke's research showed that various assemblages from Zimbabwe which were termed MSA on both technological and typological grounds and which were quite similar to some of the MSA assemblages found south of the Limpopo River seemed to continue in Zimbabwe until approximately 12,000 years ago. After 12,000 years ago they were replaced by typical LSA assemblages which Cooke termed "Pomongwe" after the type site where these artifacts were first recovered (Cooke 1969). These LSA assemblages are typologically and technologically similar to assemblages found further south where they are termed Albany.

Cooke (1966) separated the Zimbabwe MSA into the

Gambat

the Ba

Still

Tshan

Indus

the r

Indus

the T

indic

defi

the

Cook

were

Tsha

1979

Ind

fol

Ind

cha
pr
ar
Di
an
bi
pr
ba
pr

b
r

Bambata Industry and the Tshangula Industry. He introduced the Bambata industry in 1966 to replace the term Rhodesian Stillbay (Cooke et al. 1966). He later introduced the Tshangula Industry to replace the Magosian and Umgusan Industries (Cooke 1968b). Cooke indicated that, based on the radiocarbon dates available at that time, the Bambata Industry began 40-35,000 years ago and then was replaced by the Tshangula Industry approximately 20,000 years ago. He indicated that the break between the two industries was defined by a universal rock fall that occurred throughout the Zimbabwe cave sites (Cooke 1968b). In a later report Cooke (1979) suggested that some of the Bambata assemblages were perhaps older than 100,000 years and that some of the Tshangula assemblages were older than 26,000 years (Cooke 1979).

In the same review article of the Upper Pleistocene Industries from Zimbabwe, Cooke (1979) presented the following definitions of the Tshangula and Bambata Industries:

> The Tshangula Industry: is variable because of the changing percentages of the microlithic elements. The prepared cores (ie. thickness less than 50% of the diameter) are usually far in excess of high backed tortoise cores. Discs are a very common feature showing bi-polar striking and use as adzes. Unifacial points tend to be commoner than bifacials. Flaking techniques are similar to those practiced by the Bambata people. Microlithic blades are backed by a variety of techniques... Blades were often produced from radially prepared discs.

> The Bambata Industry was one of long duration and has been divided into five phases, which so far have not been recognized elsewhere. Except for the microlithic intrusive

laye
with
thro
ie.
comb
radi
disc
occu
(Coc

tre

(19

whi

as

ass

ass

as

in

or

cl

o

a

a

> layers... there is little or no evidence of development within the industry. The tool kit is almost identical throughout. All methods of flaking appear in all phases, ie. direct and indirect percussion, pressure, and combinations of them on one tool. Flakes were struck from radially prepared high backed tortoise cores and thin discoidal ones; blade cores are not a common feature but do occur. Bifacial and unifacial points are well represented (Cooke 1979:6-7).

According to Cooke, there appeared to be no clear trends in artifact size in the Bambata Cave sequences (1979). He discussed artifacts in the Tshangula levels which were above the Bambata assemblages stratigraphically as being smaller on average, but that the Tshangula assemblages could not be separated from the Bambata assemblages based on the size of lithic artifacts in the two assemblages. Cooke indicated that non-lithic artifacts, including bone artifacts and ostrich eggshell beads, were only associated with the Tshangula Industries. I should clarify that according to Cooke (1979), bone artifacts and ostrich eggshell beads were only associated with Tshangula assemblages at Pomongwe.

As I mentioned previously, Cooke also separated Bambata and Tshangula lithic assemblages based on the presence of rock falls which occurred in cave sites over the whole of Zimbabwe at the termination of the Bambata Industry and prior to the inception of the Tshangula Industry (Cooke 1971, 1973, 1978, 1979). Cooke dated this rock fall to between 25,000 and 21,000 years ago on the basis of radiocarbon dates from Duncombe Farm, Pomongwe, Redcliff and Zombepata. He also suggested that these rock falls occurred at Ba

1979)

signi

termi

the p

uppe

asse

dati

sign

Zimb

VI.

exc

Inc

Mov

su

on

Ba

ac

p

p

d

at Bambata, Inyanga and Tshangula at the same time (Cooke 1979). I find this universal rock-fall, presumably due to a significant paleoclimatic event, in Zimbabwe at the termination of the Bambata particularly interesting due to the presence of a similar rock-fall at WPS separating the upper MSA from the transitional MSA/early LSA "Large Blade" assemblages, although in our current interpretation of the dating sequence at WPS, the rock fall at WPS occurred significantly earlier than the dates suggested by Cooke for Zimbabwean sites. I will return to this issue in Chapter VI.

The type site for the Bambata Industry was originally excavated by Armstrong (1931). He recognized the lithic Industries with increasing age as follows: Wilton, Bambata, Mousterian and Acheulean. Armstrong (1931) further subdivided the Bambata into a Upper, Middle and Lower based on the types of retouched points recovered. The Lower Bambata contained well made unifacial points that were, according to Armstrong, more finely worked than the proceeding Mousterian assemblages. The Middle Bambata had points that were more symmetrical and finely flaked and during the later or upper part of the Middle Bambata levels the points were occasionally bifacially retouched. The Upper Bambata contained finely flaked unifacial points, as well as bifacial types. According to Armstrong (1931), the Mousterian levels lacked the blades and burins that were recovered in the Bambata levels. He also mentioned mic

Bamb

coul

leve

occu

lev

Coo

Arm

Arm

ass

ex

ar

Sa

to

t

a

a

T

microlithic backed blades from the Bambata levels.

In 1940 Jones conducted another excavation at the Bambata site. Based on these data he concluded that he could not distinguish the Mousterian levels from the Bambata levels recognized by Armstrong and furthermore, that burins occurred throughout the entire sequence even in the lowest levels which Armstrong labeled Acheulean (Jones 1940). When Cooke revised the Zimbabwe sequence (1969, 1971) he combined Armstrong's Lower and Middle Bambata into his "Bambata" and Armstrongs' Upper Bambata into to his "Tshangula" assemblages.

The type site for the Tshangula industry was originally excavated by Cooke (1963). The retouched and utilized artifacts were analyzed by Sampson (1972). According to Sampson (1972), there were only a few formally retouched tools in the lower levels of the excavation, but the ones that were present were scrapers and retouched points. In addition, burins, borers, segments, and grindstones were also mentioned by Sampson (1972). Walker's excavations of Tshangula assemblages at the site (1978) indicated that "the Tshangula was a nondescript assemblage with a few backed tools which were associated with occasional organic artifacts" (1978:6).

Pomongwe Cave, the type site for the Pomongwe Industry was excavated by Cooke (1963) and re-excavated by Walker (1990). Of special note is that the more recent work has gone a long way toward resolving the dating of the Tshangula inc

ref

mat

com

13,

pre

Wal

ass

la

is

to

of

me

MS

o

W

r

t

a

industry. From Walker's recent work it was clear that the reference assemblage was mixed, having both MSA and LSA material (Walker 1990). According to Walker, the final MSA component postdates 35,000 B.P and is certainly older than 13,000 B.P. "perhaps by several millennia on the basis of preservational differences in the deposits" (1995:150-151). Walker did agree with Cooke's grouping of levels and the assemblage into the Pomongwe industry. His research "has largely confirmed Cooke's description but suggests that it is less distinct from the overlying assemblages. Backed tools are present, albeit rare, and convex scrapers are as often as small as many in the later levels, although the mean size is greater" (1995:151).

One other site that contains important data on the MSA/LSA sequence is the site of Nswatugi which was originally excavated by Jones (1933) and re-excavated by Walker (1978, 1980, 1995). At Nswatugi, Jones (1933) recovered upper Bambata artifacts including large segments, trapezoids, as well as additional backed artifacts which according to Walker (1978, 1980, 1995) were comparable to the Howieson's Poort assemblages from South Africa (to be discussed later). The site was reexamined by Walker (1995) who reported that artifacts were recovered below a decomposed granite layer that Jones (1933) had assumed was the cave floor. The archaeological sequence reported by Walker (1978, 1980, 1995) from most recent to oldest are as follows: Khami; Pomongwe; Tshangula and Bambata. Backed too

dat

cur

cla

how

rec

tra

ne

ap

ma

an

be

re

as

t

a

a

d

a

tools were recovered near the top of the MSA levels and dated to greater than 41,940 B.P. (Pta-1772) (Walker 1995).

The continuing work in Zimbabwe is significant to the current analysis of the MSA/early LSA transition and clarifies various aspects of the MSA/LSA transition, however, it also understandably raises issues that will require further exploration. For example, the dating of the transition between the Bambata and the Tshangula certainly needs more clarification. From the current evidence it appears that Tshangula materials replace Bambata MSA material at different sites at dramatically different times and the factors leading to the end of the Bambata and the beginning of the Tshangula Industries are still difficult to resolve. From the current data it seems that some lithic assemblages continue to contain a range of artifacts and technological reduction techniques that are typical of MSA assemblages elsewhere until ca. 12,000 B.P., although the actual dates are still in question. Certainly more reliable data are needed. However, at present it does appear that assemblages that have been assigned to the Late MSA (Tshangula) in Zimbabwe are more recent than 25,000 years B.P.. According to Volman (1981) these assemblages "contain smaller artifacts on average than older assemblages (Bambata), a more prominent small blade, backed artifact component and higher proportions of fine-grained raw materials" (Volman 1981:80). In reference to the current analysis, assemblages from Redcliff contain similar art

and

dat

see

The

si

ma

as

Th

Vo

re

er

ar

T

a

c

(

(

artifacts that were dated to 26,000 years ago (Volman 1981) and assemblages from Nswatugi categorized as Tshangula were dated to +42,000 years B.P. (Walker 1995).

Overall, the lithic artifact assemblages from Zimbabwe seem to demonstrate significant continuity through time. The Bambata/Tshangula assemblages tend to merge at some sites with no real break between the two industries. The major technological break recognized in the Zimbabwean assemblages is between Tshangula and Pomongwe Industries. This transition is dated to ca. 12,000 B.P. According to Volman (1981) the Pomongwe industries appear "to lack MSA reduction techniques and the retouched artifacts are almost entirely scrapers, associated with non-lithic tools of bone and shell ornaments" (Volman 1981:81).

THE LATE PLEISTOCENE AND EARLY HOLOCENE OF ZAMBIA

The Nachikufan is a term originally used to refer to all LSA assemblages found in the forest and savanna regions of Zambia. The Nachikufan was first defined by J.D. Clark (1950) based on his excavation at Nachikufu (Figure 2.1). Clark identified three phases of this industry and presented type lists for each. In 1969 Sheryl Miller reviewed the available Nachikufan collections for her doctoral dissertation and she quantified tools types in each phase and redefined Clark's (1950) Phase II into an early (A) and later (B) stage. According to Miller (1969), Nachikufan I assemblages had the highest frequencies of backed bladelets and

Mic

but

the

inc

and

co

(s

ty

as

ty

ba

th

w

i

r

I

(

e

a

and pointed backed bladelets in the three phases. Microlithic tools including crescents (segments) were noted but, according to Miller (1969), made up less than 10% of the collection. Miller's (1969) Nachikufan IIA had an increased frequency of scrapers and fewer backed bladelets and pointed backed bladelets dropped to less than 10% of the collections. Nachikufan IIB had an increase in crescents (segments) and scrapers dominated by convex and concave types. Miller (1969) noted that the Nachikufan III assemblages were not particularly consistent in their tool type percentages, yet she indicated that there were more backed tools in Phase III and scrapers were less frequent than in Phase IIB, but the types of scrapers were similar, with convex and concave scrapers most common (Miller 1969).

The general outline of the chronology of the Nachikufan is fairly well established. However, it is based on only 31 radiocarbon dates covering a period of nearly 20,000 years. In the most recent summary of this chronology, Musonda (1985) divided the sequence into three periods. The first extended from 18,000 to 9,000 B.P. and included all assemblages designated as Nachikufan I. The second period dated from 9,000 to 5,000 B.P. and included both phases of the Nachikufan II. The final period corresponded to Nachikufan III and extended from 5000 to 100 B.P. Musonda (1985).

The Nachikufan designation was disputed by Sampson (1974). He questioned Miller's (1969) analysis and noted cor

Sar

var

spe

the

ma

ra

(1

ir

mi

l

N

s

d

a

r

e

s

l

considerable variability within each of her three phases. Sampson observed that each of the phases were dominated by a variety of tools that he interpreted as reflecting specialized tasks, rather than regional styles. "Most of the fine subdivisions between Phase II and III themselves may be the result of activity variations from site to site rather than purely chronological changes in design" (1974:357).

Other authors like Phillipson (1976,1977) have interpreted the Nachikufan I as a widely distributed early microlithic tradition which led to many of the later local lithic assemblages. Phillipson (1977) argued that the Nachikufan II and III and the "Zambian Wilton" were not separate evolving industries but rather were parallel developments which arose from an indigenous MSA tradition, and that these phases were the result of local groups responding to the effects of climatic change in the local environments. Phillipson's (1976, 1977) interpretation was supported by J. Deacon (1984) in her major synthesis of the LSA in southern Africa. However, Musonda (1983) had previously noted that differences in the subsistence strategies in the various Nachikufan assemblages could account for some of the variation, that Clark's (1950) and Miller's (1969) framework, with the possible exception of the Nachikufan IIB, was correct.

THE

fro
ong
for
kno
ex
an
th
st
th
as
th
5I
e
c
W
e
a
a

THE LATE PLEISTOCENE AND EARLY HOLOCENE OF SOUTH AFRICA

Late Pleistocene and early Holocene archaeological data from southern Africa are primarily from South Africa, where ongoing research far exceeds all the other research combined for the remainder of the region. As a result, much more is known and dating of various assemblages is much more extensive than the sites discussed so far. In South Africa and adjacent areas there are detailed studies of changes in the MSA and the LSA, yet the transition between the two is still poorly understood. In addition, there is an enigma in this region called the Howieson Poort industry which has assemblages that contain numerous microlithic elements in the middle of MSA industries dated to oxygen isotope stage 5b (ca.95-85,000 B.P.). Finally, with the possible exception of several sites in Swaziland where MSA technology continues into more recent periods (Price Williams and Watson 1982; Price Williams et al. 1982), there is abundant evidence backed up by radiocarbon dates that between 30,000 and 40,000 years B.P., MSA assemblages were replaced by LSA assemblages which are technologically and typologically distinct from what came before.

Below I will discuss only the sites which contain clear evidence of assemblages spanning the MSA/LSA transition. As mentioned above, the sites are organized by region beginning with the Transvaal.

The Cave of Hearths is located in the Transvaal of South Africa (Figure 2.1). Published reports include Mason

(19
The
mai
thi
tin
th

as
19
si
th
pr
sc
P
w
S
H
C
C

(1957, 1962, 1967a, 1971) and Sampson (1968b, 1972, 1974). The deposits at Cave of Hearths contain ESA, MSA and LSA material. The ESA (Beds 1-3) and MSA were separated by a thick sterile deposit representing an undetermined length of time during which the site was unoccupied. However, it is the late MSA materials which are significant here.

The MSA lithic assemblages at Cave of Hearths were assigned to the Pietersburg Industry (Mason 1962; Sampson 1974) and characterized by large numbers of long, parallel-sided "flake-blades", often with retouch or use wear along the tool edges. Disc cores and triangular points were both present but relatively rare. Mason (1962) divided this sequence into Earlier Pietersburg (Bed 4), Middle Pietersburg (Bed 5) and Later Pietersburg (Beds 6-9) which were overlain by LSA deposits with material assigned to the Smithfield industry. Several comments regarding Cave of Hearths are warranted. The following observations are based on Sampson's 1968b and 1974 analyses. Sampson (1968b, 1974) documented an overall decrease in the frequencies of blades from the Early to Middle Pietersburg and then roughly equal proportions of blades in the Middle and Later Pietersburg. This was coupled with an increase in the proportion of retouched pieces in the Later Pietersburg. Sampson (1968a, 1974) also discussed a notable shift in raw material preferences evident in the assemblages from almost exclusive use of quartzite in Bed 4 to the use of other raw materials, most notably chert, in Bed 5, and then to a roughly equal prc

9.

Tra

the

Vog

Pr

wa

di

19

19

10

(1

le

(

i

e

F

E

V

I

proportion of quartz and non-quartz raw materials in Beds 6-9.

The Bushman Rock Shelter is also located in the Transvaal of South Africa (Figure 2.1). Various elements of the rock shelter were described by Brain (1969a), Butzer and Vogel (1979), Eloff (1969), Mason (1969), Plug (1978, 1979), Protsch and de Villiers (1974), and Vogel (1969). The site was excavated by the University of Pretoria under the direction of J. F. Eloff for eleven field seasons between 1967 and 1978, following initial tests conducted by Louw in 1965. According to Eloff (1969), the excavation included 107 levels to bedrock at a depth of 7 m. The upper level (1) contained a mixture of Iron Age and LSA artifacts, levels (2-14) were assigned to the LSA, and below, levels (15-107) a long sequence of MSA artifacts were identified.

Some disagreement exists with regard to the interpretation of the sequence. For example, Louw (1969) equates the artifacts from above layer 28 to the LSA, while Plug (1978, 1979) assigns LSA artifacts only above level 15. Plug (1979) identified several differences from levels 15-18 which she assigned to the MSA, most importantly in raw material selection and tool types present. The MSA raw materials were dominated by indurated shale and to a much lesser degree (37%) quartz. The LSA levels on the other hand, were predominantly quartz (75%) with (23%) indurated shale. In reference to tools Plug (1979) noted 31 (18%) of the retouched tools in the MSA levels were well-made uni

poi

scr

but

sid

prc

no

oc

th

an

or

ra

th

K

p

l

i

unifacial and bifacial points and none of these retouched points were present in the LSA levels. In addition, scrapers were the most common tools in both the LSA and MSA, but the MSA scrapers were larger and consisted of mostly side scrapers, while the LSA was dominated by a much higher proportion of end scrapers (Plug 1979).

In reference to the non-lithic remains, Plug (1979) noted that bone tools were common in levels 6-14, but also occurred in the upper MSA levels. Plug (1979) documented the association of typically LSA artifacts such as beads, and ground and polished bone tools and what are called "bone ornaments" with MSA tools in levels 15-18. Bone tools are rare in MSA contexts. The only other MSA bone tools from the South Africa are several worked rib fragments from Klasies River Mouth in MSA II levels and a polished bone point from Klasies Howieson's Poort levels (Singer and Wymer 1982) and Henshilwood and Sealy (1997) reported bone tools in Late MSA deposits from Blombos Cave in the Southern Cape. Finally, in Namibia there are two worked or notched long bone fragments from layer G at Apollo 11 (Wendt 1976).

The final Transvaal site that I will discuss is Cave James (Figure 2.1) excavated by Lyn Wadley and her students (Wadley 1987, 1989). According to Wadley (1987,1989) the site contained Wilton and Oakhurst assemblages, as well as an early LSA assemblage (G and BL-C members) which dated to 29,000 B.P. (Wits-1386). In her interpretation of the Cave James early LSA assemblage Wadley (1989) noted that it was "uns

misc

and

medi

a li

and

(19

thi

(19

bla

So

(F

re

Hi

ar

fa

a

(

u

"unstandardized and contains few retouched pieces other than miscellaneous retouch" (1989:51). The tool types for the G and Bl-C early LSA levels included: (1) large scraper; (1) medium scraper; and (13) small scrapers. She also recovered a limited number of backed bladelets (2), a single segment and eight irregular backed and broken backed pieces (1989:47). Wadley noted that flakes were abundant and that this was due to "the high percentage of quartz used" (1989:51). However, Wadley does not mention any unretouched bladelets or blades from the early LSA levels.

The next region I will discuss is the Cape Province of South Africa beginning with the Highlands Rock Shelter (Figure 2.1) excavated by H.J. Deacon (1976). H.J. Deacon recognized both LSA and MSA sequences at this rock shelter. His "Upper Member" was assigned to the Smithfield Industry and dated to the last 4500 years with abundant artifacts and faunal and plant remains. The "Lower Member" was identified as MSA and subdivided into four units. The most recent unit (A) dated to 30,840 +/- 480 B.P (Pta-537) and the deepest unit (D) dated to 38,900+/-1200 B.P. (Pta-564). According to H.J. Deacon (1976), the MSA assemblages were produced predominantly on indurated shale and dominated by large blades. In addition to the large blades there were unifacial points, and blades with steep retouch along one or both lateral margins and at least one large segment (crescent). The late MSA age range for the Highlands assemblages are roughly comparable to the later MSA at

Boompl
below,
compar
I
termec
consi
Cave
Oudts
the C
E.J.
and U
1980;
Deacc
1979
at B
occu
Robb
occu
earl
forr
occ
700
mem
inc
10(
19

Boomplaas (H.J Deacon 1979; J. Deacon 1979a), discussed below, and within the range of dates suggested for comparable assemblages at WPS.

Boomplaas Cave is another site with deposits which are termed early LSA and which are thus relevant to the consideration of the MSA/LSA transition at WPS. Boomplaas Cave is located in the Cango Valley northeast of the Oudtshoorn in the foothills of the Swartberg Mountains of the Cape Province (Figure 2.1). Excavations undertaken by H.J. Deacon between 1974 and 1979 uncovered 5 m of Holocene and Upper Pleistocene deposits (H.J. Deacon, 1978, 1979, 1980; Deacon and Booker 1976; Deacon et al., 1976; J. Deacon 1979a, 1979b; Klein 1978c; Avery 1979; Vogel 1979). According to J. Deacon (1979a), the upper deposits at Boomplaas contained Wilton, Albany and Robberg occupations dating to the last 20,000 years. Under the Robberg levels in the LP member there was an early LSA occupation (LPC) dated to 22,000 B.P. identified. This early LSA assemblage was dominated by quartz with almost no formally retouched tools. Below this was a late MSA occupation (BP Member) with radiocarbon dates of 32,400 +/- 700 B.P. (UW-304) and 34,670 +/- 350 B.P.(Pta-2220). The BP member artifacts were primarily produced using quartzite and included long flake blades, some of which were greater than 100 mm long and several had lateral retouch (J. Deacon 1979a:123).

Rose Cottage Cave is actually a rock shelter in the

Ora

was

195

fur

stu

ele

(19

Bea

(1

se

ov

or

Co

"r

ar

v

d

i

i

Orange Free State of South Africa (Figure 2.1). The site was excavated by Malan between 1943 and 1946 (Malan 1946, 1952) and then reexcavated by Beaumont in 1962. Recently further excavations were undertaken by Lyn Wadley and her students (Wadley 1991, 1996; A.M.B. Clark 1997). Various elements of the site are described by Beaumont and Vogel (1972), Butzer and Vogel (1979), Mason (1969), Vogel and Beaumont (1972), Wadley (1991, 1996,), and A.M.B. Clark (1997).

From the earlier excavations, Malan (1952) divided the sequence into Lower, Middle and Upper "Magosian", which were overlain by deposits which were described as either Late MSA or Early LSA. In Mason's (1969) analysis of the Rose Cottage "Upper Magosian" assemblages he noted that it was "markedly microlithic with a reasonable proportion of flakes and blades with very steep backing or trimming from the ventral face" (1969:58) and Butzer and Vogel (1979) also discuss the presence of large quartzite segments (crescents) in Masons' (1969) Upper Magosian units which they interpreted as Howieson' Poort.

Recent work by Wadley (1991, 1996) and A.M.B. Clark (1997) at Rose Cottage Cave are of particular interest to my analysis of the MSA/LSA transition at WPS. At Rose Cottage, Clark (1997) discussed a lithic assemblage dated to 20,600 +/- 250 B.P.(Pta-5598) which was interpreted as a transitional assemblage containing both MSA and LSA elements. The transitional assemblage at Rose Cottage Cave

'is
incr
(A.N
asse
curr
tra
Acc
"de
wit
int
dur
Cof
Cla
pr
(c
of
as
do
fe
s
R
n

"is dominated by Middle Stone Age tools, coupled with an increasing frequency of Later Stone Age bladelet production" (A.M.B. Clark 1997:113). Clark maintained that this assemblage was distinct and "does not belong within the current definition of either the MSA or the LSA and is transitional between the two" (A.M.B Clark 1997:118). According to Clark, at 20,000 B.P. she has evidence of the "development of LSA methods of lithic production combined with a preference for MSA tools" (Clark 1997:118). This is interpreted by Clark as indicating continuity in technology during the late Pleistocene. The similarities of the Rose Cottage Cave to the more recent LSA assemblages mentioned by Clark (1997) included the production of bladelets and the presence of bladelet cores and the use of opaline (chalcedony) as the primary raw material. The similarities of the transitional assemblages with the Final MSA assemblages mentioned by Clark (1997) included "the dominance of knives (blades) and the presence of relatively few scrapers of which the majority are side scrapers and significantly larger than those from the Robberg level at Rose Cottage Cave"(Clark 1997:118). Finally, Clark (1997) notes the presence of MSA worked flake points in the transitional levels dated to roughly 20,000 B.P..

Border Cave, located in KwaZulu in South Africa (Figure 2.1), is another site with a transitional MSA/early LSA or early LSA assemblage. The initial excavation of Border cave was undertaken by Cooke in the 1940's (Cooke, Malan and

Wells 1945). Further excavations were carried out by P.B. Beaumont in the 1970's (Beaumont 1973a, 1979a, 1980; Beaumont and Vogel 1978; Beaumont et al. 1978; Klein 1977b). The earlier excavations by Cooke, Malan and Wells (1945) presented a three phase interpretation of the Border Cave lithic material from oldest to youngest as "Simple Middle Stone Age", "Normal" Pietersburg" and "Advanced" Pietersburg (Cooke et al. 1945). According to Cooke et al. (1945) the "Advanced" Pietersburg stage at Border Cave was characterized by "many long, narrow, thin blades, backed pieces that included segments (crescents) and a number of trapezoids, some up to 80 mm long, and some small triangular points only 30 mm on a side" Cook et al. 1945 in Volman 1981:109).

The excavations by Beaumont (1973a, 1979a, 1980) further refined this sequence. It also included the designation of an Early LSA assemblage radiocarbon dated to Late Oxygen Isotope Stage 3, roughly 37,000 B.P., which included no microlithic retouched tools, but numerous scaled pieces and associated with ground bone points and ostrich egg shell beads. Beaumont et al. (1978), indicated that this early LSA assemblage was associated with levels 1BS.LR and 1WA at Border Cave and included large scrapers, including circular, convex, concave and informal types, scaled pieces, broad triangular flakes, and micro-blades with predominantly plain striking platforms and very high percentages of core reduced pieces.

(19

the

3b

en

ba

we

of

re

va

th

wa

re

fi

th

l

F

s

c

r

a

In Beaumont's analysis of the MSA at Border Cave (1979a) he designated three Phases and two sub-Phases. In the most recent Phase, dated to ca. 49,000 B.P., MSA Phase 3b was characterized by scaled pieces, retouched points and end scrapers. In addition, several trapezoids and other backed pieces were associated, but no segments (crescents) were mentioned (1979a:18).

Beaumont's (1979a) MSA Phase 3a included lower numbers of scaled pieces than Phase 3b and more scrapers and retouched points including both unifacial and bifacial varieties. Of special interest was Beaumont's suggestion that the differences between MSA Phase 3a and MSA Phase 3b was based on raw material. That is, there were differing relationships between cryptocrystalline (chalcedony) and fine/medium grained (rhyolite and quartzite) raw material in the length of unretouched flakes, which were increasingly longer for both types of raw material in the more recent MSA Phase 3a compared to the older MSA Phase 3b (1979a:18).

Beaumont (1979a) concluded that the Border Cave lithic sequence was an "entirely unbroken and fully autochthonous cultural trajectory" (1979a:23). As such, he saw the lithic reduction trends reflecting increased knapping or flaking efficiency which was reflected in the reduction of the relative thickness of tools and flakes through time. He also proposed a similar trend in the selection of and use of cryptocrystalline raw materials, which he believed aided in the production of thinner flakes. Furthermore, he suggested that the LSA microlithic technology and the production of composite tools, was a continuation of these strategies that was "devised in ultimate response to a bar (obstruction) on the further refinement of standard detachment techniques that the raw material quality limitation imposed" (1979a:23).

Another possibility exists, that the well documented increased use of microlithic tool technology in the LSA and the related use of increasingly fine grained raw materials were functionally related. That is, that these raw materials in many cases may have only be available in relatively small packages naturally, and since the finer grained raw materials tend to produce sharper edges than coarser raw materials, they necessitated the development of a technological means to exploit them. I will return to this issue in Chapters V.

Certainly Beaumont's scenario for the LSA peoples' development of microlithic technology and composite tools as resulting from solving problems related to raw material characteristics is intriguing. It does not explain the presence of similar tools in the Border Cave Phase 2 assemblages and other Howieson's Poort industries throughout the region though. This very early appearance and then subsequent abandonment of these backed tools within the MSA of southern Africa is one of the most difficult lithic questions to explain. I will return to the Howieson's Poort

enig
abou
sout
sect

Bord
ana
sti
thr
The
the
con
as
in
Bu
Be
ir
d
o
h
c

enigma in my discussion of what lithic remains can tell us about the original appearance of fully "modern" humans in southern Africa in the interpretation and conclusions section of the last chapter of this dissertation.

Finally, I need to discuss the human remains from Border Cave. There is no question that these remains are anatomically modern, but their dating and association is still somewhat in question. The remains include at least three individuals which were possibly from MSA contexts. The controversy revolves around the possibility that all of these individuals may be intrusive burials, and may not be contemporary to the MSA levels. The individual referred to as Border Cave 3 appears to have been buried or interred into level 10 from level 9 or level 8 (Cook et al. 1945; Butzer, Beaumont and Vogel 1978; Beaumont et al. 1978; Beaumont, 1980). The problem is that this individual is an infant. If this is the proper association, this is the only definite MSA burial in sub-Saharan Africa. The importance of these finds are that if some or all of the Border Cave human remains are from MSA contexts, they provide evidence of anatomically modern humans in MSA contexts.

Sehonghong is a rock shelter in the Thaba Tseka District of eastern Lesotho (Figure 2.1) excavated by P. Carter in 1971 (Carter 1977; Carter and Vogel 1974; Carter et al. 1988) and later re-excavated by Mitchell (1994). According to Carter et al. (1988) Sehonghong contained LSA, early

10 cm

1-9,

which

bipol

and s

by a

dates

(Pta-

the s

the p

(cres

blade

inter

and

dates

spit

(Pta

from

of 2

30,9

12 (

with

10 e

back

art

early LSA, and MSA assemblages. The site was excavated in 10 cm levels or "spits". In Layer 2, which included spits 1-9, Carter defined an early LSA assemblage for spits 5-6 which included small bladelet cores, some of which were bipolar, small utilized and unutilized bladelets, and end and side scrapers. This early LSA assemblage was bracketed by a date for Spit 5 of 13,000 +/- 140 (Pta-884) and two dates for spit 6 17,820 +/- 270 (Q-1453) and 20,900 +/- 270 (Pta-789). Carter (1977) originally assigned spits 7-16 to the southern African MSA Howieson's Poort Industry based on the presence of a curved backed piece in spit 8 and segments (crescents), trapezoids and straight and curved backed blades which occurred below spit 13, but later revised this interpretation indicating that these levels were late MSA and transitional MSA/early LSA (Carter et al. 1988). The dates for the upper portion of this assemblage come from spit 7 19,860 +/-220 (Pta-918) and spit 8 20,240 +/- 230 (Pta-919). A middle range of dates for Sehonghong come from Carter's Layer 4 (spits 10-11) with a date for spit 10 of 28,870 +/- 520 (Pta-920) and a date for spit 10/11 or 30,900 +/- 550 (Pta 787). The oldest dates come from spit 12 (Located in Carter's Layer 5 which included spits 12-13) with a date of 32,150 +/- 770 (Pta-785).

Tool totals for spits 7-9 included two side scrapers, 10 end scrapers, 60 scaled pieces, 5 burins, and one curved backed tool. He also noted 39 utilized pieces. The artifacts from Carter's Layer 4 included very few formal tool

part

Bene

obta

reco

(Car

thr

bla

10

the

MSA

tim

he

20,

Th

do

ma

co

th

sm

a

'

a

S

tools and were roughly similar to what occurred in the lower part of Layer 2. Layer 5 was capped by a rock fall. Beneath it in spit 12 was where the ca. 32,000 B.P. date was obtained. In spit 13, the only unifacial point was recovered and spits 13-15 have nine Levallois cores recorded (Carter et al. 1988).

It is interesting that flake blades were noted throughout spits 7-16. Complete specimens of these flake-blades from Sehonghong averaged between 35-40 mm in spits 7-10 and 15-16 and between 40-47 mm in spits 11-14. Thus, there appears to be an increase in blade size from the Late MSA/early MSA and then a subsequent decrease in size through time (Carter 1977; Carter et al. 1988).

In Mitchell's (1994) recent excavations at Sehonghong, he assigns layers OS/MOS/RFS dated to approximately 26,000-20,000 B.P. to a transitional MSA/early LSA assemblage. These layers were characterized by Mitchell (1994) as being dominated by opalines (chalcedonies) as the preferred raw material. According to Mitchell (1994), the majority of the cores were irregular, but some bipolar cores were present in the form of core reduced pieces, flat bladelet cores and small bladelet cores. Mitchell (1994) noted that the use of a radial core technique was limited to only one example and "Levallois" cores were totally absent from this transitional assemblage. A bladelet component was also present but in lower frequencies then in the overlying Robberg levels at Sehonghong. According to Mitchell (1994), blades and

blad
larg
reto
asse
the
and
MSA/
occa

Shel
site
"sp
were
spi
to
two
bac
fro
too
the
rep
the
the
un
fo
aw
fl

bladelets account for between 3-4% of all unmodified flakes larger than 10 mm in the three transitional levels and retouched formal tools account for less than 1% of the total assemblages. Of special interest, blades account for 80% of the unmodified flakes in Mitchell's (1994) levels OS and MOS and 56% in level RFS. Thus, Sehonghong's transitional MSA/early LSA assemblage was blade-dominated with an occasional microlithic bladelet present.

Another eastern Lesotho rock Shelter is Moshebi's Shelter (Figure 2.1) excavated by Carter (1969, 1977). This site, like Sehonghong was also excavated in 10 cm levels or "spits". Only two radiocarbon dates were reported and both were late LSA or modern. Carter assigned the Upper (1-6) spits to LSA, spits 7-16 to Howieson's Poort and spits 17-25 to MSA. He reported one segment (crescent) from spit 14, two from spit 15, and one from spit 17. He also noted a backed tool from spit 13, three curved backed knives, one from spit 14 and two from spit 18. Carter called these tools "backed crescents" in his illustrations and assigned them to the Howieson's Poort Industry. Of interest, Carter reported blades with both dorsal and ventral retouch near the striking platform which he interpreted as a tang from the MSA levels at Moshebi's shelter. He also reported six unifacial points from spits 15-20 (Carter 1977). The other formal tools recovered were end scrapers and side scrapers, awls, burins and scaled pieces. Again, as with Sheonghong, flake-blades were recovered with size ranges between 30 and

45 m

mm i

here

(197

Aldw

ider

How

10

wer

yie

art

the

+/

an

we

+/

Ca

(1

d

s

a

l

45 mm in spits 7-16 (sample size 159) and between 50 and 85 mm in spits 17-20 (sample size 79).

The final eastern Lesotho rock shelter I will discuss here is Melikane (Figure 2.1), also excavated by Carter (1977). Some of the stone tools were also analyzed by Aldworth (1979). This shelter contained assemblages identified by Carter (1977) and Aldworth (1979) as LSA, Howieson's Poort and MSA. Again the site was excavated in 10 cm levels or "spits". A total of eight radiocarbon dates were obtained for this site. Spit 2 of Carter's Layer 1 yielded a date of 1500 +/- 50 B.P.(Pta 1364) and the artifacts assigned to the LSA. A series of three dates from the top of Layer 3 in spit 10 were very consistent: 19,650 +/- 220 B.P. (Pta-1367); 20,000 +/-170 B.P. (Pta-1406); and 20,200 +/- 150 B.P (Pta-1407). Two dates for Layer 4a were 33,100 +/- 600 B.P. at the top of spit 14 and 35,830 +/- 920 for the base of Layer 4a in spit 15. At the base of Carter's Layer 4b in spit 16 a date of 42,000 +/- 1700 B.P. (Pta 1534) was obtained and at the top of Carter's Layer 5 a date of 42,000 +/- 2100 B.P was the final date for the sequence.

The lithics were interpreted as follows. Carter (1977) assigned spits 1-6 to the LSA, spits 7-16 to the Howieson's Poort and spits 17-25 to the MSA. He also reported that segments (crescents) occurred before the ca. 42,000 B.P. date and, of interest, he discussed a "small blade industry" in spits 22-23, which he stated was distinct from

(197

and

then

of t

a tr

site

seq

tra

exc

rel

Kap

of

the

sig

pe

of

to

to

LS

ma

th

p

a

E

from the typical MSA or the Howieson's Poort. Aldworth (1979) assigned Melikane assemblages to the LSA for Layers 1 and 2, the MSA for Layers 3 to the Middle of Layer 5 and then Howieson's Poort from the middle of Layer 5 to the base of the excavation at 2.7 m.

Another important site located in Natal which contains a transitional MSA/early LSA assemblage is the rock shelter site of Umhlatuzana (Figure 2.1). At Umhlatuzana a long sequence of stone artifacts from the MSA, the MSA/LSA transition, and the early LSA were recovered. The site was excavated in 1985 by Kaplan as part of a salvage project related to road construction (Kaplan 1989). According to Kaplan (1989), the transition from the MSA to the beginning of the LSA took place between 35,000 and 25,000 B.P.. In these transitional levels (14-18), Kaplan (1989) noted significant changes in raw material composition where the percentage frequency of hornfels increased from 29% to 82% of the debitage, and quartz decreased from 70-16% of the total debitage. The majority of the formally retouched tools were also made on hornfels (Kaplan 1989:10). In the LSA (Robberg) layers (4-13), quartz was the dominant raw material in the waste category, but again the majority of the formally retouched tools are on hornfels (Kaplan 1989).

Other interesting data were the increase in bladelet production in the late MSA and MSA/LSA transitional layers at Umhlatuzanal, with the former dating to around 40,000 B.P. (Kaplan 1989). Other observations were the correlation betw

and

piec

freq

blac

Umh

tra

bla

uni

toc

pi

In

we

se

po

bl

b

l

between the increase in bladelet production in the late MSA and MSA/LSA transition and the increase in core reduced pieces. The "Robberg assemblages were characterized by high frequencies of unmodified bladelets and single and bipolar bladelet cores" (Kaplan 1989:10).

According to Kaplan (1989) formally retouched tools at Umhlatuzana occurred most frequently in the late MSA and transitional MSA/LSA layers and the lowest numbers in the bladelet-rich Robberg assemblages. In the MSA assemblages, unifacial and bifacial points were the most common formal tool followed by scrapers, segments and miscellaneous backed pieces. Kaplan (1989) recorded 36 blades from levels 19-21. In the transitional MSA/LSA layers, MSA retouched points were again the most common formal tools followed by segments, scrapers, miscellaneous backed pieces, backed points and adzes. From levels 14-18, Kaplan recorded 179 blades (1989:11-13).

In summary, Umhlatuzana assemblages span the transition between the MSA and the early microlithic assemblages of the LSA. Kaplan (1989) argued that based upon the dating of deposits, the flaking technology, raw material composition and the formal tools present in the assemblages, the site supported a view that the MSA/LSA transition and the beginning of the LSA in southern Africa took place between ca. 35,000-25,000 B.P. and that it is "part of an ongoing, uninterrupted sequence of events in stone artefact manufacturing systems" (Kaplan 1989:13). He also

Umhl

blac

that

asso

MSA

and

THE

fro

(1

fr

Po

se

10

fo

p

t

P

a

a

l

also noted that the transitional MSA/LSA layers at Umhlatuzana had features of the Robberg Industry including bladelet cores and unmodified bladelets. Kaplan concluded that "the origins of the early microlithic Robberg assemblages of southern Africa may be located in the final MSA, where the production of bladelets from single platform and bipolar cores is apparent" (Kaplan 1989:13).

THE LATE PLEISTOCENE AND EARLY HOLOCENE OF NAMIBIA

An important site outside of South Africa is Apollo 11 from Namibia (Figure 2.1). Apollo 11 was excavated by Wendt (1972, 1974, 1976). The archaeological materials recovered from Apollo 11 included a long sequence of MSA, Howieson Poort and LSA assemblages, as well as a very extensive series of radiocarbon dates ranging from 320+/-40 B.P. (Pta-1009) to +49,500 B.P. (KN-I 619). Particularly interesting features of the Apollo 11 sequence included some decorated pieces of ostrich eggshell within the MSA levels and dated to +48,000 B.P.. The sequence had a significant Howieson Poort horizon with various small microlithic backed tools and according to Wendt (1976), there was a decrease in artifact size from the lowest levels up through the Howieson's Poort industry with a parallel increase in the frequency and variety of retouched tools including burins. The MSA levels at Apollo 11, which lie above the Howieson's Poort industry, contained low numbers of formal MSA artifacts and date from greater than 46,000 B.P. to appr

most

sla

the

197

of

20,

THE

MS

pu

De

19

th

(1

3

o

b

r

s

t

approximately 26,000 B.P.. The artifacts that received the most attention from Apollo 11 were a number of painted stone slabs which Wendt interpreted as "the oldest known art on the African continent and date to 28,000 B.P." (Wendt, 1976:7). Following the MSA at Apollo 11, there are a series of LSA microlithic assemblages which begin at approximately 20,000 B.P..

THE LATE PLEISTOCENE AND EARLY HOLOCENE OF BOTSWANA

Finally, turning to Botswana, information on the MSA/early LSA is rare. However, the sites which are published are quite informative. The two Tsodilo sites of Depression (Robbins 1990) and Rhino Cave (Robbins et al. 1996) contain archaeological materials which are relevant to this current study (Figure 2.1). At Depression, Robbins (1990) reported a "well-made backed crescent from between 320 and 330 cm ... estimated to be at least 20,000 years old" (Robbins 1990:336). Also at Depression, in levels below 4 m Robbins (1990) reported recovering burins, retouched blades, "artifacts with traces of backing, and some points and pointed flakes... debitage includes flakes, true blades and bladelets" (Robbins 1990:336). Finally, Robbins (1990) also mentioned microlithic bladelet cores from the base of the deposits at 5 m at Depression. If the estimated date of 20,000 B.P. for the 320-330 cm levels are accepted, the assemblage below could be substantially older, and in fact be comparable to the early LSA "Lower Fish" asse

m),

tran

at W

rela

rec

sig

thi

(Be

tha

le

no

re

19

MS

s

e

u

r

assemblages and although based on a limited sample (1 square m), the lowest levels of Depression may be equivalent to the transitional MSA/early LSA to the "Large Blade" assemblages at WPS. I will return to a discussion of these relationships in Chapter V.

At Rhino Cave, also located within the Tsodilo Hills, recent excavations by Robbins et al. (1996) discovered a significant MSA assemblage. The current interpretation of this site was based on a radiocarbon date of 5,300 +/- B.P. (Beta 84720) for the 70-75 cm level, combined with the fact that "the MSA begins approximately 15/20 cm below the dated level" (Robbins et al. 1996:29) was that the early LSA was not represented at Rhino Cave. The lithic artifacts reported from the MSA deposits at Rhino Cave (Robbins et al. 1996) were highlighted by 21 MSA points; "other retouched MSA tools were a number of medium to large end and side scrapers as well as awls, denticulates and notches" (Robbins et al. 1996:32). Of special interest, "several large unretouched blades were found in the MSA levels, the largest measures 49 mm in length" (Robbins et al. 1996:32).

The most important site located close to the Tsodilo Hills in NW Botswana, is the site of Gi (Brooks and Yellen 1977, 1987; Brooks 1978; Brooks et al. 1990; Kuman 1989). In contrast to all of the sites discussed so far, the site of Gi (Figure 2.1) is an open air pan margin site.

According to Brooks et al. (1990) the artifacts at Gi included LSA, "Intermediate" transitional MSA/early LSA and

MSA r

impr

spec

<u>Mega</u>

The

comp

(Bro

inc

sid

ret

198

Kun

fre

Ye

as

wa

si

(K

c

l

p

G

I

MSA materials. The MSA levels were associated with a rather impressive array of "... large, dangerous, or elusive prey species" (Brooks et al. 1990:62) including the extinct fauna Megalotragus priscus, Equus capensis and Pelorovis antiquus. The Gi MSA assemblage were defined as Stillbay and were compared with the Bambata material from Redcliff in Zimbabwe (Brooks and Yellen 1977, 1987). The retouched tools included large numbers of bifacial and unifacial points, side scrapers on flakes, notched scrapers, denticulates, retouched flakes, scaled pieces, perforators and becs (Kuman 1989). According to Brooks and Yellen (1977, 1987) and Kuman (1989), faceted platforms were rare and the most frequent core types were termed "small discoids" (Brooks and Yellen 1977, 1987). The raw materials discussed for the MSA assemblage at Gi which consisted of 7515 lithic artifacts was dominated by chalcedony (71%) and Chert (20%), with silcrete (3%) and quartz(ite) (6%) as minor components (Kuman 1989:192). The MSA artifacts and fauna at Gi were concentrated in a 10 cm level which was capped by a calcrete layer (Brooks and Yellen 1977). Of special interest to the present study is the "intermediate industry" from unit 2C at Gi which was dated to ca. 34,000 B.P. (Brooks et al. 1990). This assemblage, which follows the MSA at Gi, was described "as containing blades but few formal tools" (Brooks et al. 1990:62).

it

Afr

his

del

bel

fo

mo

wh

ab

ch

de

s

e

F

a

CHAPTER III

LITHIC ARTIFACT TYPOLOGY AND ANALYTICAL METHODS

Before presenting the categories used in the analysis, it is useful to make some general comments about southern African lithic classification and review the conceptual history of the MSA-LSA terminology.

In southern Africa as elsewhere, stone tools and lithic debitage are the most common and oldest evidence of human behavior during the Pleistocene and Holocene. The reason for this is obvious. The stone tools and debitage are the most durable artifacts due to their chemical composition which renders them nearly impervious to weathering and mild abrasion. In addition, lithics generally show very little chemical or physical alteration once they have been deposited in archaeological contexts. As a result, the study of lithic artifacts is an important part of virtually every Paleolithic archaeological investigation.

Since stone knapping is a reductive process, the production of stone tools requires the creation of large amounts of lithic waste, or debitage, in the act of tool fabrication. As a result of this process, there are usually large quantities of lithic debris on nearly every paleolithic site.

Lithic debitage received little attention in early archaeological accounts. However, in recent decades debitage analysis has been viewed as an increasingly productive source of archaeological information. This is due

much

forr

of

ori

lit

rec

rec

mat

of

de

ca

ma

ge

c

c

l

d

due to several factors. For one, debitage has not been of much interest to amateur collectors or relic hunters, as are formal tools. Therefore, it is likely that the quantities of debitage recovered in an archaeological represents the original aboriginal deposition and distribution. Also, lithic debitage can provide important insights into lithic reduction techniques and sequences, as well as changes in reduction techniques through time.

Debitage also affords the opportunity to examine raw material preferences through time. Lithic raw materials often possess identifiable characteristics which allow the determination of source areas. Raw materials can be categorized as locally available or non-local. Local raw materials were acquired with minimal effort and were generally available year-round. Non-local raw materials could be obtained both directly and indirectly, and in some cases were passed across territories as a commodity. Thus, lithic source information is an invaluable aid in determining patterns of trade and exchange. In addition, identifiable raw materials may aid in determining the amounts and types of lithic reduction which was carried out at a particular site at different times.

The formal stone tool typological approach, prior to the advent of absolute dating methods, was aimed at determining temporal and spatial relationships or what has been termed an "index fossil" approach to stone artifacts similar to approaches in the fields of Paleontology and

Gecl

sup

ana

the

app

par

mor

bec

cl

ev

ar

Bo

va

19

a

I

a

(

Geology. Although this type of analysis has now been superseded by absolute dating methods and more comprehensive analyses of all tools and debitage from particular sites, the "index fossil" approach does retain some useful applications for assemblage classification and comparison.

Although this may be true, the assignment of a particular assemblage to a certain industry sometimes causes more problems than they resolve. Thus, as more collections become available for comparison, the long accepted classification systems based on "index fossils" may eventually be abandoned. Unfortunately, problems may also arise with more comprehensive analyses, as occurred with Bordes' classification and interpretation of the tool variation in the Mousterian of Europe (Binford and Binford 1966; Binford 1973; Dibble 1987).

It is now widely accepted by archaeologists that stone artifacts are not actually equivalent to a specific culture. In fact, most researchers now stress variability in stone artifact assemblages and much effort has been dedicated to explaining the determinants of assemblage variability. Some of the factors recognized that account for assemblage variability include site function and location, time intervals represented by the assemblage, geographical distribution and physical properties of lithic raw materials, technological capacities of the stone knapper's techniques, immediate and future functional requirements of the tools, and random variation (Volman 1981:15).

whic

Whil

most

ass

Thi

ass

(19

LSA

amo

pr

bo

th

(K

i

i

t

a

These factors assist in explaining the variability which is often seen in differing archaeological assemblages. While recognizing this variability, typological studies are most useful for the description and comparison of artifact assemblages, as well as communication between scholars. This is certainly the case in studies of the MSA/LSA lithic assemblages in sub-Saharan Africa. For example, Klein (1980b) points out that the distinctions between the MSA and LSA assemblages in sub-Saharan Africa are seen more clearly among non-lithic artifacts. In the MSA/LSA case, it is the presence of items of personal adornment, art objects, and bone tools that distinguish the MSA from the LSA, rather than dramatic changes in the stone artifact assemblages (Klein, 1980b).

However, the vast majority of the surviving artifacts in archaeological contexts are made of stone. Therefore, it is necessary to define assemblages, at least initially, on the basis of the stone artifacts. In practice, most archaeologists use a combination of the relative frequencies of retouched tools types in combination with a number of other technological or morphological features of an assemblage. This is far from a perfect solution to the difficulties previously discussed. Other problems revolve around the selection of specific artifacts and attributes deemed significant by individual analysts for measuring the similarities and variability among assemblages objectively.

THE

use

ass

we

art

sys

19

up

La

ar

ro

to

A

(

t

L

p

S

S

THE MIDDLE AND LATE STONE AGE IN SOUTHERN AFRICA

In order to set the stage for the classification system used for my analysis of the MSA/ early LSA lithic assemblages from WPS, I think it is relevant to review how we came to the current state of typological studies of stone artifacts from the MSA and early LSA in southern Africa.

The earliest comprehensive stone tool classification system for southern Africa was developed by Goodwin (1926a, 1928a, 1929a). Goodwin proposed a three phase system based upon stone tool typology which included Early, Middle and Late Stone Ages. Since much of the sub-Saharan archaeological research over the succeeding decades has its roots in Goodwin's original classification, it is important to summarize his original and subsequent classifications.

Goodwin (1926a) proposed a division of the southern African archaeological record into an Earlier Stone Age (ESA), dominated by core technique industries which were termed Fauresmith, Stellenbosch and Victoria West, and a Later Stone Age (LSA), in which flake tool industries were predominant and were labeled by Goodwin (1926a) as Smithfield, Stillbay and Wilton. Goodwin noted that Smithfield was characterized by duck-bill shaped end scrapers and the Wilton, by small segments (crescents) and small end scrapers.

Originally, Goodwin was not sure of the chronological placement of the Stillbay. Further research led him to the conclusion that it included various industries which diff

indu

this

Mid

the

pro

and

va

to

in

pl

an

st

le

i

t

i

v

differed technologically and typologically from ESA industries and from both Wilton and Smithfield. Based upon this research, in later papers Goodwin proposed the term Middle Stone Age (MSA) (Goodwin 1928a, 1929a). He defined the Middle Stone Age as being characterized by the production of triangular flakes with convergent dorsal scars and faceted striking platforms, and typologically by a variety of both unretouched and retouched points. According to Goodwin (1929a), the LSA industries differed technically in their emphasis on flakes with parallel dorsal scars and plain striking platforms, and in the characteristic Wilton and Smithfield artifact types discussed above. The limited stratigraphic information available to Goodwin at that time led him to conclude that the Middle Stone Age was intermediate between the ESA and LSA.

Goodwin (1929a) felt that the southern African MSA was the result of Mousterian influences on local ESA hand axe industries. Furthermore, he believed that the Mousterian was chronologically older than the southern African MSA and that the flake component of the Fauresmith industry demonstrated the influence of Mousterian techniques. Goodwin thought that the numerous burins, segments and trapezoids in the southern Cape MSA, termed Howieson's Poort, were the result of European Upper Paleolithic influences on the southern African MSA, which was viewed as leading to the LSA over time (Goodwin 1929a).

Goodwin's terminology was quickly accepted by arch

the

ind

app

col

the

Sou

it

te

pr

19

19

w

H

t

archaeologists working in sub-Saharan Africa. In addition, the terms used by Goodwin for some southern African industries, such as Stillbay and Wilton, are still widely applied with regional prefixes (ie. Interior Wilton) for collections from Botswana (Robbins 1990). In many cases, these collections are only superficially similar to the South African assemblages. As the available data increases, it is clear that there is a great deal of typological and technical variability within and between the collections previously assigned to Goodwin's categories (Avery et al. 1997; A.M.B Clark 1997; Mitchell 1994; Singer and Wymer 1982; Walker 1995).

Over time the idea of transitional industries, which was implied by Goodwin's definition of the Fauresmith and Howieson's Poort, led archaeologists to introduce new terminology. This included a First Intermediate, which included the Fauresmith and Sangoan industries and fell between the ESA and MSA, and a Second Intermediate, including Magosian and Howieson's Poort, which was placed between the MSA and LSA. At the Third Pan-African Congress in 1955, a resolution was passed which recommended that archaeologists attempt to fit their local prehistoric sequences into this five stage scheme (Clark 1957).

However, the resolution did little to resolve the various typological problems. As a result, at the Burg Wartenstein conference in 1965, a rigorous critique of the cultural terms then in use was presented by Kleindeinst

(19

def

whi

sch

hie

(Cl

cl

Af

As

In

co

se

M

i

C

H

(1967). She pointed out a lack of uniform application and definition and a notable lack of quality in the data upon which the classifications were based. As a result, a new scheme was proposed at the conference based upon the hierarchical classification of archaeological assemblages (Clark et al. 1966; Bishop and Clark 1967). This classification system was later accepted at the Sixth Pan-African Congress in Dakar in 1967. This system recognized Assemblages, Phases, Industries and Industrial Complexes. In addition, it was decided that the 1955 system should be completely dropped from usage in developing chronological sequences.

Although supposedly dropped from use, the terms Early, Middle and Late Stone Age are still widely utilized, usually in reference to technological stages (Avery et al. 1997; Clark 1974; A.M.B. Clark 1997; J. Deacon 1978, 1984; Kaplan 1989; Klein 1989, 1995; Mitchell 1994; Phillipson 1988; Singer and Wymer 1982; Thackeray 1989; Volman 1981, 1984; Walker 1995).

The continued use of these terms does have the potential to create problems, and I shall consider these throughout this dissertation where appropriate. To date, the application of the Burg Wartenstein Conference recommendations have completely clarified the temporal and spatial variability that occurs in southern African artifact assemblages. In addition, local terminologies have proliferated, often referring to only a small number of ass

sub

Coc

sys

War

19

the

in

es

Wa

re

a

f

s

c

t

a

assemblages, and in some cases new names have simply been substituted for old ones (Clark 1974; Cooke et al. 1966; Cooke 1969). Other attempts to provide a new classification system for southern African archaeology utilizing the Burg Wartenstein procedures (J. Deacon 1976b, 1984; Sampson 1974) were not completely successful either. For example, these authors use geographical information to define industries whose typological differences are not well established and not completely consistent with the Burg Wartenstein conference recommendations. I am not recommending that we do not continue to try to place assemblage variability within a broader chronological framework as we accumulate more reliable samples, I am only suggesting caution in creating hierarchical classifications of the southern African Stone Age. With this in mind, in this manuscript I shall attempt to establish a sequence of assemblages for the interior regions of southern Africa, particularly WPS, and will not attempt to define new or higher units.

To allow comparison with other regional sites the retouched lithic tool typology was modeled after J. Deacon (1984) for the LSA and Volman (1984) for the MSA. Although this kind of typological approach has been criticized (Cahen et al. 1979; Draper 1985; Flenniken 1985; Hassan 1988; Speth 1972), an analysis such as this was a necessary first step to allow comparability of the WPS formal tool assemblage with the vast amount of data outside of the

Kala

Docu

sou

sim

are

thr

oth

ans

hel

Ka

De

wi

Sc

o

P

W

a

Kalahari, particularly in South Africa and Zimbabwe. Documentation and comparison of lithic assemblages from southern Africa is critical to our understanding of the similarities, as well as differences between the coastal areas and the interior. Documentation of the variability through time at WPS and comparison with assemblages from other sites in the region is an important step in seeking to answer the "marco problem" posed in Chapter I, as well as to help eliminate the enormous gap which exists for the Kalahari in the regional prehistory (for example see J. Deacon 1984 p. 306).

To date, there are a number of descriptive systems which have been used to classify stone tool assemblages. Some systems have withstood the test of time better than others. Bordes' (1961a) work for the Lower and Middle Paleolithic and De Sonneville-Bordes and Perrot's (1954-56) work for the Upper Paleolithic are still widely employed, although Bordes in particular, has been heavily criticized (Binford and Binford 1966). Archaeologists working in sub-Saharan Africa have attempted to use these systems with reference to earlier work by Goodwin (1929a) and Goodwin and Van Riet Lowe (1929). For example, Wendorf and Schild (1974) used Bordes' classification for MSA artifacts from Ethiopia and Volman did likewise for the MSA of South Africa (1981). Other authors working on the African Stone Age have developed their own systems which recognize a significantly smaller number of retouched tools (eg. Avery et al. 1997;

A.M

Kap

Wym

the

198

ass

tha

Vol

com

Mou

Sah

as

var

typ

wel

Ger

ret

con

(19

(1

co

pr

Ph

so

li

A.M.B. Clark 1997; Cooke 1969; J. Deacon 1978, 1984; Kaplan 1989; Mitchell 1994; Sampson 1968a; Singer and Wymer 1982; Thackeray 1989; Walker 1995). Furthermore, the classification system developed by J. Deacon (1978, 1984) for southern African Late Pleistocene and Holocene LSA assemblages defined 15 artifact types, as compared to more than 90 in De Sonneville-Bordes and Perrot's system, and Volman (1981) defined 35 flaked-stone tool types for the MSA compared to more than 63 defined by Bordes for the Mousterian (1961a).

Overall, the classification systems developed for sub-Saharan Africa place artifacts into rather broad categories as opposed to the European system which recognized a large variety of retouched tool types. This was the result of the types of stone artifact assemblages in the two regions, as well as the approaches of the different investigators. Generally, southern African assemblages have fewer formally retouched artifacts than their European counterparts.

The typological system developed for this analysis is a combination of key elements of J. Deacon (1984), Volman (1981, 1984), Bisson (1990), Miller (1969) and Phillipson (1976) as well as my own analyses of the WPS collections in consultation with L. Robbins and A. Campbell. Volman (1981) provided a regional synthesis of the MSA, J. Deacon (1984), Phillipson (1976) presented an overview of the LSA for southern Africa and Bisson (1990) and Miller (1969) did likewise for the LSA in Zambia. These classification syst

on b

were

anal

and

abo

Alt

19

te

th

Cl

t

t

b

r

a

systems, for the most part, involved measuring each artifact on both nominal and interval scales. Most of these methods were not new and reflect conventional archaeological lithic analyses; however, each was innovative in certain regards and that is why they were selected.

As mentioned above, the classification of stone tools above the level of the assemblage is somewhat arbitrary. Although participants in the Burg Wartenstein Conference in 1965 recommend the grouping of lithic assemblages into temporal phases or geographical phases of a single industry, the procedures to accomplish this were unclear (Bishop and Clark 1967).

I have chosen an approach which recognizes general trends in temporal patterning in the assemblages, rather than attempt to identify phases or industries due to my belief that the WPS occupations or assemblages do not represent discrete occupations and more than likely accumulated over tens, if not hundreds or even perhaps, thousands of years. Also, in order to summarize some of the later Pleistocene archaeological data, I shall refer to existing regional terms, but I will, when possible, refer the reader to specific assemblages. Beyond the specific assemblages, I will refer to general assemblages as either MSA or LSA. In some cases where assemblages have informal designations like "early LSA" I retain the informal terminology.

LITHIC

Th

was a

1991-1

inform

analys

cores

MSA/LS

ident

from

1.5 m

betwe

the N

at W

the

was

the

Raw

mat

not

the

so

th

1.
vi
in

LITHIC ANALYSIS AND TYPOLOGY

The procedure utilized in the lithic analysis for WPS was a complete analysis of all lithic artifacts from the 1991-1993 excavations (Squares 10-31) recording the information outlined below. Special consideration and analysis was given to the retouched tools, utilized flakes, cores and debitage from the early LSA, the Transitional MSA/LSA and the Upper MSA deposits. The data set included identifiable lithic raw materials, stone tools, and debitage from 21 (1 x 1 m) squares at WPS which ranged in depth from 1.5 m to 7.0 m (Figure 1.8). The 6 squares which reached between 200 cm and 450 cm were the most helpful in examining the MSA/LSA transition at WPS. However, the outlying units at WPS were also important for the study of variation during the LSA, when it appeared that the occupation of the site was not restricted to areas beneath or directly adjacent to the shelter overhang.

WPS LITHIC ANALYSIS

Raw Material:

The WPS lithic artifacts were first separated by raw material and placed into one of nine categories. Please note that: 1) there is comparatively little information on the sources of the cherts and silcretes in the Kalahari; 2) some of the raw material intergrades implying that some of the apparent distinctions are subjective.

1. Quartz or Quartzite: Colorless, white, smoky, rose, violet, brown, also translucent and tinted any hue by impurities. Luster glassy; hardness 7; gravity 2.6;

fractu

2. Bro
the sa

3. Cha
the sa
slende
transl
is ver
chalce
occasi

4. Tr
varie
is ag
the s
fiber
this

5. Ja
grain
lacks

6. B
grai
the

7. S
with
foun
brow

8. M
grai
whic
tra

9.
con
inc
lig
inc

*
Roc
Con

PR

th
th
pr

fracture conchoidal; cleavage rhombohedral.*

2. Brown chert: A microscopically crystallized variety of the same mineral with more impurities.

3. Chalcedony: A microscopically crystallized variety of the same mineral, with the individual crystals arranged in slender fibers in parallel bands. Chalcedony tends to be translucent and smooth. Banding is sometimes observable and is very obvious in the type called agate. At WPS the chalcedony ranged in color from translucent to white and occasionally pink.

4. Translucent chalcedony with black flecks: A unique variety of chalcedony recognized in the WPS assemblage. It is again a mostly microscopically crystallized variety of the same mineral, but the crystals are arranged in slender fibers in parallel bands. It is translucent and smooth, and this variety has black macroscopic crystals.

5. Jasper: A red variety of the same microscopically grained mineral, yet it tends to have more impurities and lacks the translucency and banding of the chalcedony group.

6. Black Chert: A black variety of the same microscopically grained mineral, tending to have more impurities and lacking the translucency and banding of the chalcedony group.

7. Silcrete: Macrocrystalline siliceous variety of quartz with a sugary texture and various impurities. The colors found in the WPS assemblages include white, grey, green, brown, pink, and red.

8. Multi-color Chert: A variety of the same microscopically grained mineral with more than one color in the sample, which tends to have more impurities and lacks the translucency and banding of the chalcedony group.

9. Other fine-grained rock: This is a residual category consisting primarily of cryptocrystalline siliceous rocks including honey colored chert, pink chert, white chert, light brown chert, silicified shale, but occasionally include indurated shale and other rock types.

* All descriptions adapted from Peterson's Field Guide to Rocks and Minerals. Fourth ed. 1976 Houghton Mifflin Company, Boston.

PRIMARY CATEGORIES

All lithic artifacts were initially typed into one of three primary categories on the basis of shape, size, and the assignment of their mode of origin in the stone knapping process.

Cores:
detachm
subdivi
product

1.
an
re
ar
ir
ar

2
T
p
u
g
C
a
s
F
F
S

Cores: Cobbles or pebbles which served for the systematic detachment of two or more flakes. Cores were further subdivided into several categories based on inferred production procedures.

1. Minimal cores: (Figure 3.1) These are nodules or angular fragments from which a few flakes were removed in a random fashion and thus have not assumed any of the forms described below. Flakes from irregular cores are often partially or fully cortical and have simple or cortical striking platforms.

2. Unilateral single-platform cores: (Figure 3.1) These cores were made in two ways. In the first, a pebble or block was split and flakes were removed unidirectionally from a restricted platform area. In general, flakes were not removed from the complete circumference of the platform. In the second type, an angular block was chosen on which a natural flat surface already existed and served as a platform. Flakes from these cores tend to be elongated, having parallel or sub-parallel dorsal scars and plain striking platforms.

3. Radial or disc cores: (Figure 3.1) Cores with flake removals directed from the circumference toward the center of one surface or toward the centers of two opposing surfaces. Cross-sections are generally plano-convex, or sometimes biconvex. This category includes cores called "Mousterian disc cores" by other researchers. These cores are unilateral single platform cores that were worked around the entire circumference of the striking platform. Flakes from these cores have parallel dorsal scars, plain platforms and if the cores is long enough, (ie. L = 2 X W) qualify as blade/bladelet cores.

4. Tortoise or prepared cores "Levallois" cores: (Figure 3.1) These are a special class of radial cores in which the desired product was a single or several large flakes that removes most of one face of the core. Tortoise-core flakes have scars that converge toward the center and often have multiple-faceted striking platforms.

5. Bipolar cores: (Figure 3.1) The bipolar core was described at length by Binford and Quimby (1963), McPherron (1966), Fitting (1968), Sorensen (1978) and Bisson (1990). In African literature these are sometimes called core-reduced pieces, pieces esquillees, outils ecaillees or scaled pieces. These cores have signs of battering and flake and splinter removal from opposed edges on a parallel or sub-parallel plane. These are interpreted here as the

Figure 3.1 I
Bisson 1990:
core; 2: U
disc core;
6: Multiple
core; 9: F

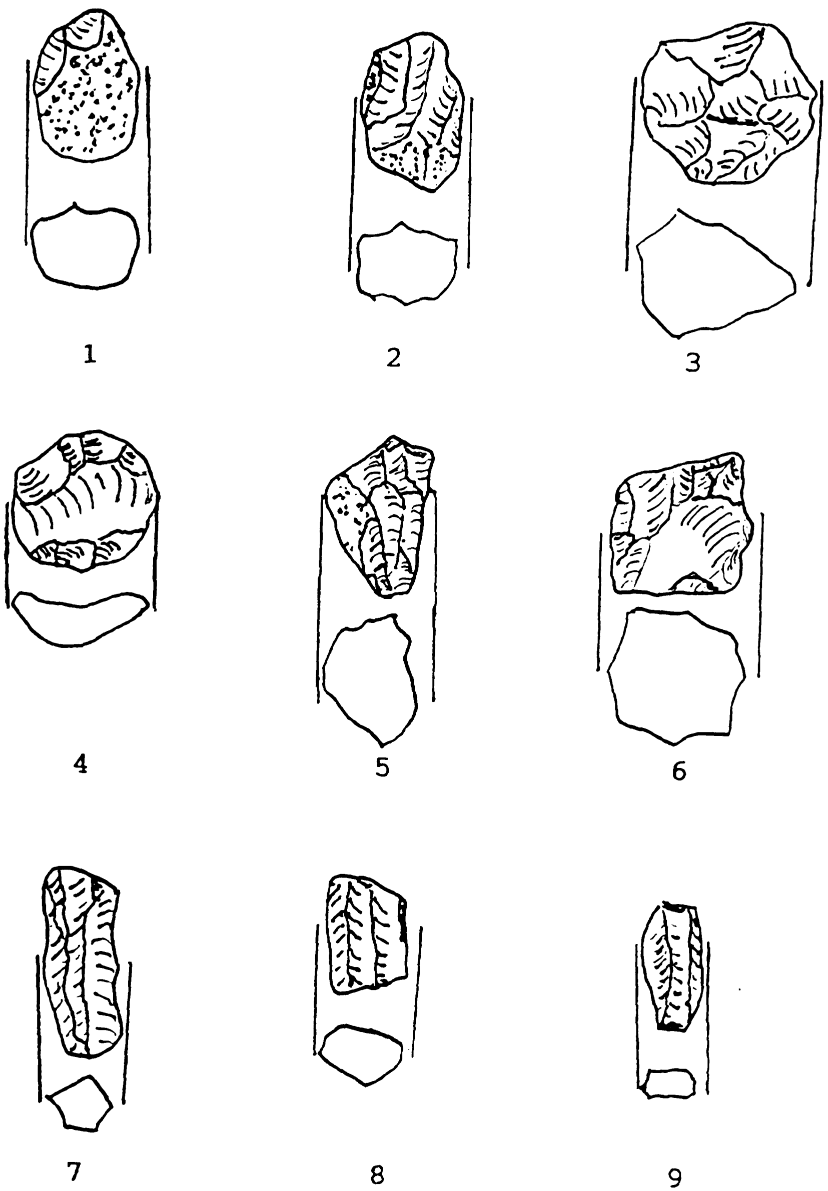


Figure 3.1 Idealized Core Categories (After Phillipson 1976, Bisson 1990:121 and J. Deacon 1984b:372-374). 1: Minimal core; 2: Unilateral single-platform core; 3: radial or disc core; 4: Tortoise or prepared core; 5: Bipolar Core; 6: Multiple platform core; 7: Blade core; 8: Bladelet core; 9: Flat bladelet core. Not to scale.

result of
core on an
hammer pro
small quar
other fine
which appe
utilizatio
awls.

6. Multip
Cores wit
different
intersect
with many
Flakes fr
short rel

7. Blade
of flakes
directio
from a p
These co
platform
same dir

8. Blade
occasion
flakes c
struck.
resemble
they occ
microli
as well

9. Flat
(usuall
(see be
platfor
chisel-
They ar
numbers
signifi
the raw
hold th
(White
southw
in Lat
not ap
during

10. Co
exhaus
be fla
with a

result of attempts to produce flakes by supporting a core on an anvil and striking the platform with a hammer producing opposed damage. They were commonly small quartz pieces, but were sometimes silcrete or other fine grained materials. Closely similar pieces which appeared to show deliberate modification or utilization were classified as tools under bipolar awls.

6. Multiple platform (polyhedral) cores: (Figure 3.1) Cores with three or more striking platforms oriented on different planes with respect to one another, with intersecting removals on one or more planes. Specimens with many flake removals may assume a spheroidal shape. Flakes from multi-platform (polyhedral) cores are often short relative to their width.

7. Blade cores: (Figure 3.1) Cores for the production of flakes with parallel or subparallel scars (Uni-directional ridge cores). Cores on which flake scars from a platform tend to run in a single direction. These cores were usually single platform with one major platform from which several flakes were struck in the same direction.

8. Bladelet Cores: (Figure 3.1) Cores with one and occasionally more platforms from which parallel-sided flakes of bladelet dimensions were systematically struck. Damage along the striking platform can resemble scraper retouch. According to Deacon (1984), they occur most frequently in Late Pleistocene microlithic assemblages, but are found in Holocene ones as well.

9. Flat Bladelet Core: (Figure 3.1) A small core (usually less than 20 mm long) from which bladelets (see below) were struck. The core does not have a flat platform; instead, the bladelets were removed from a chisel-like end. The bi-polar technique was often used. They are found in assemblages with unusually large numbers of unretouched bladelets and resemble in all significant respects the core residues that result when the raw materials are bound with leather or fibre to hold the bladelets together during the flaking process (White and Thomas 1972:278). In the southern and southwestern Cape, flat bladelet cores are found only in Late Pleistocene microlithic assemblages. They do not appear to be associated with bladelet production during the Holocene (J. Deacon 1984:373).

10. Core Reduced Piece: Core reduced pieces are exhausted cores or residues of cores that can no longer be flaked. They are usually quadrilateral in plan form with a chisel-like striking platform that is often

curved ar
Accordinc
be found
those da

DEBITAGE: In
the separatio
waste. Angul
striking plat
ventral surfa
equal to, or
retouch or ut

1. Flake
struck f
surface
missing,

2. Utili
the cutt
edge sha
which th
of smal
the dors
to a sma
Utilize
and in
treated
separat
do not

3. BLAD
dimensi
the wid
cases I
with pa
not its

4. BLAD
length
of less
commonl
silcret
occur r
assemb
assemb

STRIKING PL
Transitiona
Levels (200
analyzed fo
striking pl
categorized

curved and are made with a variety of raw materials. According to J. Deacon (1984), core reduced pieces may be found in any LSA assemblage, but are most common in those dating to the Late Pleistocene.

DEBITAGE: Initial separation of debitage or debris involved the separation of the material into flakes and angular waste. Angular waste does not possess an identifiable striking platform or a clearly distinguishable dorsal and ventral surface. All quartzite with a maximum dimension equal to, or larger than 30 mm, and lacking any sign of retouch or utilization were placed in this category.

1. Flakes: Complete and broken pieces presumably struck from cores and on which a dorsal and ventral surface was identified. The striking platform may be missing, but the margins taper to a thin edge.

2. Utilized flakes (flakes with utilization damage to the cutting edge): Flakes or flake fragments with an edge sharp enough to serve as a cutting tool and on which there is visible damage in the form of a series of small flake scars along the cutting edge, usually on the dorsal surface. This damage is usually restricted to a small section of the edge (Deacon 1984:380). Utilized flakes occur in all forms of raw material and in all the assemblages at WPS. They were initially treated and counted as debitage and then treated separately in the utilized category. Utilized flakes do not include blades(lets) which are described below.

3. BLADES: A flake whose original and present dimensions are such that length is greater than twice the width following conventional practices. In some cases I have used the term blade for elongated flakes with parallel or sub-parallel dorsal scars, whether or not its length is greater than twice its width.

4. BLADELETS: A narrow parallel-sided flake with a length greater than twice the maximum width and a width of less than 12 mm (Deacon 1984). At WPS bladelets are commonly made on chert or chalcedony but, quartz or silcrete examples do occur. According to Deacon, they occur most abundantly in Late Pleistocene microlithic assemblages, yet "they also occur in Holocene assemblages but in much smaller numbers" (1984:375).

STRIKING PLATFORMS: All debitage from the early LSA, Transitional MSA/early LSA (Large Blade) and Upper MSA Levels (200-450 cm) with complete striking platforms were analyzed for the amount and nature of preparation of the striking platform. Three types of striking platforms were categorized as follows:

1. Plair
no vertic
junction
platforms
surface c

2. Simp
one vert
junction
platform
included

3. Mult
two or m
the junc

4. Point
vertical
"point"
by a cor
producec
core is
In most
platfor

TYPOLOGY FOR

1. CRES
crescen
curved
sharp l
relativ
segment
on whic
portior
as the
was fla
presenc
classi
snappe

2. BAC
bladel
were b
cuttin
produc
reduct
and se
proxin

3. ENI
usual

1. Plain: Striking platform without cortex and with no vertical or sub-vertical ridges extending to the junction with the ventral flake surface. Striking platforms with some preparation near the dorsal flake surface only were included in this category.

2. Simple faceted: Striking Platform on which only one vertical or sub-vertical ridge extends to the junction with the ventral flake surface. Striking platforms with cortex on one side of the ridge were included.

3. Multiple faceted: Striking platform on which two or more vertical or sub-vertical ridges extend to the junction with the ventral flake surface.

4. Point faceted: Striking platform in which no vertical or sub-vertical ridges exist and the impact "point" is the top of the cone or partial cone produced by a conchoidal fracture. This is interpreted as being produced using a bipolar form of reduction in which the core is supported on an anvil and struck with a hammer. In most cases, the striking platform and the opposed platform are quite similar and both have point facets.

TYPOLOGY FOR FORMAL TOOLS WITH SECONDARY RETOUCH

1. CRESCENTS (SEGMENTS) (Figure 3.2) In plan view a crescent (segment) is a portion of a circle with a curved arc backed with abrupt retouch and a straight, sharp lateral edge. The shape may be exaggerated to a relatively thin and elongated segment or to a deep segment that is more like a truncated oval. Specimens on which abrupt retouch was present only along a portion of the arch were included with segments as long as the plan form was crescent-shaped. Where the base was flat, however, due either to abrupt retouch or the presence of the platform and bulb, the artifact is classified as a backed point. Broken segments may be snapped (presumably accidently) at one or both ends.

2. BACKED BLADELETS: (Figure 3.2) In plan form backed bladelets have straight margins of which one or more were blunted with abrupt retouch and one is a straight cutting edge. Sub-classes are seen as deliberate end-products or discards made at various stages of a reduction sequence. The former include backed points and segments, while the latter may be distal or proximal discards.

3. END SCRAPERS: (Figure 3.2) End scrapers were usually made on flakes or flake fragments, but core

Figure 3.2
Deacon 1984
(segment);
scraper; 5
Drill/borer
Burin; 11:

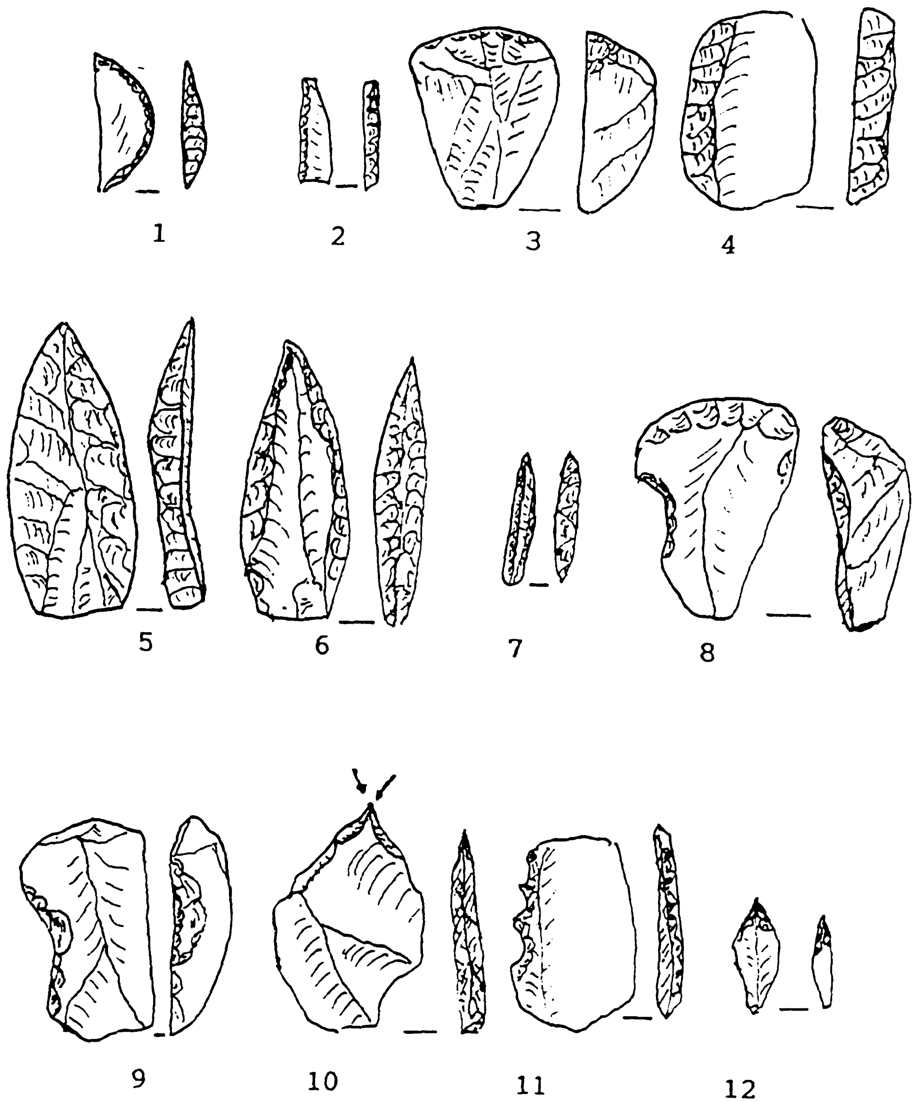


Figure 3.2 Idealized retouched tool categories (After J. Deacon 1984b:375:397, Volman 1981). 1: Crescent (segment); 2: Backed bladelet; 3: End scraper; 4: Side scraper; 5: Unifacial point; 6: Bifacial point; 7: Drill/borer; 8: Combination tool; 9: Notch; 10: Burin; 11: Denticulate; 12: Awl. Not to scale.

types wer
main feat
unretouch
the dista
bulb of p
by second
in the re
that stee
the worki
degrees.

4. SIDE
usually
types we
main fea
unretouc
one or m
of percu
secondar
the remo
that ste
and the
and 90

Note:
between
separat
the pos
bulb of
Scraper
30mm;
length
scraper
(1981)
Convex
Side s
scrape
with H
scrape
rather

5. UNI
or sub
pointe
was us
dorsal
ventra
end.
be in
"Leva

6. BI
unifa
on th

types were also found. They were characterized by two main features: a flat ventral surface that was unretouched and a convex or straight working edge on the distal end of the flake (in relationship to the bulb of percussion) which has been deliberately shaped by secondary retouch. Subsequent utilization results in the removal of smaller flakes along the working edge that steepens the angle between the ventral surface and the working edge so that it can range between 30 and 90 degrees.

4. SIDE SCRAPERS: (Figure 3.2) Side scrapers were also usually made on flakes or flake fragments, but core types were also found. They are characterized by two main features: a flat ventral surface that was unretouched and a convex or straight working edge on one or more lateral sides (in relationship to the bulb of percussion) which had been deliberately shaped by secondary retouch. Subsequent utilization resulted in the removal of smaller flakes along the working edge that steepened the angle between the ventral surface and the working edge so that it can range between 30 and 90 degrees.

Note: J. Deacon (1984) did not make a distinction between end and side scrapers. Instead they were separated into sub-classes based on size rather than the position of the working edge in relation to the bulb of percussion. Her categories include: Large Scrapers - a scraper with width or length greater than 30mm; Medium Scrapers - a scraper with width and/or length between 20 and 30mm; and Small Scrapers - a scraper with width and length less than 20mm. Volman (1981) distinguishes six side scraper types including: Convex side scraper; Straight Side scraper; Concave Side scraper; Convergent Side scraper; Double Side scraper; and Bifacial Side scraper. I tend to agree with H. Dibble's (1987) conclusions that these side scraper types are stages in the reduction sequence rather than separate tool types.

5. UNIFACIAL POINTS: (Figure 3.2) Roughly triangular or sub-triangular retouched flakes with the distal end pointed through retouch or by primary flaking. Retouch was usually restricted to one surface (usually the dorsal surface), but may include a few removals on the ventral surface and/or modification of the proximal end. Retouch on the lateral edges must be present to be included in this category to differentiate them from "Levallois Points" which were not retouched.

6. BIFACIAL POINTS: (Figure 3.2) Same definition as unifacial points, but with more than incidental retouch on the dorsal and ventral surfaces.

7. DRILLS
drills is
sections
steep ma
usually
Deacon (
bladelet
designed
make bea
bladelet
sides an
use. Fr
hornfels
Early or
1984:395

8. COMB
retained
one pur
having
edges e
being e
differ,
functio

9. NOTO
to true
(1961a)
"Spokes
shaping
working
concavi
(1984)
restric
half o
Zimbab

10. BU
techni
fragme
flakin
obtain
formed
any su
platfo
1992:

11. D
serie
produ
1992:

12. A
porti

7. DRILLS/BORERS: (Figure 3.2) The blade morphology of drills is long and narrow with steep biconvex cross sections. The blade lateral margins were subjected to steep marginal retouch and distal edge wear/damage was usually present. The basal configuration varies. J. Deacon (1984) defines a borer as having blade or bladelet proportions and is assumed that they were designed for perforating ostrich eggshell fragments to make beads. One or both of the edges of the blade or bladelet was blunted by abrupt retouch on the lateral sides and the end usually exhibited polished from use. Preferred raw materials were silcrete, quartz, hornfels and chalcedonies. Borers are not known from Early or Middle Stone Age contexts (J. Deacon 1984:395).

8. COMBINATION TOOLS: (Figure 3.2) This category was retained for tools which were utilized for more than one purpose. These artifacts are characterized by having more than one retouched edge. Commonly their edges exhibit one concave lateral edge, with the second being either notched or convex. The edge angles also differ, indicating that these tools served a variety of functions.

9. NOTCHES: (Figure 3.2) This category was restricted to true notches created by retouch as defined by Bordes (1961a). Deacon (1984) refers to these as "Spokeshaves". They typically possess unifacial shaping scars and step-flaking. The shape of the working edge is concave and may have two or more concavities, or notches. According to J. Deacon (1984), "spokeshaves" appear to be a geographically restricted in that they are more common in the eastern half of southern Africa, including parts of Zambia, Zimbabwe, the eastern Transvaal and Natal.

10. BURINS: (Figure 3.2) A particular retouch technique produced by the removal of an elongated fragment or "burin spall" by pressure or percussion flaking from a flake, blade, or bladelet. A facet was obtained through this removal. The tip of a burin was formed by the meeting of at least one burin facet with any surface apt to be used as a striking or pressure platform for the "burin blow" (M.L.Inizan et al. 1992:77).

11. DENTICULATES: (Figure 3.2) A tool formed by a series or succession of adjacent notch removals which produced serrated lateral edge(s) (M.L. Inizan et al. 1992:85).

12. AWLS: (Figure 3.2) Awls were made on flakes with a portion of the piece being shaped to an elongated point

leaving
usually
Deacon 1

13. MISC
retouche
were eit
but whic
recogniz
the flat
third a
surface
piece t
require
Miscell
utilize
similar
and ext
were ma
the ass

MEASUREMENT

bladelets w

width and t

were determ

Length
platfo
axis
line
to th

Width
surfa
deter

Thick
ventr
paral
the

In a

Transitio

assemblag

To m

measureme

leaving the rest of the flake unretouched. Polish is usually present at the tip of the working end (J. Deacon 1984:394).

13. MISCELLANEOUS RETOUCHED PIECES: Miscellaneous retouched pieces form a loose category for tools which were either broken or that displayed sustained retouch, but which do not fall into any of the commonly recognized formal tool classes. The retouch may be of the flat invasive type extending over or between one-third and two-thirds of the dorsal and/or ventral surface of the tool, or it may be steep retouch on a piece that does not conform to other attributes required to place it in the scraper class. Miscellaneous retouched pieces are an extension of the utilized flake class in the sense that they have similar sub-classes, but the retouch is more deliberate and extends over a larger portion of the tool. They were made on all raw materials and were found in all the assemblages examined.

MEASUREMENTS: All formal retouched tools, blades and bladelets were measured. For complete specimens, length, width and thickness rounded to the next highest millimeter were determined as follows.

Length: With the tool lying flat and the striking platform placed against a line perpendicular to the axis of percussion, the distance from this line to a line touching the distal end of the flake and parallel to the line touching the striking platform.

Width: Maximum distance across the tool's ventral surface along a line parallel to the lines used to determine length.

Thickness: Maximum distance between the dorsal and ventral flake surfaces measured perpendicular to a line parallel to those used to determine length and width at the one-half length point.

In addition, all debitage from the early LSA, the Transitional MSA/LSA (Large Blade), and Upper MSA assemblages were measured.

To minimize the effects of sampling error, length measurements were only taken on whole artifacts. For broken artifacts whe

present, thes

All arti

weighed and t

gram.

artifacts where maximum width and thickness were still present, these dimensions were recorded.

All artifacts including debitage and formal tools were weighed and the results recorded to the nearest tenth of a gram.

OVERVIEW OF T

REVI

This c

WPS excavati

archaeologic

the assembla

as backgrour

transition,

Excavations

The th

Male, Femal

refer to th

located at

easily acce

located wi

approximat

cattle pos

northwest

which is s

The f

Campbell

in August

more exte

and 1993

the exca

CHAPTER IV

OVERVIEW OF THE MAIN CULTURAL/STRATIGRAPHIC UNITS AT WPS AND REVIEW OF THE LITHIC AND NON-LITHIC DATA

This chapter presents a detailed description of the WPS excavations and an overview of the entire WPS archaeological sequence including the fauna and dating of the assemblages and how the various assemblages were defined as background to my major emphasis on the MSA/early LSA transition, which is the topic of the next chapter.

Excavations:

The three hills at Tsodilo are traditionally called Male, Female, and Child from largest to smallest, and I will refer to them as such below. The White Paintings Shelter is located at the base of the Male Hill at Tsodilo and is easily accessible from the Tsodilo road system. It is located within one km of an abandoned Zhu San village and is approximately three km from the local Mbukushu village and cattle post. Specifically, the shelter is situated on the northwest corner of the Male Hill on an isolated monolith which is separated from the hill proper (Figure 4.1).

The first excavation of the site were conducted by Alec Campbell and Nick Walker in 1988 followed by an larger test in August of 1989 by Campbell and Robbins. Subsequent and more extensive excavations were carried out in 1991, 1992, and 1993 finally reaching a depth of 7 m. The location of the excavations at the White Paintings Shelter are shown in

Figure 4.
text. (Af

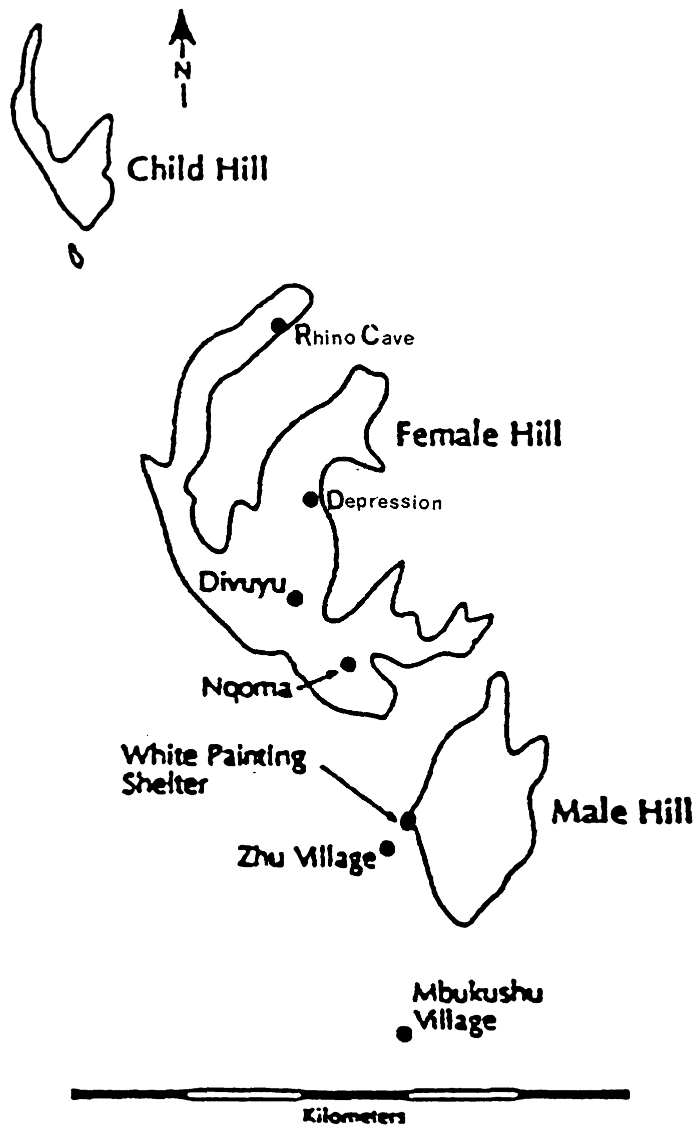


Figure 4.1 Locality map with Tsodilo sites mentioned in the text. (After Campbell et al. 1994)

Figure 1.8. A

(Squares 1-9)

consisting of

respectively.

encountering

8 were termin

200 cm due to

and back fill

The 1991

block of 9 (

excavations

tied into th

and 12) plac

outside the

problems of

excavation

1.8). It w

as a "toss

Furthermore

line would

afforded b

(Figure 1.

order to s

units to s

safety. T

excellent

remains a

Figure 1.8. As mentioned previously, the 1989 excavations (Squares 1-9) were concentrated adjacent to the shelter wall consisting of two blocks of 3 square m and 6 square m respectively. Squares 1-6 were terminated due to encountering large blocks of parent material, Squares 7 and 8 were terminated at 70 cm and Square 9 was terminated at 200 cm due to time constraints and was lined with plastic and back filled (Robbins 1989, 1991).

The 1991 excavations consisted of a 3 x 3 m square block of 9 (1 x 1 m) squares (Squares 10-18). These excavations were placed 6.05 m from the shelter wall and tied into the 1989 datum (Figure 4.2) with 3 units (10, 11, and 12) placed inside the drip line and 5 units (13-18) outside the drip line in hopes that this would avoid the problems of rock falls encountered in 1989 and allow for the excavation of deep deposits if they in fact existed (Figure 1.8). It was also believed that this area might have served as a "toss zone" for inhabitants of the shelter. Furthermore, it was hoped that the units inside the drip line would have better preservation of faunal material afforded by the protection offered by the shelter overhang (Figure 1.8). We planned to excavate in this fashion in order to step the excavation down to a smaller number of units to safely excavate 5 m deep or more in relative safety. The units inside the drip line proved to have excellent preservation of faunal and other archaeological remains and were chosen for a deep sounding of the site.

Figure 4.2
1991 excava

Squares 11,

than Depre

in 1991 so

Deter

returned t

of back fi

located in

were excav

of conduct

the lower

large bou

to enter

Figure 4.2 Dr. Robbins pointing to the 1989 datum with the 1991 excavations staked and strung in the foreground

Squares 11/12 were carried to a depth of 5.5 m (40 cm deeper than Depression). The base of the deposits were not reached in 1991 so the pit was lined and back filled.

Determined to reach the "bottom" of the site, we returned to Tsodilo in 1992 and began by removing the 5.5 m of back fill. In the process, we opened Squares 19-23, all located inside the drip line, along with Squares 10-12 which were excavated as part of the central block, for the purpose of conducting a deep sounding and enlarging the sample from the lower levels of the site. We needed to remove several large boulders and eventually used a 20 ft extension ladder to enter and exit the excavation (Figure 4.3). All material

Figure 4.3 Lark A. Murphy on spiral staircase and the author with 20 ft. extension ladder. Note large bolder on step and under Lark's foot.

was removed by "bucket brigade" up and out of the pit and all the soil was screened to recover artifacts for analysis.

As the excavation proceeded, we stopped the excavation of Squares 10, 19, and 20 at deeper levels respectively to produce, in effect, a spiral staircase allowing us to enter and exit th

excavation

excavations

artifacts w

Variation i

preferences

will be ful

In 199

(Squares 19

outside the

habitation

shelter ov

to a depth

units prod

were not e

certain ti

rather lar

In 19

our goal w

excavating

at 50 and

with the u

produced c

scatters c

excavation

pottery (

Bone was r

and exit the excavation. We eventually reduced the excavation to Squares 12 and 23, and terminated the excavations at a depth of 7 m (Figure 1.10). Stone artifacts were recovered throughout the entire sequence. Variation in tool technology, morphology and raw material preferences are clearly evident with depth of excavation and will be fully elaborated upon below.

In 1992, in addition to our central block excavation (Squares 19-23), we excavated 6 (1 x 1 m) test squares outside the shelter (Squares 24-29) to determine if the habitation debris was confined to the area beneath the shelter overhang. These units (Figure 1.8) were excavated to a depth of 150 cm. To our surprise, each of the outlying units produced artifacts, indicating that the occupations were not entirely confined to the shelter, and that at certain times in the past the site may have served as a rather large aggregation point for a number of families.

In 1993 we again returned to the site, but this time our goal was to determine the limits of the occupation by excavating two more one by one m squares (Squares 30 and 31) at 50 and 70 m from the shelter (bearing 271 degrees). As with the units closer to the shelter wall, these units also produced cultural materials in the form of low density scatters of artifacts through most of the 150 cm of excavations. Finds included LSA debitage, microliths, pottery (in the upper 60 cm), and an occasional grindstone. Bone was not abundant in comparison to excavations conducted

in the shelt
m pit (Unit
auger probes
examine the
fine screen
occupation
310 cm.

In ord
the site, w
200 mm bite
total of 12
intervals i
lake shore
1994). The
in the dep
soil auger
existed to
seven soil
located be
not produc
calcrete c
between 90
the WPS wa
past, that
although

in the shelter itself. Fish bones were recovered in the 50 m pit (Unit 30) but not in the 70 m pit (Unit 31). Soil auger probes were placed in the bottom of Squares 30-31 to examine the deeper deposits. These soil auger samples were fine screened using a pasta caldron and produced traces of occupation in the form of quartz microdebitage to a depth of 310 cm.

In order to quickly examine the more remote areas of the site, we utilized the soil bucket auger, which takes a 200 mm bite and could be extended to a depth of over 4 m. A total of 12 bucket auger tests were placed at regular intervals in the area between the 70 m pit and the ancient lake shore line investigated by Brook (1992; Robbins et al. 1994). The depths of the auger holes ranged from 165-290cm in the deposits which produced archaeological material. The soil auger probes indicated that archaeological occupations existed to at least 174.5 m from the shelter wall. The seven soil auger tests beyond the 174.5 m hole which were located between 183.5 and 354.5 m from the shelter wall did not produce artifacts and were progressively shallow as calcrete deposits precluded further excavation at depths between 90 and 15 cm. In short, our excavation documents the WPS was in fact a massive site at various times in the past, that included both shelter and open air components, although the two may not have been simultaneous.

FAUNA:

Faunal

Minimum Numb

mammals fro

Milo (perso

Southern Af

lizards, sn

ducks/geese

persinal co

by C.C. App

and are cu

sheep jaw

identifiab

animals, m

the Tsodil

fauna of t

(identifie

from Sq. 1

at the ear

interestin

current re

lechwe, bu

species o

hartebees

remains w

Other wet

FAUNA:

Faunal evidence from WPS is abundant although the Minimum Number of Individuals (MNI's) are not numerous. The mammals from WPS were analyzed by Richard Klein and Richard Milo (personal communication) and represent a wide range of Southern African fauna (Table 3). In addition, tortoises, lizards, snakes, birds (including white breasted cormorants, ducks/geese, helmeted guinea fowl and francolin, G. Avery, persinal communication to L. Robbins) and molluscs (studied by C.C. Appleton, University of Natal) have been identified and are currently under study. With the exception of one sheep jaw recovered from Square 23 40-50 cm, the entire identifiable bone assemblage consists of non-domesticated animals, many of which inhabit, or until recently, inhabited the Tsodilo area. The notable exceptions to the current fauna of the area were klipspringer and rock hyrax (identified separately from the other fauna by J. A. Holman from Sq. 12 110-120 cm), although hyrax bones were recovered at the early Iron Age sites of Nqoma and Divuyu. Most interesting were several wetland species which are not current residents of the Tsodilo Hills (ie. reedbuck, lechwe, bushbuck and vlei rat), as well as two extinct species of large mammals (ie. "giant" cape zebra and "large" hartebeest). The largest number of lechwe and reedbuck remains were recovered from a depths ranging from 80-200 cm. Other wetland species like crocodile and hippo were notable

Table 3 Whit
communicatio

WPS Fauna List (All Material Thru 1992) Note: First Number = Total bones/
Second Number = MNI (Minimum Number of Individuals).

Common Name:	+12-40cm	40-80cm	80-200cm	200-480cm	480-580cm	All Units
lesser red musk shrew	--	1/1	1/1	1/1	--	3/1

Table 3 White Paintings Fauna. (Richard Klein personal communication)

WPS Fauna List (All Material Thru 1992) Note: First Number = Total bones/ Second Number = MNI (Minimum Number of Individuals).

Common Name:	+12-40cm	40-80cm	80-200cm	200-480cm	480-580cm	All Units
lesser red musk shrew	--	1/1	1/1	1/1	--	3/1
hare	3/1	2/1	4/2	2/1	--	11/2
springhare	81/3	97/8	332/15	112/6	--	622/19
molerat	2/1	2/1	15/3	--	--	19/3
pouched mouse	--	1/1	1/1	--	--	2/1
hairy-footed gerbil	1/1	--	1/1	--	--	2/1
bushveld gerbil	1/1	2/2	11/8	--	--	14/9
Angoni vlei rat	3/1	1/1	5/1	--	--	9/3
porcupine	1/1	4/1	10/1	1/1	--	16/1
vervet monkey	--	--	1/1	--	--	1/1
bat-eared fox	4/1	4/1	11/1	9/2	--	28/3
honey badger	--	--	2/1	--	--	2/1
genet	1/1	--	--	--	--	1/1
indet. mongoose	22/3	3/1	7/2	1/1	--	33/4
small mongoose	1/1	4/1	10/1	3/1	--	18/1
hyena	--	2/1	2/1	--	--	4/1
African wild cat	--	--	--	2/1	--	2/1
wild cat-size carnivore	1/1	2/2	--	2/1	--	5/2
caracal	--	3/1	--	--	--	3/1
leopard	1/1	2/1	--	--	--	3/1
aardvark	--	2/1	--	--	--	2/1
plains zebra	2/1	7/1	10/1	--	--	19/1
"giant" Cape zebra	--	--	--	2/1	--	2/1
zebras-gen'l	2/1	8/1	10/1	2/1	--	1/1
white rhinoceros	--	--	--	1/1	--	1/1
rhinoceros-gen'l	--	--	8/1	1/1	--	9/1
warthog	--	1/1	8/1	--	1/1	10/1
bush pig	--	--	6/1	--	--	6/1
suids-gen'l	--	1/1	16/1	2/1	1/1	20/1
giraffe	2/1	--	--	--	--	2/1

WPS Fauna List cont. (All Material Thru 1992) Note: First Number = Total *bones/ Second Number = MNI* (Minimum Number of Individuals).

Table 3 con
personal co

Table 3 cont. White Paintings Fauna. (Richard Klein personal communication)

WPS Fauna List cont. (All Material Thru 1992) Note: First Number = Total bones/ Second Number = MNI (Minimum Number of Individuals).

Common Name:	+12-40cm	40-80cm	80-200cm	200-480cm	480-580cm	All Units
eland	--	--	1/1	--	--	1/1
greater kudu	--	--	1/1	--	--	1/1
bushbuck	--	1/1	--	1/1	--	2/1
roan	--	2/1	1/1	--	--	3/1
lechwe	--	--	3/1	--	--	3/1
reedbuck	2/1	2/1	17/2	7/2	--	28/4
hartebeest or tsessebe	2/1	2/1	15/3	6/1	--	25/3
large "hartebeest"	--	--	--	1/1	--	1/1
blue wildebeest	1/1	--	--	--	--	1/1
impala	--	--	1/1	--	--	1/1
grey duiker	5/1	4/1	8/2	--	--	17/3
klipspringer	--	--	--	1/1	--	1/1
steenbok	3/1	3/1	3/1	--	--	9/1
sheep	--	1/1	--	--	--	1/1
buffalo	--	--	4/1	--	--	4/1
Bovidae--General						
Small	90/3	178/7	102/3	28/2	--	397/9
Small-Medium	22/1	49/2	170/4	55/3	1/1	297/6
Medium-Large	20/1	52/2	173/4	80/2	--	325/5
Large	5/1	19/2	25/2	8/1		57/2

for their al

species in

very recent

Of par

quantities

"harpoon" p

al. 1992;

Fish bone w

depth of ov

element wa

quantities

(Table 4).

(Robbins e

the Canadi

species of

encountere

common in

species of

the Okavan

(Schilbe)

fragments

noted tha

relativel

time peri

adaptatio

the diet

the site

for their absence, considering the abundance of these species in the Okavango. Also, with the exception of the very recent levels, there was no elephant.

Of particular interest was the recovery of large quantities of fish bone and at least 15 barbed bone "harpoon" points (Figure 4.4) in the excavations (Robbins et al. 1992; Robbins et al. 1994; Robbins and Murphy 1998). Fish bone was found in every level from the surface to a depth of over 4 m. In some levels only the occasional fish element was recovered, while in others, significant quantities of evidence for a fishing economy were retrieved (Table 4). The fish have been identified by Kathlyn Stewart (Robbins et al. 1992, 1994, and personal communication) of the Canadian Museum of Nature, Ottawa. She identified four species of fish from the WPS deposits. The most frequently encountered was a species of barbel (clarius sp), a catfish common in the Okavango Delta. The other was one of several species of bream (cichlids), a perch-like fish also found in the Okavango today. Stewart also identified a catfish (Schilbe) and a mormyroid. The evidence included skull fragments, vertebrae, and "catfish spines". It should be noted that in recent times, fish were more than likely a relatively minor part of the diet. However, in more remote time periods there was significant evidence of an aquatic adaptation in which fish made up a considerable portion of the diet (approximately 22% of the total bone fragments from the site are from fish). Although some of these fish may

Figure 4.4

have been

probably a

Denbow and

in the ear

adapted fa

If fi

evidence a

Age villag

relationsh

Figure 4.4 WPS barbed bone points (Photo by S. Eyde)

have been of considerable size, usable meat from fish was probably always lower relative to mammals represented. Denbow and Wilmsen (1986) have noted that fish remains occur in the early Iron Age villages along with water/wetland adapted fauna indicating exchange with the Okavango Delta.

If fish were not in evidence from the archaeological evidence at WPS before the settlement of the two early Iron Age villages, we could assume a similar exchange relationship to the delta for the inhabitants of WPS.

However, ou

exploited th

of the MSA,

entered the

that the ex

andthe delt

early Iron

of fish wit

peoples of

were the on

the fish ca

of the past

We sou

interviewin

Mbukushu.

and Nationa

interest in

the Okavang

within 17 k

interviews

same river

flow during

in Namibia.

rivers floo

impounding

purpose.

However, our excavations revealed that fish were being exploited throughout the LSA and even in the upper portion of the MSA, well before the period when food producers entered the area. One interpretation of these data could be that the exchange relationships between the Tsodilo area andthe delta had early roots that substantially pre-date the early Iron Age, or that the San participated in the exchange of fish with other groups of San as well as the Iron Age peoples of the region. Before our research began, these were the only plausible explanations. Now we believe that the fish came from the Tsodilo area during several periods of the past.

We sought information on the history of fishing by interviewing and recording oral traditions of local San and Mbukushu. These interviews were recorded by Alec Campbell and National Museum staff as part of their long-term interest in the area. Both groups related that in the past, the Okavango would flood back up the Ncamaseri valley to within 17 km from Tsodilo. Another area identified through interviews was the Xeidum River valley (which is part of the same river as the Ncamaseri), in which water was known to flow during historical times until a dam was built upstream in Namibia. According to the oral tradition, when these rivers flooded, fish were captured as the waters receded by impounding the fish behind small dams constructed for that purpose.

All of
levels of th
in these occ
below the le
early Iron
convincing
itself. Th
harpoon poi
numbers of
encountered
and were oc
indicated a
several sty
encountered
triserial
diagnostic
were explo
periods of

At WP
(Robbins e
a fishing
associated
were obtai
horizons i
dating the
attempt to

Anoth

All of this information was logical for the upper levels of the site and explained the presence of fish bones in these occupation horizons. However, as we proceeded below the levels that contained unmistakable evidence for an early Iron Age presence in the region, we discovered some convincing evidence for fish exploitation near Tsodilo itself. This evidence consists of at least 15 barbed bone harpoon points mentioned above (Figure 4.4) found with large numbers of fish bones. These bone artifacts were first encountered between 30-40 cm below the surface of the site, and were occasional finds to a depth of nearly 3 m. This indicated a long tradition of spearing fish, particularly as several styles of these exceptional artifacts were encountered including uniserial, biserial, and possibly triserial varieties. We believe that the presence of these diagnostic artifacts indicates that the inhabitants of WPS were exploiting local aquatic resources during several periods of the past (Robbins et al. 1994).

At WPS there were two distinct occupation horizons (Robbins et al. 1994) which contained extensive evidence of a fishing economy at WPS with abundant fish bones and associated barbed bone points and I believe that the fish were obtained locally. The dating of these two occupation horizons is critical and some problems exits in regard to dating these horizons which I will elaborate upon and attempt to resolve below.

Another important contribution to this interpretation

was derived
University c
evidence fo
ancient "La
in the Late
350 m of th
between the
Thus, at di
Early Holoc
considered

DATING OF T

There
obtained ut
complete li
dates are p

The di
radiocarbo
the dates
roots from
dating tec
These incl
ostrich eg
ostrich eg
Kokis. Th
processed
Washington

was derived from the findings of Dr. George Brook of the University of Georgia, who is studying the paleoclimatic evidence for the region. Brook discovered evidence of an ancient "Lake Tsodilo" (Figure 4.5) which at several times in the Late Pleistocene and Early Holocene came to within 350 m of the White Paintings Shelter based on auguring between the site and the lake area (Brook et al. 1992). Thus, at different times during the Late Pleistocene and Early Holocene, the location of the shelter could be considered "lake front property".

DATING OF THE WPS SEQUENCE

There are still some inconsistencies in the dates obtained utilizing a number of dating techniques thus, a complete listing of all of the published and unpublished dates are presented in Table 4 below.

The difficulty arises because charcoal for conventional radiocarbon dating was rare below 130 cm, and when present the dates indicated that the charcoal resulted from burned roots from recent bush fires. Thus, a number of alternate dating techniques were employed for the deeper levels. These included bulk and AMS radiocarbon dating of bone and ostrich egg shell, as well as protein diagenesis dates on ostrich egg shell which were processed by A.S. Brooks and J. Kokis. These dates were supplemented by TL (OSL) dates processed by J. Feathers (1997) of the University of Washington and an additional series of TL dates run by W.

Figure 4
et al. 1

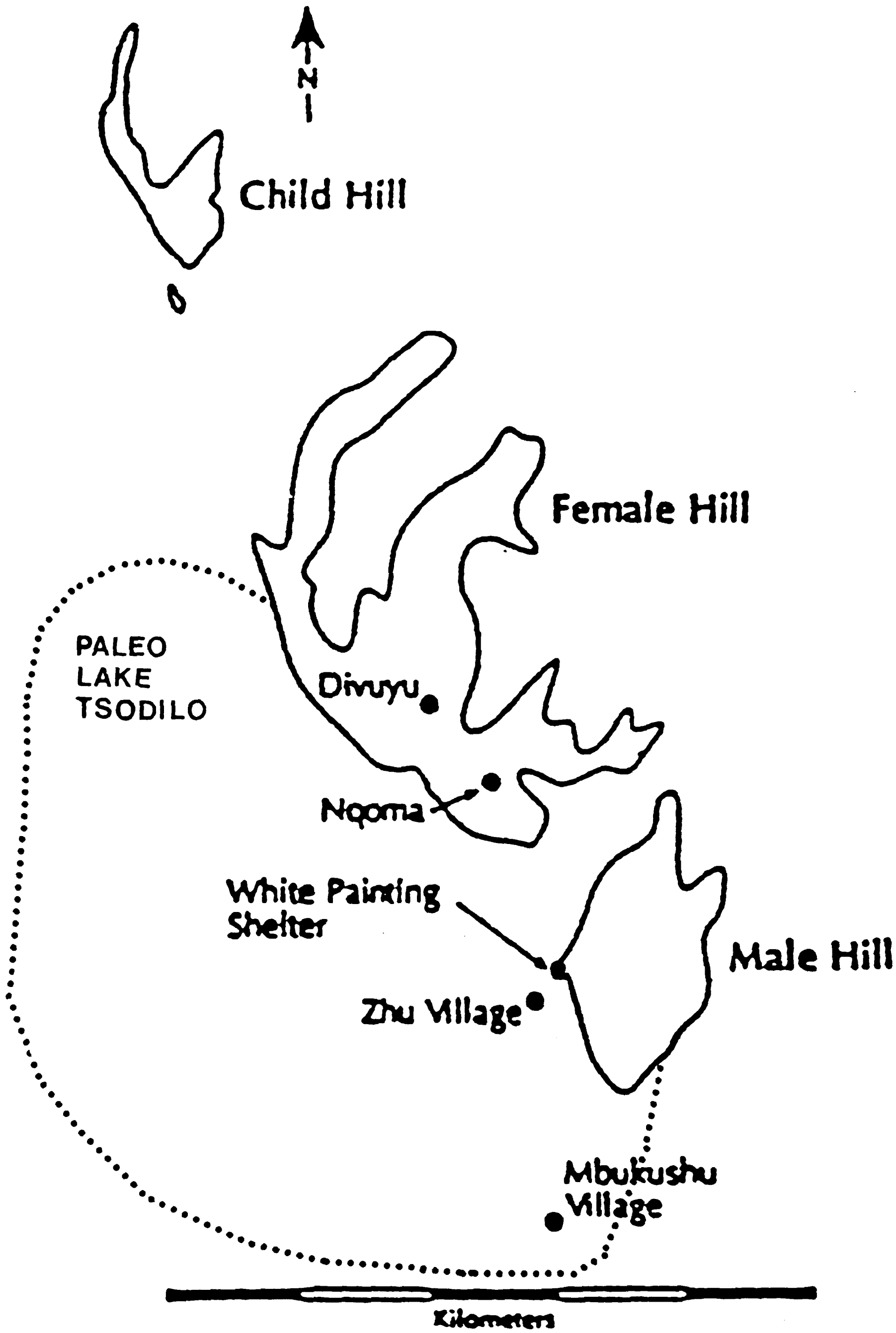


Figure 4.5 Location of Paleo Lake Tsodilo. (After Campbell et al. 1994, adapted from Ivester 1995:14)

Downey of t
dates and m
al. (in pro
dates for t
Riverside,
to correlat
of the site
techniques
OSL. The
was relate
understand
Table 4, t
with one a
particular
discussion
dating evi
consistent
regional
data as we
the artifa
levels, e
contain n
and ceram
site refi
relative
had to ev
archaeolo

Downey of the University of Botswana (these are unpublished dates and may not be quoted until the article by Robbins et al. (in progress) has appeared). The radiocarbon and AMS dates for the WPS were run by Beta Analytic, SMU, U.C. Riverside, the University of Georgia and Oxford. In order to correlate and help confirm the dating of various levels of the site, levels and units were dated using multiple techniques including AMS, protein diagenesis and OSL. The rationale for using the numerous dating techniques was related to an attempt to provide a more comprehensive understanding of the WPS chronology. As is apparent in Table 4, the various dating techniques did not always agree with one another on the ages of the various levels. This was particularly true for samples below 130 cm. In the discussion which follows, I shall attempt to interpret the dating evidence that appears to be the most logical and consistent to me and which is in agreement with the dated regional archaeological sequence and fits the paleoclimatic data as well. In reference to the upper levels of the site, the artifacts provided a clear indicator of the age of the levels, especially for the upper levels of the site which contain numerous imported glass trade beads, iron artifacts and ceramics. In addition, for the deeper levels of the site refitting of broken stone and bone tools indicate the relative integrity of the adjoining levels. In the end, I had to evaluate the data, looking for trends in the various archaeological materials to interpret the sequence and

Table 4. A
W. Downey (
(Robbins et

WPS 10
WPS 23
WPS 50
WPS 60

Feathers (
on sedimen

* WPS
Sq. 2
Sq. 2
* WPS
WPS
* Fea

C14 (Charc
calibrated
Sq. 9
Sq. 1
Sq. 1
Sq. 8
Sq. 5
Sq.
Sq.
Sq.
Sq.
Sq.

Sq.

Sq.

Bone coll
Sq.

Sq.1

Sq.

Ostrich
WPS
WPS
WPS
WPS
WPS
WPS
WPS
WPS

Table 4. Age Determinations for the White Paintings Shelter
W. Downey (University of Botswana) TL dates on sediments (Robbins et al ms. in prep.).

WPS	100 cm	5,747	+/- 590 B.P.
WPS	230 cm	47,971	+/- 4,834 B.P.
WPS	500 cm	66,393	+/- 6461 B.P.
WPS	605 cm	94,262	+/- 9411 B.P.

Feathers (1997) University of Washington T.L. (OSL) dates on sediments.

*	WPS	(WP91-120)	120 cm	20,580	+/-1,950 B.P.
	Sq. 23	(WP91-250)	250 cm	35,850	+/-2,590 B.P.
	Sq. 23	(WP91-450)	450 cm	55,430	+/-4,700 B.P.
*	WPS	(WP91-610)	610 cm	38,270	+/-4,040 B.P.
	WPS	(WP92-700)	700 cm	58,370	+/-5,270 B.P.

* Feathers rejects these dates

C14 (Charcoal) Beta dates (note that C14 dates are not calibrated)

Sq. 9	40-50 cm	(Beta33056)	1,080	+/-	100	B.P.
Sq. 14	40-50 cm	(Beta47864)	2,260	+/-	80	B.P.
Sq. 1-4	62 cm	(Beta33052)	500	+/-	60	B.P.
Sq. 8	70 cm	(Beta33055)	110	+/-	80	B.P.
Sq. 5	77 cm	(Beta33681)	2,640	+/-	130	B.P.
Sq. 6	90-100 cm	(Beta33053)	3,700	+/-	130	B.P.
Sq. 11	110-120 cm	(Beta47865)	4,330	+/-	160	B.P.
Sq. 27	139 cm	(Beta55731)	60	+/-	80	B.P.
Sq. 5/6	155-165 cm	(Beta37489)	1,780	+/-	70	B.P.
Sq. 23	180 cm	(Beta55732) CAMS3728	3,479	+/-	90	B.P.
Sq. 23	230 cm	(Beta55733) CAMS3729	Modern			
Sq. 23	285 cm	(Beta55734) CAMS3730	Modern			

Bone collagen (AMS and Bulk)

Sq. 23	40-50 cm	(OXA6038)	1,225 +/- 60 B.P.	sheep jaw
Sq.11/12	320-330 cm	(Beta47866)	20,340 +/- 520 B.P.	bulk bone
Sq.11/12	440-450 cm	(Beta47867)	20,110 +/- 160 B.P.	AMS

Ostrich eggshell (AMS and Bulk C14)

WPS	Sq.22	60-70 cm	(UCR3370)	3,570 +/-60	B.P. AMS
WPS	Sq.22	110-120 cm	(UCR3368)	3,860 +/-50	B.P. AMS
WPS	Sq.21	110-120 cm	(UCR3366)	3,900 +/-50	B.P. AMS
WPS	Sq.23	110-120 cm	(UGa6728)	6,840 +/-40	B.P. Bulk
WPS	Sq.12	120-130 cm	(UCR3365)	35,510+/-560	B.P. AMS
WPS		150-160 cm	(UGa6731)	31,220+/-320	B.P. Bulk
WPS	Sq.23	170-180 cm	(UCR3289)	33,470+/-250	B.P. AMS
WPS	Sq.11/12	180-190	(SMU2656)	33,020+/-270	B.P. Bulk

Table 4. A
cont.

WPS Sq.23 2
WPS Sc
WPS Sc
WPS Sc

Ostrich Eg
results by

WPS S
WPS S
WPS S
WPS S
WPS S
WPS S
WPS S

* A/I rat
ratios be
A/I ratio
(A.S Broo
1997)

Table 5.

1. I beli
120 cm as
These are

2. I woul
for the
consiste
other ar
with 198
shelter
village

3. The 7
pattern.
120 cm 4
OES AMS
120 cm c
3,900 +

4. The C
40 is a
100 cm

Table 4. Age Determinations for the White Paintings Shelter cont.

WPS Sq.23	210-220 cm	(UGa6729)	>42,000 B.P	Bulk
WPS Sq.23	240-250 cm	(UGa6730)	>42,000 B.P.	Bulk
WPS Sq.21	250-260 cm	(UCR3367)	28,360+/-240 B.P.	AMS
WPS Sq.11	390-400 cm	(UCR3364)	28,890+/-300 B.P.	AMS

Ostrich Egg Shell A/I racemization/protein diagenesis results by A.S. Brooks and J. Kokis

		*A/I ratios
WPS Sq.22	60-70 cm	0.179
WPS Sq.22	110-120 cm	0.60
WPS Sq.21	110-120 cm	0.074
WPS Sq.12	120-130 cm	0.493
WPS Sq.23	170-180 cm	0.535
WPS Sq.21	250-260 cm	0.462
WPS Sq.11	390-400 cm	0.057

* A/I ratios 0.18-0.2 date to between 3,000-5000 B.P., A/I ratios between 0.27-0.38 date to the mid 20,000 B.P. range, A/I ratios between 0.43-0.6 date to 28,000-37,000 B.P. range (A.S Brooks personal communication with L. Robbins Nov. 1997)

Table 5. COMMENTS CONCERNING DATING SEQUENCE AT WPS

1. I believe that the charcoal C14 dates are useless below 120 cm as indicated by out of sequence/recent/modern ages. These are most likely burned root fragments.

2. I would accept Oxford AMS (OXA6038) bone collagen date for the sheep jaw at 1,225 +/-60 for 40-50 cm. This is consistent with Early Iron Age ceramics, beads, metal and other artifacts from this level. This is also consistent with 1989 (Beta33056) date of 1080 +/-100 for 40-50 cm from shelter wall area of site and other EIA dates at the Tsodilo village sites of Divuyu and Nqoma and the Tsodilo Mines.

3. The 70-120 cm levels also seem to show a consistent pattern. The 90-100 cm C14 (Beta33053) 3,700+/-100 and 110-120 cm 4,330 +/-160 (Beta47865) and roughly agree with the OES AMS dates from 60-70 cm of 3,570 +/-60 (URC3370), 110-120 cm of 3,860 +/-50 (URC3368), and the 110-120 cm date 3,900 +/-50 (URC3366).

4. The OES Bulk date from 110-120 cm (UGa6728) of 6,840 +/-40 is also roughly consistent with the U.B., T.L. date from 100 cm of 5,747 +/-590.

Table 5. co

5. The 150
from three
cm 31,220
(URC3289);
chronologi
47,971 +/-
and 240-25
noted that
study show
32,000 B.P
younger ag
indicates
be about 5
radiocarbo
method mus

6. The U.
in rough
210-210 c
>42,000 (
reconstru
by Brook
levels da
wet phase

7. Feathe
and chron
from 230
+/-4,700
9,411.

8. The U.
seems re
sequence
of 55,43
Feathers
full 3.5
logical
order, u
rejects

9. Final
diagenes
agreeme
proposed

Table 5. cont. COMMENTS CONCERNING DATING SEQUENCE AT WPS

5. The 150-190 cm levels are dated by OES, AMS and Bulk from three different labs and are very consistent: 150-160 cm 31,220 +/-320 (UGa6731); 170-180 cm 33,470 +/-250 (URC3289); 180-190 cm 33,020+/-270 (SMU2656) and in chronological order with the U.B. T.L. date from 230 cm of 47,971 +/-4,834 and the UGa OES Bulk dates from 210-220 cm and 240-250 cm of>42,000 discussed below. Also it should be noted that Kitagawa and van der Plict's (1998) calibration study shows an increase in atmospheric radiocarbon at ca. 32,000 B.P. Samples taken from this period would produce younger ages. Ambrose (1998) notes the U-series calibration indicates that radiocarbon ages of about 42,000 B.P. could be about 5,000 years older. The above evidence suggests radiocarbon dates between ca 30,000 to the limits of the method must be interpreted with caution.

6. The U.B., T.L. date for 230 cm of 47,971 +/-4,834 is also in rough agreement with the OSE Bulk dates from UGa from 210-210 cm of >42,000 (UGa6729) and from 240-250 cm of >42,000 (UGa6730). However, based on the paleoenvironmental reconstruction for the site by Ivester (1995) and the region by Brook et. al. (1996) for the region, I believe that these levels date to ca. 30,000-38,000 B.P. and correlate with a wet phase documented by these researchers.

7. Feathers and U.B. T.L. (OSL) dates are stratigraphically and chronologically consistent beginning with the U.B. date from 230 cm of 47,971 +/-4,834, Feathers 450 cm of 55,430 +/-4,700 (WP91-450), and U.B. date from 500 cm of 66,393 +/- 9,411.

8. The U.B. T.L. (OSL) date from 605 cm of 94,262 +/- 9,411 seems reasonable to me considering the dating of the sequences above and Feathers T.L. date for 450 cm (WP91-450) of 55,430 +/-4,700 B.P.. In addition is seems to me that Feathers date of 58,370 +/-5,270 (WP92-700) which lies a full 3.5 m below his 55,430 +/-4,700 date does not seem logical or consistent although it does fall in chronological order, unlike his WP91-610 date of 38,270 +/-4,040 which he rejects in his (1997) article.

9. Finally, the ostrich egg shell A/I racemization/protein diagenesis results by A.S. Brooks and J. Kokis are in rough agreement with the AMS and bulk radiocarbon chronology proposed and seem to confirm the proposed chronology.

Table 6. C
* Cultural

* Historic/
Maize, gl
* LSA Conte
- 40-50 cm
- 40-50 cm
* "Upper F
- 90-100
- 100
- 110-120
- 110-120
- 110-120
- 110-120
* Low Dens
- 150-160
- 170-180
- 180-190
* "Lower
- 210-220
- 230 cm
- 240-250
* "Large
* MSA 420
- 450 cm
- 500 cm
- 600 cm

chronolo

the othe

archaeol

dates fo

George E

Botswana

chronolo

propose

Table 6. Current WPS Chronology
* Cultural Designation

* Historic/Late Prehistoric 0-30 cm		
Maize, glass trade beads to ca. 20 cm		
* LSA Contemporary With The Early Iron Age 30-80 cm		
- 40-50 cm	1,080 +/- 100 B.P.	(Beta33056)
- 40-50 cm	1,225 +/- 60 B.P.	(OXA6038)
* "Upper Fish" LSA 80-130 cm		
- 90-100 cm	3,700 +/- 130 B.P.	(Beta33053)
- 100 cm	5,747 +/- 590 B.P.	(U.B. TL)
- 110-120 cm	3,860 +/- 50 B.P.	(UCR3368)
- 110-120 cm	3,900 +/- 50 B.P.	(UCR3366)
- 110-120 cm	4,330 +/- 160 B.P.	(Beta47865)
- 110-120 cm	6,840 +/- 40 B.P.	(UGa6728)
* Low Density LSA 130-200 cm		
- 150-160 cm	31,220 +/- 320 B.P.	(UGa6731)
- 170-180 cm	33,470 +/- 250 B.P.	(UCR3289)
- 180-190 cm	33,020 +/- 270 B.P.	(SMU2656)
* "Lower Fish" Early LSA 200-300 cm		
- 210-220 cm	>42,000 B.P.	(UGa6729)
- 230 cm	47,971 +/- 4,834 B.P.	(U.B. TL)
- 240-250 cm	>42.000 B.P.	(UGa6730)
* "Large Blade" MSA/Early LSA 300-420 cm		
* MSA 420-700 cm		
- 450 cm	55,430 +/- 4,700 B.P.	(Feathers TL)
- 500 cm	66,393 +/- 6,461 B.P.	(U.B. TL)
- 600 cm	94,262 +/- 9,411 B.P.	(U.B. TL)

chronology that I believe is the most reasonable considering the other data such as paleoclimatic data and the accepted archaeology of the region. Finally, a recent series of T.L. dates for WPS sediments were collected by the author and Dr. George Brook in 1996 and run by the W. Downey University of Botswana (1997) as a final attempt to clarify the WPS chronology and appear to offer some confirmation to my proposed chronology.

WPS ARCHAE

The W

approximat

between th

lengthy pe

and MSA cc

The 7

Paintings

archaeolog

were recov

focus of t

was also s

faunal and

The s

habitation

years ago

Iron Age v

1986; Wil

into a lon

Middle to

evidence c

Age sequer

assemblage

use well k

The W

relating t

by the loc

WPS ARCHAEOLOGICAL SEQUENCE OVERVIEW:

The WPS archaeological sequence extends from approximately 60 years ago, through a period of "overlap" between the LSA and the local Early Iron Age and into a lengthy period of LSA, early LSA, transitional MSA/early LSA and MSA occupations.

The 7 m of archaeological deposits at the White Paintings Rock Shelter are, to date, the deepest archaeological excavation in the Kalahari. Stone artifacts were recovered throughout the sequence and were the primary focus of this analysis. However, as mentioned above, WPS was also significant due to the excellent preservation of faunal and botanical remains.

The shelter has archaeological evidence of human habitation covering a time span from approximately 50/60 years ago through a period of chronological overlap with the Iron Age villages of Ngoma and Divuyu (Denbow and Wilmsen 1986; Wilmsen 1989) located on the Female Hill, and then into a long series of Late Stone Age deposits dating to the Middle to Early Holocene. In deeper deposits, there was evidence of a transitional early Late Stone Age/Middle Stone Age sequence, and deeper still, a typical Middle Stone Age assemblage was discovered, pushing the time frame for site use well back into the Pleistocene.

The White Paintings Shelter has oral traditions relating to its use in historic times as a rainy season camp by the local San as recently as 50 to 60 years ago. This is

particularl
have livin
concerned.
account of
in the upp
The a
debris lef
Over time,
meals, too
incorpora
filled th
rate of a
condition
habitatio
Pleistoce
The
produced
tools, m
signific
Much of
formal s
LSA and
1977;
and J.
that th
remains
and Fig

particularly significant as it is a very rare occurrence to have living informants where rock shelter archaeology is concerned. As will be discussed below, the San elder's account of the shelter closely matched what was discovered in the upper levels of the site.

The archaeological deposits at the shelter consist of debris left by numerous habitations over the millennia. Over time, the debris from these habitations (bones from meals, tools, and other garbage) accumulated and were incorporated into the windblown sand deposits that slowly filled the shelter to its current depth. Certainly, the rate of accumulation varied over time depending on climatic conditions, but the result was a layer cake of human habitation covering a time span from modern to the Upper Pleistocene.

The 1991-1993 excavations at White Paintings Shelter produced over 32,000 lithic artifacts, including 2,779 tools, many of which have cultural and chronological significance (Tables 7 and 8) and (Figures 4.6 and 4.7). Much of the discussion in later chapters will center on the formal stone tools from the MSA, the transitional MSA/ early LSA and early LSA levels of the site (Brooks and Yellen 1977; Kuman 1989; Singer and Wymer 1982; Volman 1984; and J. Deacon 1984a, 1984b). However, it must be stressed that the vast majority (31,465) of the archaeological remains were in the form of lithic cores (Tables 9 and 10 amd Figures 4.8 and 4.9) and debitage. These cores and

Table 7 WPS Tool Totals Squares 10-29 Note: Squares excavated to different depths.

Depth	*BLT	BL	BBL	CRS	BPTS	PTS	SS	ES	DENT	NOT	BEC	BUR	AWL	DRL	COM	MRT	Totals:
0-10	7	0	2	4	0	0	1	2	0	0	0	4	3	0	0	4	27
[illegible]	3	1	2	0	0	0	1	2	0	0	0	7	4	2	0	1	23
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4	3	0	0	5	50

Table 7 WPS Tool Totals Squares 10-29 Note: Squares excavated to different depths.

Depth	*BLT	BL	BBL	CRS	BPTS	PTS	SS	ES	DENT	NOT	BEC	BUR	AWL	DRL	COM	MRT	Totals:
0-10	7	0	2	4	0	0	1	2	0	0	0	4	3	0	0	4	27
10-20	3	1	2	0	0	0	1	2	0	0	0	7	4	2	0	1	23
20-30	16	1	2	10	0	0	7	2	0	0	0	4	3	0	0	5	50
30-40	14	1	2	6	0	0	10	2	0	1	1	8	6	1	2	2	56
40-50	17	1	1	6	0	0	9	3	0	0	0	7	4	1	3	5	57
50-60	23	1	2	7	4	1	10	1	0	0	1	4	3	1	1	4	63
60-70	22	2	3	7	3	0	12	3	1	1	0	12	11	0	0	4	81
70-80	35	6	0	7	1	0	13	3	0	2	1	7	14	0	1	5	95
80-90	36	3	2	3	2	0	3	4	0	1	0	10	12	1	1	3	81
90-100	24	2	3	1	1	0	8	2	0	1	0	4	10	0	0	7	63
100-110	69	4	2	0	2	0	8	3	3	2	1	13	18	1	1	5	132
110-120	73	3	0	3	0	0	15	3	0	3	0	9	14	1	1	4	129
120-130	74	2	4	0	0	0	10	3	0	6	0	6	14	1	0	3	123
130-140	14	0	2	1	0	0	4	1	0	0	0	2	3	0	1	1	29
140-150	18	1	2	1	0	0	2	0	0	1	0	3	4	0	0	2	34
150-160	12	0	0	1	0	0	2	2	1	0	0	0	2	1	0	0	21
160-170	4	2	0	0	0	0	1	4	0	0	0	2	1	0	0	1	15
170-180	14	1	0	0	0	1	3	0	0	2	0	2	8	0	2	6	39
180-190	19	5	0	0	0	1	7	3	0	1	1	9	8	0	1	1	56
190-200	10	0	0	2	1	0	2	0	0	0	0	7	10	0	1	4	37
200-210	8	2	0	0	0	0	1	0	0	0	0	3	1	1	0	0	16
210-220	15	3	1	0	1	0	1	2	0	0	0	2	2	0	0	1	28
220-230	11	5	0	2	0	0	4	0	1	0	0	4	8	0	2	2	39
230-240	37	6	0	2	2	0	1	0	0	1	0	5	8	1	1	3	67
240-250	44	12	4	0	1	0	9	2	0	0	0	15	21	0	2	3	113
250-260	40	8	3	3	7	0	3	2	1	0	1	30	27	0	3	0	128
260-270	28	3	2	1	2	0	3	3	0	1	3	20	14	0	0	5	85
270-280	13	4	1	3	1	0	1	1	0	0	1	18	7	0	2	0	52
280-290	11	0	0	0	3	0	3	2	0	0	1	8	10	0	0	1	39
290-300	5	4	0	0	0	0	0	0	0	0	0	10	17	0	0	1	37
300-310	1	1	0	1	0	0	0	1	0	0	0	8	1	0	0	0	13
310-320	0	1	1	0	2	0	0	0	0	0	0	3	0	0	0	0	7

Table 7 cont. WPS Tool Totals Squares 10-29 Note that squares were excavated to different depths.

Depth	*BLT	BL	BBL	CRS	BPTS	PTS	SS	ES	DENT	NOT	BEC	BUR	AWL	DRL	COM	MRT	Totals:
320-330	2	0	0	0	0	0	1	3	0	2	0	2	3	0	0	1	14
[illegible]	[illegible]	[illegible]	0	0	0	1	0	1	0	0	0	4	6	0	0	1	19
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	1	8	11	0	0	0	36
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	32

Table 7 cont. WPS Tool Totals Squares 10-29 Note that squares were excavated to different depths.

Depth	*BLT	BL	BBL	CRS	BPTS	PTS	SS	ES	DENT	NOT	BEC	BUR	AWL	DRL	COM	MRT	Totals:
320-330	2	0	0	0	0	0	1	3	0	2	0	2	3	0	0	1	14
330-340	3	3	0	0	0	1	0	1	0	0	0	4	6	0	0	1	19
340-350	8	5	0	1	0	0	1	1	0	0	1	8	11	0	0	0	36
350-360	5	4	1	1	0	0	0	0	0	1	0	10	10	0	0	0	32
360-370	5	4	0	0	0	0	2	1	1	1	0	3	3	0	0	0	20
370-380	2	2	0	0	0	0	1	0	1	1	0	11	4	0	0	0	22
380-390	7	4	0	1	0	1	0	1	0	1	0	3	0	0	0	1	19
390-400	7	9	0	0	0	0	2	0	0	1	0	4	4	0	0	3	30
400-410	5	10	0	2	0	0	5	0	0	0	0	8	11	0	0	2	43
410-420	6	14	0	0	0	2	4	2	2	0	0	14	15	0	0	0	59
420-430	12	7	0	1	0	1	2	2	0	2	0	18	9	0	2	4	60
430-440	8	8	0	0	0	6	3	1	0	0	0	9	4	0	2	1	42
440-450	5	10	0	0	0	7	6	2	1	1	0	8	20	0	2	3	65
450-460	9	9	0	0	0	2	2	1	4	0	0	13	8	0	0	0	48
460-470	9	7	0	0	1	6	6	0	2	0	0	11	6	0	1	1	50
470-480	13	11	0	0	0	3	5	1	0	1	0	13	3	0	1	6	57
480-490	3	7	0	0	0	6	4	3	1	1	0	10	13	0	1	1	50
490-500	4	4	0	0	0	5	4	5	1	0	1	3	2	0	0	2	31
500-510	4	4	0	0	0	1	2	0	1	1	0	6	2	0	0	1	22
510-520	2	3	0	0	0	3	3	0	1	0	0	3	2	0	2	0	19
520-530	3	5	0	0	0	9	4	0	0	0	1	7	3	0	3	1	36
530-540	1	1	0	0	0	3	3	0	0	0	0	1	3	0	1	3	16
540-550	7	6	0	1	0	5	2	1	0	0	0	5	2	0	0	2	31
550-560	3	2	0	0	0	4	1	0	1	0	1	8	1	0	1	2	24
560-570	6	5	0	0	0	4	4	0	1	0	0	3	3	0	0	1	27
570-580	1	3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	5
580-590	4	0	0	0	0	3	3	0	0	0	0	2	1	0	0	0	13
590-600	4	2	0	0	0	3	0	0	0	0	0	4	3	0	0	4	20
600-610	0	2	0	0	0	0	0	0	1	0	0	3	0	0	0	1	7
610-620	0	1	1	0	0	1	0	1	0	0	0	2	1	0	0	1	8
620-630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
630-640	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1

Table 7 cont. WPS Tool Totals Squares 10-29 Note that squares were excavated to different depths.

Depth	*BLT	BL	BBL	CRS	BPTS	PTS	SS	ES	DENT	NOT	BEC	BUR	AWL	DRL	COM	MRT	Totals:
640-650	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
[illegible]	[illegible]	0	0	0	0	3	0	0	0	0	0	0	1	0	0	0	7
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	2	0	0	0	4

Table 7 cont. WPS Tool Totals Squares 10-29 Note that squares were excavated to different depths.

Depth	*BLT	BL	BBL	CRS	BPTS	PTS	SS	ES	DENT	NOT	BEC	BUR	AWL	DRL	COM	MRT	Totals:
640-650	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
650-660	3	0	0	0	0	3	0	0	0	0	0	0	1	0	0	0	7
660-670	0	1	0	0	0	0	0	0	0	0	0	1	2	0	0	0	4
670-680	0	0	0	0	0	2	1	0	0	0	0	0	1	0	0	0	4
680-690	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
690-700	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Totals:	869	239	43	78	34	84	225	82	-33	36	15	444	425	12	41	127	2779

*BLT=Bladelets
BL=Blades
BBL=Backed Blades/Bladelets
CRS=Crescents (Segments)
BPTS=Backed Points
PTS=MSA Points
SS=Side Scrapers
ES=End Scrapers
DENT=Denticulates
NOT=Notches
BEC=Becs
BUR=Burins
Awl=Awls
DRL=Drills
COM=Combination Tools
MRT=Miscellaneous Retouched Pieces

Figure

WPS Tool Totals
Square's 10-29

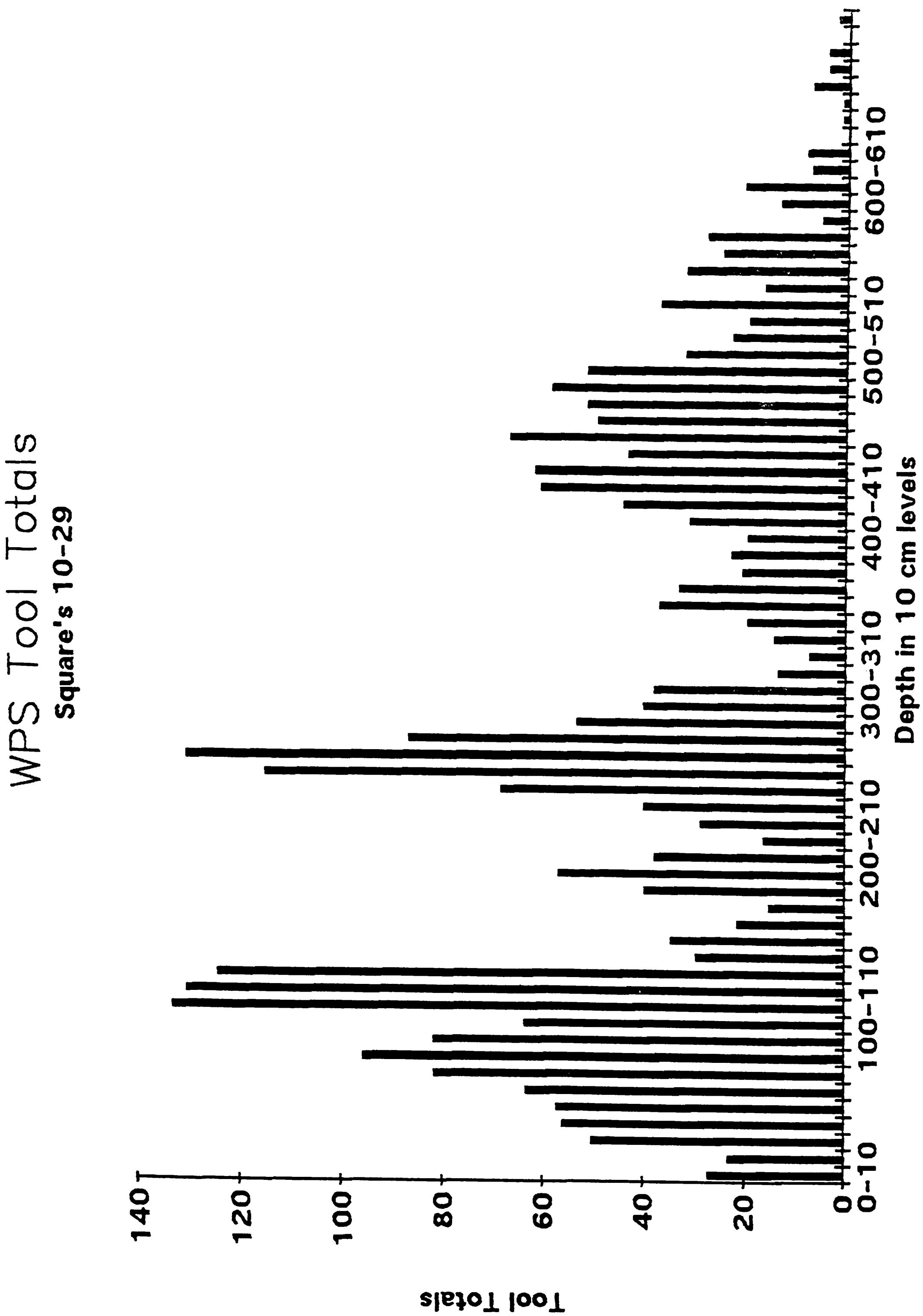


Figure 4.6 WPS Tool Totals. Square's 10-29.

Table 8 Lithic
Squares 1C-29

Depth	*QAW
0-10	54
10-20	25
20-30	50
30-40	59
40-50	69
50-60	82
60-70	139
70-80	161
80-90	132
90-100	141
100-110	273
110-120	196
120-130	241
130-140	40
140-150	54
150-160	26
160-170	42
170-180	65
180-190	62
190-200	44
200-210	52
210-220	55
220-230	58
230-240	94
240-250	161
250-260	157
260-270	76
270-280	55
280-290	22
290-300	80
300-310	33
310-320	9
320-330	53
330-340	87
340-350	103
350-360	47
360-370	35
370-380	37
380-390	10
390-400	28
400-410	30
410-420	54
420-430	31
430-440	8
440-450	47
450-460	66
460-470	46
470-480	43
480-490	36
490-500	12

Table 8 Lithic Debitage and Angular Waste Totals.
Squares 10-29 Note: Squares excavated to different depths.

Depth	*QAW	QD	BCD	CHD	JAD	TWBF	BC	SD	MCCD	OFGD	Totals
0-10	54	185	10	7	6	1	0	4	8	9	284
10-20	25	209	1	1	10	1	0	6	5	11	269
20-30	50	392	4	4	25	0	0	11	19	26	531
30-40	59	551	7	8	18	2	1	8	16	40	710
40-50	69	662	11	6	24	0	1	16	30	39	858
50-60	82	577	32	17	20	3	0	17	31	33	812
60-70	139	594	34	15	30	1	1	26	20	44	904
70-80	161	764	39	31	30	6	3	27	45	43	1149
80-90	132	567	36	16	24	2	0	28	51	30	886
90-100	141	491	31	16	28	4	1	29	43	44	828
100-110	273	568	52	29	29	7	3	89	68	105	1223
110-120	196	573	50	33	46	8	4	111	109	130	1260
120-130	241	529	59	37	45	5	2	113	114	141	1286
130-140	40	316	14	5	17	1	1	35	40	36	505
140-150	54	280	14	4	12	7	0	28	18	15	432
150-160	26	110	14	5	14	1	1	21	21	26	239
160-170	42	126	10	5	7	0	0	28	12	24	254
170-180	65	212	25	14	12	4	0	63	40	21	456
180-190	62	182	16	6	9	1	4	103	19	24	426
190-200	44	159	12	6	6	4	0	46	12	12	301
200-210	52	142	7	2	4	0	0	26	12	11	256
210-220	55	257	10	2	6	1	0	30	26	15	402
220-230	58	264	5	3	3	1	0	16	16	23	389
230-240	94	596	4	13	7	5	0	28	30	8	785
240-250	161	758	18	19	9	5	0	27	42	19	1058
250-260	157	762	15	17	12	4	6	32	54	42	1101
260-270	76	299	7	9	8	4	2	12	38	10	465
270-280	55	216	3	4	8	1	1	7	38	12	345
280-290	22	152	2	6	3	1	0	3	17	11	217
290-300	80	130	4	2	0	0	1	4	13	4	238
300-310	33	57	0	1	0	1	0	3	5	1	101
310-320	9	41	3	0	0	0	0	4	1	4	62
320-330	53	64	1	1	1	0	0	1	0	2	123
330-340	87	100	5	1	0	0	0	9	3	4	209
340-350	103	119	3	0	0	0	0	5	1	3	234
350-360	47	120	3	1	2	1	0	6	7	5	192
360-370	35	56	1	4	1	0	0	7	7	6	117
370-380	37	77	5	5	4	0	1	12	7	11	159
380-390	10	92	5	0	1	3	0	10	31	9	161
390-400	28	142	7	5	6	1	2	26	26	10	253
400-410	30	189	5	2	4	2	0	42	28	10	312
410-420	54	173	10	8	17	1	1	58	36	22	380
420-430	31	131	8	5	11	2	0	72	35	11	306
430-440	8	128	12	2	7	6	0	22	50	7	242
440-450	47	241	13	14	27	10	0	63	55	29	499
450-460	66	139	15	6	9	6	1	52	37	34	365
460-470	46	137	13	6	10	7	0	73	51	41	384
470-480	43	160	7	19	15	7	0	83	57	44	435
480-490	36	112	13	20	23	8	0	84	78	27	401
490-500	12	95	8	13	9	4	0	55	42	36	274

Table 8 cont. L

Squares 10-29

Depth	*QAW
500-510	15
510-520	6
520-530	22
530-540	18
540-550	12
550-560	6
560-570	16
570-580	13
580-590	44
590-600	24
600-610	11
610-620	21
620-630	6
630-640	0
640-650	6
650-660	14
660-670	7
670-680	5
680-690	0
690-700	0

Totals:3826 1

*QAW = Quartz

QD = Quartz D

BCD = Brown C

CHD = Chalced

JAD = Jasper

TWBF = Transp

BC = Black Ch

SD = Silcrete

MCCD = Multi-

OFGD = Other

Table 8 cont. Lithic Debitage and Angular Waste Totals.
Squares 10-29 Note: Squares excavated to different depths.

Depth	*QAW	QD	BCD	CHD	JAD	TWBF	BC	SD	MCCD	OFGD	Totals
500-510	15	70	6	12	6	1	2	53	32	26	223
510-520	6	46	4	8	7	2	0	37	25	28	163
520-530	22	71	7	22	17	8	0	80	29	30	286
530-540	18	76	11	18	12	8	0	71	35	35	284
540-550	12	58	17	26	16	7	3	80	34	46	299
550-560	6	43	16	13	8	3	0	47	35	20	191
560-570	16	87	18	9	18	3	0	64	30	41	286
570-580	13	50	6	0	9	3	0	41	15	24	161
580-590	44	85	7	2	5	0	0	26	10	15	194
590-600	24	49	9	1	4	1	0	30	5	7	130
600-610	11	46	3	1	4	0	0	10	0	10	85
610-620	21	55	3	3	3	0	0	16	7	23	131
620-630	6	22	1	0	2	3	0	7	6	7	54
630-640	0	27	0	1	1	1	0	4	0	0	34
640-650	6	22	0	0	0	0	0	1	4	4	37
650-660	14	43	4	5	4	0	0	3	4	9	86
660-670	7	33	2	2	3	0	0	12	4	7	70
670-680	5	35	3	0	6	3	0	8	12	1	73
680-690	0	12	0	0	8	0	0	10	4	12	46
690-700	0	9	1	5	2	0	0	3	16	0	36
Totals:	3826	14895	801	583	754	182	42	2284	1870	1669	26906

*QAW = Quartz Angular Waste
QD = Quartz Debitage
BCD = Brown Chert Debitage
CHD = Chalcedony Debitage
JAD = Jasper Debitage
TWBF = Transparent w/ Black Flecks Debitage
BC = Black Chert Debitage
SD = Silcrete Debitage
MCCD = Multi-Color Chert Debitage
OFGD = Other Fine Grained Debitage

WPS Debitage/Angular Waste Totals
Square's 10-29

Figure 4.7
10-29.

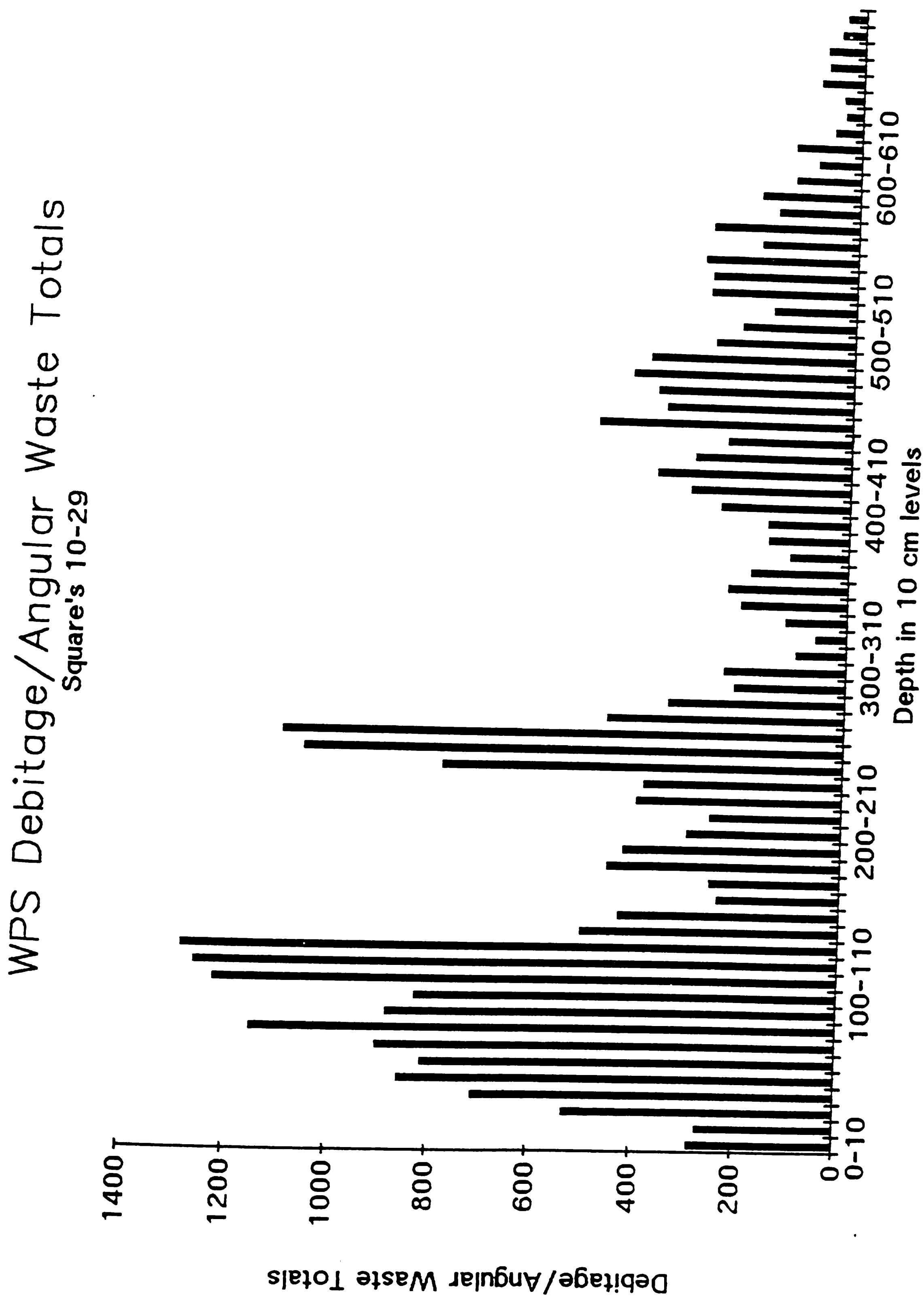


Figure 4.7 WPS Debitage and Angular Waste Totals. Square's 10-29.

Table 9 WPS Q

Squares 10-29

Depth	* BP
0-10	21
10-20	19
20-30	18
30-40	36
40-50	28
50-60	41
60-70	57
70-80	35
80-90	38
90-100	38
100-110	49
110-120	55
120-130	35
130-140	16
140-150	16
150-160	9
160-170	14
170-180	31
180-190	25
190-200	23
200-210	17
210-220	21
220-230	35
230-240	54
240-250	66
250-260	113
260-270	60
270-280	18
280-290	9
290-300	12
300-310	7
310-320	5
320-330	6
330-340	17
340-350	13
350-360	17
360-370	9
370-380	1[illegible]
380-390	[illegible]
390-400	[illegible]
400-410	[illegible]
410-420	1[illegible]
420-430	
430-440	2[illegible]
440-450	2[illegible]
450-460	1[illegible]
460-470	1[illegible]
470-480	1[illegible]
480-490	
490-500	

Table 9 WPS Quartz/Quartzite Core Totals.
Squares 10-29 Note: Squares excavated to different depths.

Depth	* BP	MC	FBL	SPC	R/D	LC	MPC	BLT	BL	CRP	Totals
0-10	21	6	4	0	0	0	1	1	0	0	33
10-20	19	3	8	2	0	0	2	1	0	0	35
20-30	18	12	4	1	0	0	0	0	0	2	37
30-40	36	15	4	1	0	0	3	0	0	0	59
40-50	28	20	7	2	0	0	7	0	0	3	67
50-60	41	19	15	1	0	0	5	3	0	4	88
60-70	57	9	15	3	0	0	4	2	0	5	95
70-80	35	11	21	3	1	0	10	2	0	4	87
80-90	38	14	10	1	0	0	2	1	0	4	70
90-100	38	13	6	2	0	0	2	0	0	7	68
100-110	49	7	20	0	0	0	8	1	0	5	90
110-120	55	5	21	0	0	0	5	5	0	8	99
120-130	35	5	18	1	1	0	10	0	0	2	72
130-140	16	12	2	0	0	0	1	0	0	3	34
140-150	16	16	3	0	0	0	0	0	0	0	35
150-160	9	5	1	0	0	0	1	1	0	1	18
160-170	14	7	2	0	0	0	2	1	0	0	26
170-180	31	2	3	0	0	1	1	1	0	2	41
180-190	25	2	4	1	0	0	3	2	2	0	39
190-200	23	4	4	0	0	0	3	0	0	0	34
200-210	17	0	3	0	0	0	3	0	0	0	23
210-220	21	4	2	0	0	0	2	1	0	0	30
220-230	35	3	3	0	0	0	3	0	0	2	46
230-240	54	10	4	0	0	0	6	5	0	3	82
240-250	66	9	6	0	0	0	8	2	0	5	96
250-260	113	11	15	0	1	0	10	1	0	3	154
260-270	60	4	6	0	0	0	6	2	0	4	82
270-280	18	3	6	0	0	0	4	0	0	4	35
280-290	9	4	1	0	0	0	1	0	0	1	16
290-300	12	8	1	0	0	0	0	0	0	3	24
300-310	7	1	2	0	0	0	1	0	0	1	12
310-320	5	4	0	0	0	0	3	0	0	0	12
320-330	6	3	4	0	0	0	1	0	0	0	14
330-340	17	4	3	0	0	0	1	0	0	1	26
340-350	13	2	6	0	0	0	3	1	1	2	28
350-360	17	2	3	0	0	0	1	0	0	2	25
360-370	9	3	1	1	0	0	1	0	0	0	15
370-380	16	3	2	0	0	0	1	0	0	0	22
380-390	8	4	1	0	0	0	3	0	0	1	17
390-400	5	4	3	0	0	0	4	0	0	0	16
400-410	8	2	0	0	0	0	4	0	0	0	14
410-420	14	2	0	0	0	0	3	0	0	2	21
420-430	3	3	2	0	0	0	4	0	0	1	13
430-440	20	0	0	2	0	0	1	1	0	1	25
440-450	22	3	1	0	1	0	5	0	0	1	33
450-460	17	2	4	0	0	0	6	0	0	1	30
460-470	14	2	12	0	1	0	4	0	0	0	33
470-480	13	2	5	0	2	0	3	0	0	2	27
480-490	3	1	1	0	0	0	2	0	0	1	8
490-500	6	1	1	0	0	0	1	0	0	0	9

Table 9 cont.
Squares 10-29

Depth	* BP
500-510	5
510-520	11
520-530	9
530-540	7
540-550	4
550-560	9
560-570	0
570-580	0
580-590	1
590-600	9
600-610	6
610-620	3
620-630	6
630-640	0
640-650	0
650-660	0
660-670	0
670-680	1
680-690	0
690-700	0

Totals:1303

*BP = Bipol
MC = Minima
FBC = Flat
SPC = Singl
R/D = Radia
LC = Levall
MPC = Multi
BLT = Blade
BL = Blade
CRP = Core

Table 9 cont. Quartz/Quartzite Core Totals.
Squares 10-29 Note: Squares excavated to different depths.

Depth	* BP	MC	FBL	SPC	R/D	LC	MPC	BLT	BL	CRP	Totals
500-510	5	1	1	0	0	0	1	0	0	0	8
510-520	11	1	2	0	0	0	2	0	0	0	16
520-530	9	1	1	0	0	0	0	0	0	0	11
530-540	7	2	0	0	0	0	2	0	0	0	11
540-550	4	1	1	0	0	0	3	0	0	0	9
550-560	9	0	0	0	0	0	2	0	0	0	11
560-570	0	3	0	0	0	1	4	0	0	0	8
570-580	0	1	0	0	0	0	2	0	0	0	3
580-590	1	1	0	0	0	0	0	0	0	0	2
590-600	9	0	0	0	0	0	1	0	0	0	10
600-610	6	0	0	0	0	0	0	0	0	0	6
610-620	3	0	0	0	0	1	0	0	0	0	4
620-630	6	0	0	0	0	1	0	0	0	1	8
630-640	0	0	0	0	0	0	0	0	0	0	0
640-650	0	0	0	0	0	0	0	0	0	1	1
650-660	0	2	0	0	0	0	1	0	0	0	3
660-670	0	0	0	0	0	0	0	0	0	0	0
670-680	1	2	0	0	0	0	1	0	0	0	4
680-690	0	2	0	0	0	0	1	0	0	0	3
690-700	0	3	0	0	0	0	0	0	0	1	4
Totals:	1303	311	275	21	7	4	185	34	3	94	2237

*BP = Bipolar Cores
MC = Minimal Cores
FBC = Flat Bladelet Cores
SPC = Single Platform Cores
R/D = Radial/Disc Cores
LC = Levallois Cores
MPC = Multi-Platform Cores
BLT = Bladelet Cores
BL = Blade cores
CRP = Core Reduced Pieces

Figure 4.8

WPS Quartz/Quartzite Core Totals
Square's 10-29

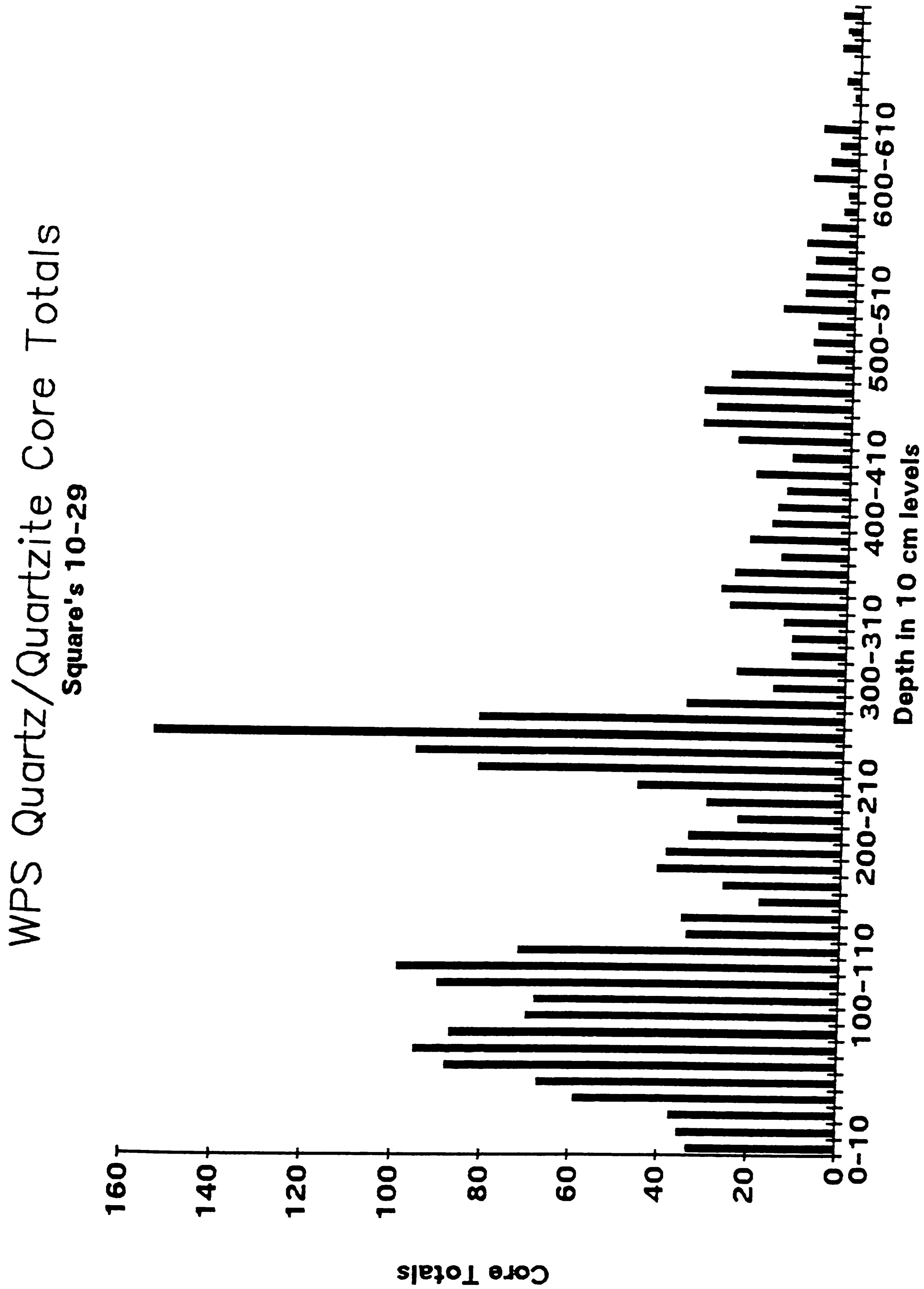


Figure 4.8 WPS Quartz/Quartzite Core Totals.

Table 10 WPS

Squares 10-29

Depth	* SPC
0-10	0
10-20	0
20-30	0
30-40	1
40-50	2
50-60	3
60-70	2
70-80	2
80-90	0
90-100	2
100-110	3
110-120	5
120-130	11
130-140	0
140-150	0
150-160	0
160-170	0
170-180	3
180-190	1
190-200	2
200-210	0
210-220	0
220-230	0
230-240	0
240-250	0
250-260	[illegible]
260-270	[illegible]
270-280	
280-290	
290-300	
300-310	
310-320	
320-330	
330-340	
340-350	
350-360	
360-370	
370-380	
380-390	
390-400	
400-410	
410-420	
420-430	
430-440	
440-450	
450-460	
460-470	
470-480	
480-490	
490-500	

Table 10 WPS Non-Quartz Core Totals.
Squares 10-29 Note squares excavated to different depths.

Depth	* SPC	R/D	LC	MPC	BLT	BL	CRP	Totals
0-10	0	0	0	3	5	0	2	10
10-20	0	0	0	4	4	0	1	9
20-30	0	0	0	6	6	0	7	19
30-40	1	0	0	5	5	0	5	16
40-50	2	0	0	5	13	0	5	25
50-60	3	0	0	15	8	0	0	26
60-70	2	1	0	5	13	0	12	33
70-80	2	1	0	13	14	0	6	36
80-90	0	1	0	13	15	0	6	35
90-100	2	0	0	13	20	0	8	43
100-110	3	0	0	16	35	0	19	73
110-120	5	0	0	30	38	0	19	92
120-130	11	0	0	34	39	0	25	109
130-140	0	0	0	7	4	0	8	19
140-150	0	1	0	5	5	0	1	12
150-160	0	0	0	1	4	0	3	8
160-170	0	0	0	5	3	1	4	13
170-180	3	3	0	12	7	3	4	32
180-190	1	0	1	11	3	1	3	20
190-200	2	0	0	1	8	1	5	17
200-210	0	0	0	2	2	0	0	4
210-220	0	0	0	5	1	0	1	7
220-230	0	0	0	5	6	0	5	16
230-240	0	0	0	6	8	0	3	17
240-250	0	0	0	15	4	0	4	23
250-260	0	1	0	9	10	0	10	30
260-270	0	0	0	4	7	1	1	13
270-280	0	0	0	2	2	0	3	7
280-290	0	0	0	2	0	0	0	2
290-300	0	0	0	1	1	0	3	5
300-310	0	0	0	1	1	1	0	3
310-320	0	0	0	0	0	1	0	1
320-330	0	0	0	0	0	0	0	0
330-340	0	0	0	1	1	0	0	2
340-350	0	0	0	0	0	0	0	0
350-360	0	0	0	0	0	1	0	1
360-370	0	0	0	1	0	0	0	1
370-380	0	0	0	3	0	3	0	6
380-390	0	0	1	5	2	0	1	9
390-400	0	0	0	3	3	4	2	12
400-410	1	0	0	6	0	3	3	13
410-420	0	0	1	6	1	0	4	12
420-430	0	2	3	9	2	3	6	25
430-440	0	0	1	3	4	0	0	8
440-450	0	2	0	8	4	1	14	29
450-460	0	0	2	7	4	3	5	21
460-470	0	4	2	5	2	2	9	24
470-480	0	0	3	7	6	2	14	32
480-490	0	0	3	13	8	1	10	35
490-500	0	0	2	5	1	1	5	14

Table 10 con

Squares 10-2

Depth	* SP
500-510	0
510-520	0
520-530	0
530-540	0
540-550	0
550-560	0
560-570	0
570-580	1
580-590	0
590-600	0
600-610	0
610-620	0
620-630	[illegible]
630-640	
640-650	
650-660	
660-670	
670-680	
680-690	
690-700	
Totals:	3

* SPC = Si
R/D = Radi
LC = Leval
MPC = Mult
BLT = Blad
BL = Blade
CRP = Core

Table 10 cont. WPS Non-Quartz Core Totals.
Squares 10-29 Note squares excavated to different depths.

Depth	* SPC	R/D	LC	MPC	BLT	BL	CRP	Totals
500-510	0	0	0	6	5	0	4	15
510-520	0	0	2	3	1	0	3	9
520-530	0	0	4	3	4	4	2	17
530-540	0	0	1	10	4	1	3	19
540-550	0	0	0	5	4	1	2	12
550-560	0	0	1	7	0	1	4	13
560-570	0	0	1	5	1	2	2	11
570-580	1	0	0	5	1	2	0	9
580-590	0	0	2	5	2	0	3	12
590-600	0	0	0	2	0	1	1	4
600-610	0	0	1	0	0	0	0	1
610-620	0	0	0	1	0	0	0	1
620-630	0	0	0	0	0	0	0	0
630-640	0	0	0	2	1	0	0	3
640-650	0	0	0	0	1	0	0	1
650-660	0	0	0	0	0	0	0	0
660-670	0	0	0	1	0	0	0	1
670-680	0	0	0	2	0	0	0	2
680-690	0	0	0	1	0	0	0	1
690-700	0	0	0	1	0	0	0	1
Totals:	39	16	31	397	353	45	270	1151

* SPC = Single Platform Cores
R/D = Radial/Disc Cores
LC = Levallois Cores
MPC = Multi-Platform Cores
BLT = Bladelet Cores
BL = Blade Cores
CRP = Core Reduced Pieces

WPS Non—Quartz Core Totals

Square's 10-29

Figure 4

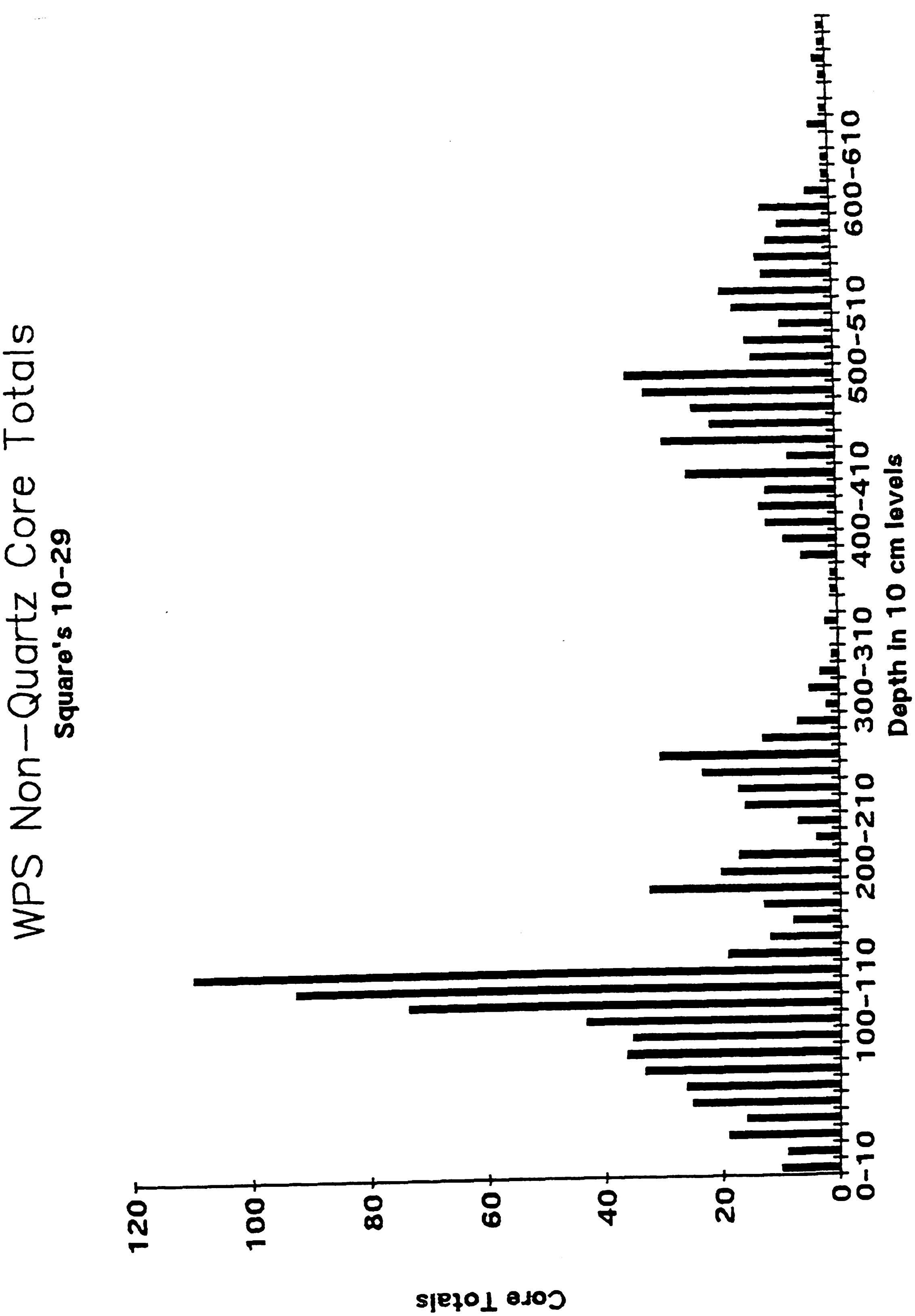


Figure 4.9 WPS Non-Quartz Core Totals.

debitage, t

manufacture

was an impo

of artifact

was carried

proportions

locally av

materials

important

cultural p

It is

debris cre

attempt to

stylistic

afforded

When chan

example c

even more

tools are

of Southe

most of

(1984) i

Volman (

are cate

communic

having t

used the

debitage, technically waste, were the result of stone tool manufacture. Far from being insignificant, this material was an important source of information about the techniques of artifact manufacture and how much tool production and use was carried out at the site. In addition, change in proportions of exotic imported raw material versus the locally available quartz(ite), and what types of raw materials were selected for certain tool categories provide important clues about changing trade relationships and cultural preferences.

It is based on the variation in these tools and the debris created in their production, that archaeologists attempt to differentiate changes in both technological and stylistic attributes through time. It is the long time span afforded the archaeologist that is our most valuable asset. When changes are recognized and can be correlated with, for example climatic shifts, the assemblages from Tsodilo have even more significance. Throughout the discussion below, tools are described using terminology accepted by scholars of Southern African prehistory. As mentioned previously, most of the tool forms discussed were codified by J. Deacon (1984) in her major work on Southern African LSA and T. Volman (1981) for the MSA. It should be noted that these are categories developed by archaeologists to facilitate communication and analysis and should not be interpreted as having the same meanings to the people who actually made and used the artifacts. Another important point is that many

artifacts we
entire regio
typological
particularl
MSA points
typical LSA
backed blad
retouched s
the "Interi
found throu
addition, a
assemblage
Donahue of
microwear
microwear
worked by
fish, bone
evidence o
tools iden
were MSA
and ms. i
combined
confidenc
analysis.

Fina
throughou
was the

artifacts were standardized, literally copies, throughout entire regions over restricted time spans and thus have typological and chronological significance. This was particularly true for many of the LSA microlithic tools and MSA points produced from prepared cores. For example, typical LSA microlithic tools include segments (crescents), backed bladelets, drills, and a range of small steeply retouched scrapers. All are typical of what has been termed the "Interior Wilton" Complex of Southern Africa and are found throughout the region for a long time period. In addition, a sample of 78 tools from the various WPS lithic assemblages were examined for microwear by Dr. Randolph Donahue of Bradford University, U.K. For the most part the microwear analysis confirmed the proposed typology. The microwear study identified a number of different materials worked by the various tool forms including meat and possibly fish, bone, hide and wood. Also, seven artifacts showed evidence of use as armatures or projectile points. Of those tools identified as armatures, two were microliths and five were MSA points (Dr. Randolph Donahue personal communication and ms. in prep.). The results of the microwear study, combined with consistent tool morphology, gave me enhanced confidence in the tool typology adopted for the WPS lithic analysis.

Finally, it was also evident that in a number of cases throughout the White Paintings Shelter occupations, that it was the debitage, sharp flakes and blades that were the "expedient"

formal tools

activities s

In the

present the

recent leve

as they wer

southern Af

with my gra

where I dis

apparent in

archaeolog

format see

discussing

The W

divisions

artifacts,

archaeolog

These inc

Age conte

4) Low de

Blade": e

proposed

technique

dated re

proposed

data pre

"expedient" tools of choice for everyday activities, and the formal tools may have only been employed for specific activities such as hunting or hide preparation.

In the following overview of the WPS sequence, I present the archaeological material from the upper, or most recent levels, downward, discussing the artifact assemblages as they were uncovered in the excavations. This follows southern African convention and was approved in consultation with my graduate committee. However, in Chapters V-VIII, where I discuss the technological and evolutionary trends apparent in the three lithic assemblages, I present the archaeological material from oldest to more recent. This format seemed the most logical and avoids the confusion of discussing these trends in reverse chronological order.

The WPS archaeological sequence had seven major divisions based on technological (lithic) and non-lithic artifacts, fauna, paleoenvironmental evidence, comparative archaeology and absolute and relative dating techniques. These include: 1) Historic/Late Prehistoric; 2) Late Stone Age contemporary with Early Iron Age; 3) "Upper Fish": LSA; 4) Low density: LSA; 5) "Lower Fish": early LSA; 6) "Large Blade": early LSA/transitional MSA; and 7) MSA. The proposed chronology was based on a number of dating techniques presented above, as well as comparison with other dated regional archaeological assemblages. In addition, the proposed chronology is in agreement with the paleoclimatic data presented in Chapter VI.

1) Historic/I

As ment

oral traditi

Zhu San in l

resides in t

nature of th

upper levels

surface were

animal bones

occasional

1989 excava

use provide

inhabiting

remains fro

The fa

like duiker

medium siz

of maize b

interprete

was a crop

Below this

pea was re

evidence

kept in t

evidenced

contexts

were allo

1) **Historic/Late Prehistoric: surface - 20/30 cm.**

As mentioned above, the White Paintings Shelter has oral traditions of use as a rainy season camp by a group of Zhu San in living memory of the oldest man who currently resides in the area. Due to the protected and thus dry nature of the rock shelter, preservation conditions in the upper levels of the site were exceptional. On or near the surface were large quantities of mongongo nuts as well as animal bones, pottery sherds, iron beads, glass beads, and occasional microlithic tools. Ash layers uncovered in the 1989 excavations apparently matched the description of site use provided by the Basarwa (Zhu, San) elder who remembered inhabiting the shelter with his group, and were most likely remains from this actual group (Robbins 1991).

The fauna identified included numerous small animals like duiker, springhare, tortoises, and a range of small to medium sized bovids. The 1989 excavations recovered an ear of maize between 10 and 20 cm (Robbins 1991) which was interpreted as being from the last few centuries since maize was a crop introduced from the New World after AD 1492. Below this specimen in the 20-30 cm level, a carbonized cow pea was recovered. These two specimens were the only evidence of domesticated crops from the site. Cattle were kept in the area within the last few centuries as well, as evidenced by the discovery of cow dung in archaeological contexts to a depth of roughly 30 cm. Until recently cattle were allowed to free-range in the area. The maize and cow

pea in the u
product of e
favor of rec
beads, iron
near the su

2) LSA cont

The Wh
decorated a
with early
currently
similar in
early Iron
communicat
artifacts,
and iron
WPS conta
shafts wh
Kalahari
imply clo

In
increase
standard
levels,
the time
time sug
village

pea in the upper levels of the site could have been the product of either local production or trade. Evidence in favor of recent involvement in trade included glass trade beads, iron beads, and elephant tusk fragments recovered near the surface to a depth of 30 cm.

2) **LSA contemporary with Early Iron Age: 30-70/80 cm**

The White Paintings Shelter yielded several hundred decorated and undecorated charcoal tempered pottery sherds with early Iron Age affinities. The WPS pottery is currently being analyzed by L. Murphy. The sherds appear similar in form and decoration to examples from the Tsodilo early Iron Age sites of Nqoma and Divuyu (L. Murphy personal communication). These sherds were found amidst numerous LSA artifacts, finely-made ostrich eggshell beads, iron beads and iron fragments. The 1989 excavations of Squares 1-4 at WPS contained a number of small bone arrow points or link shafts which were similar to those used historically by Kalahari San (Robbins 1991). The decorated sherds and iron imply close contact with the early Iron Age villages.

In these levels (30-80 cm) there was a noticeable increase in artifact density at the site compared to standardized values per unit volume for the surrounding levels, suggesting more intensive use of the shelter during the time of early Iron Age occupations of the hills. The time suggested for the occupation of the two early Iron Age village sites was between A.D. 550-1,100 and a similar age is suggested

containing t

The vas

were recove

communicati

levels were

non-cultura

body sherds

various fo

(L. Murphy

was also p

Divuyu. P

as well as

This peric

increase i

site. The

the surfa

units (Sq

nearly st

density c

from the

that occu

Age. It

distribu

densitie

Irc

these le

is suggested for the units at White Paintings Shelter containing these early Iron Age cultural elements.

The vast majority (95%) of the early Iron Age sherds were recovered in levels above 60/70 cm (L. Murphy personal communication). The rare pottery sherds recovered in deeper levels were likely the result of rodent activity or similar non-cultural factors. Most of the sherds are undecorated body sherds. The sherds with exterior decoration have various forms of comb stamping, zoned incision and incising (L. Murphy personal communication). This type of decoration was also present at the early Iron Age villages of Nqoma and Divuyu. Pottery sherds were recovered in the central block as well as the outlying test units and soil auger tests. This period of occupation at WPS displayed a substantial increase in cultural remains in all excavated areas of the site. These levels also produced the first (when going from the surface down) evidence of occupation in the outlying units (Squares 24-31), the upper levels (above 30 cm) being nearly sterile of cultural remains. In general, the overall density of archaeological material decreased with distance from the shelter wall. Based on these data, it was felt that occupations were quite extensive during the early Iron Age. It should be stressed that although sherds were widely distributed at WPS, their numbers do not approach the sherd densities in the Tsodilo EIA villages.

Iron fragments and iron beads were also recovered from these levels. These items, combined with the pottery, in what was ot

interaction

the peoples

Nqoma. We

iron artifa

Shelter.

Of not

3) from the

early Iron

domesticat

seemed to

practicing

time, or i

consumed t

sheep jaw

sheep mand

by Oxford

1996). An

from the s

cm) (Robbi

proposed

villages a

In th

specific

brief syn

described

3.2.

what was otherwise a typical LSA assemblage, would suggest interaction and exchange among the inhabitants of WPS and the peoples living in the Tsodilo villages of Divuyu and Nqoma. We did not find any evidence that either pottery or iron artifacts were being produced at the White Paintings Shelter.

Of note, virtually all of the identifiable fauna (Table 3) from these levels was wild, even though evidence from the early Iron Age village's indicated that substantial herds of domesticated livestock were being kept in the area. This seemed to indicate that the inhabitants of WPS were practicing a hunting and gathering lifestyle during this time, or if they possessed domestic livestock, they kept and consumed them elsewhere. There was a single domesticated sheep jaw from these levels (Square 23 40-50 cm). This sheep mandible was identified by Richard Klein and AMS dated by Oxford University to 1225 +/- 60 B.P. (Sealy and Yates, 1996). An additional date of 1080 +/- 100 B.P. was obtained from the same levels in the 1989 excavation (Square 9 40-50 cm) (Robbins, 1991). Both dates overlap with the time frame proposed for the occupations of the local early Iron Age villages at Tsodilo.

In the remainder of this overview, I will refer to specific stone tool and core types in order to provide a brief synopsis. These tool and core categories were fully described in Chapter III and illustrated in Figures 3.1 and 3.2.

The li

(segments),

scrapers, b

from these

eggshell be

addition to

recovered f

were domina

bladelet c

included a

single pla

The lithic

It was app

at the sit

nearby ea

Faun

mammals l

wildebees

species i

3) "Upper

Pot

depth.

of the c

This was

outlying

the regi

The lithics from these levels included crescents (segments), backed bladelets, backed points, side and end scrapers, burins and awls. Two drills were also recovered from these levels which could be associated with ostrich eggshell bead production among other activities. In addition to the retouched tools, numerous bladelets were recovered from these levels (Table 8). Lithic core types were dominated by quartz/quartzite bipolar cores, flat bladelet cores, and core reduced pieces. Non-quartz cores included a number of bladelet cores, multi-platform cores, single platform cores and core reduced pieces (Table 9). The lithic debitage density also increased in these levels. It was apparent that formal stone tools were being produced at the site on a regular basis during the period when the nearby early Iron Age villages were occupied (Table 10).

Faunal evidence from this period included several large mammals like zebra, giraffe, reedbuck, hartebeest, and blue wildebeest, although small bovids were the predominant species in these levels of the site.

3) **"Upper Fish": LSA: 80/90-130 cm**

Pottery generally drop out of the sequence at 80 cm in depth. It should again be stressed that the majority (95%) of the cermaics were concentrated above the 60-70 cm levels. This was the case both within the shelter itself and the outlying units as well. Based on other dated sequences in the region, I believe that the oldest units that contain pottery car

the Christi

These

as well as

ostrich egg

botanical r

fragments.

these leve

indicating

to the mid

2000 BC.

regional d

paleoenvi

Holocene

al. 1996)

from thes

and (4) f

fish bone

presence

Seve

and bulk

bracket

The more

date fro

an OES A

(URC337

3,700 +/

pottery cannot be earlier than the first few centuries of the Christian era (Denbow and Wilmsen 1986).

These deposits had a dense LSA microlithic assemblage, as well as grindstones, hammerstones, barbed bone points, ostrich egg shell beads, fauna and botanical remains. The botanical remains were primarily occasional mongongo nut fragments. There were some inconsistencies in the dating of these levels. However, there is convincing evidence indicating that the "Upper Fish" deposits date to the early to the middle Holocene between 4-7,000 B.P. or between 5000-2000 BC. This date range was supported by: (1) comparable regional dated lithic assemblages: (2) regional paleoenvironmental evidence which indicated that the Middle Holocene was a relatively wet period in the region (Brook et al. 1996), (3) Ivester's (1995) analysis of the sediments from these levels at WPS which suggested wet conditions; and (4) faunal evidence of lechwe, reedbuck and numerous fish bones support wetter conditions and perhaps the presence of a local paleo lake.

Several radiocarbon dates, ostrich egg shell (OES) AMS and bulk dates, and an OSL date on WPS sediments date bracket this roughly 3,000 years of shelter use (Table 5). The more recent range of dates were indicated by a charcoal date from Square 5 (77) cm 2,640 +/- 130 B.P. (Beta 33681), an OES AMS date from Square 22 (60-70) cm 3,570 +/-60 B.P. (URC3370), a charcoal date from Square 6 (90-100) cm of 3,700 +/- 100 B.P. (Beta 33053), OES AMS dates from Square

22 (110-120

(110-120) c

from Square

160 B.P. (F

U.B. OSL da

C14 date or

(UGa6728).

In th

of increas

surroundin

archaeolog

Hills. It

agricultur

contained

apparent

mammal bo

greater r

increase

apparent

the same

included

also con

point fr

these bo

(Robbins

uniseria

been tri

22 (110-120) cm 3,860 +/-50 B.P. (URC3368) and Square 21 (110-120) cm 3,900 +/- 50 (URC3366), and finally a C14 date from Square 11 (110-120) cm which yielded a date of 4,330 ± 160 B.P. (Beta 47865). The older range of dates came from a U.B. OSL date from 100 cm of 5,747 +/- 590 and a UGa bulk C14 date on OES from Square 23 110-120 cm of 6,840 +/-40 (UGa6728).

In the "Upper Fish" levels, there was clear indication of increased habitation of the shelter in contrast to the surrounding levels. This time was clearly an important archaeological period in the occupation of the Tsodilo Hills. It also predates the advent of pastoralism or agriculture in the area. As mentioned above, these levels contained a notable increase in fish bones. It was also apparent that the percentages of fish bones compared to mammal bones shifted, which was interpreted as indicating a greater reliance on aquatic resources (Table 11). The increase in fish bones (clarias sp and cichlids) was most apparent and occurs in most squares in the central block at the same approximate depths (ca. 80 cm). The fish bones included vertebra, spines and skull fragments. These levels also contained the majority (10 of 19) of the barbed bone point fragments found at WPS. It has been suggested that these bone points were used to tip fish spears or harpoons (Robbins et al. 1994). These bone points were both uniserially and biserially barbed and one example may have been triserially barbed. Of interest, Dr. Robbins refit two

Table 11 V
Counts and
provided b
Nickleson,

Depth in cm	#
0-20	
20-30	
30-40	
40-50	
50-60	
60-70	
70-80	
80-90	
90-100	
100-110	
110-120	
120-130	
130-140	
140-150	
150-160	
160-170	
170-180	
180-190	
190-200	
200-210	
210-220	
220-230	
230-240	
240-250	
250-260	
260-270	
270-280	
280-300	
300-320	
320-340	
340-360	
360-380	
380-400	
400-420	
420-440	
440-460	
460-480	
480-500	
500 +	
Totals:	

Table 11 White Paintings Shelter Mammal and Fish Bone Counts and Percentages from Squares 10-23. Information provided by Dr. L. Robbins. Counts by Kevin Nichols, Jim Nickleson, Sara Cloud and other MSU lab assistants.

Depth in cm	# Mammals	% Mam.	# Fish	% Fish	Totals:	Cultural Designation
0-20	2098	97	74	3	2172	Hist./Late
20-30	1825	97	53	3	1878	Prehist.
30-40	1134	96	43	4	1177	
40-50	1348	93	108	7	1456	LSA contemp.
50-60	1273	88	174	12	1447	w/ EIA
60-70	1705	87	250	13	1955	
70-80	2442	84	451	16	2893	
80-90	1928	77	584	23	2512	
90-100	2035	69	929	31	2964	
100-110	4436	67	2215	33	6651	"Upper fish"
110-120	6067	67	2993	33	9060	LSA
120-130	4447	70	1918	30	6365	
130-140	1025	78	292	22	1317	
140-150	866	83	180	17	1046	
150-160	1000	83	209	17	1209	
160-170	1139	85	203	15	1342	Low Density
170-180	1839	90	215	10	2054	LSA
180-190	1527	87	235	13	1762	
190-200	1173	82	250	18	1423	
200-210	1592	89	198	11	1790	
210-220	1429	84	278	16	1707	
220-230	1195	79	314	21	1509	
230-240	1800	78	518	22	2318	
240-250	2378	70	1008	30	3386	"Lower Fish"
250-260	1239	76	401	24	1640	early LSA
260-270	800	85	139	15	939	
270-280	536	83	108	17	644	
280-300	460	89	57	11	517	
300-320	246	93	19	7	265	
320-340	217	92	19	8	236	"Large
340-360	356	95	18	5	374	Blade"
360-380	273	95	13	5	286	MSA/
380-400	647	95	37	5	684	early LSA
400-420	208	94	14	6	222	
420-440	41	73	15	27	56	
440-460	7	58	5	42	12	
460-480	47	100	0	0	47	MSA
480-500	29	100	0	0	29	
500 +	110	92	10	8	120	
Totals:	52917	78	14547	22	67464	

pieces of a
Square 13
give some
horizontal
although t
the ground

The i
coming fro
evidence o
paleoenvi
the rock
Robbins e
to procur
points an
K. Stewar
during sp
believe t
during th
3) indica
this time

The
containe
use in t
tools we
backed b
and end
these re

pieces of a biserially barbed point along an old break from Square 13 (80-90 cm) and Square 11 (100-110 cm), which may give some indication of the amount of vertical and horizontal displacement of the artifacts in these levels, although they may have been broken and been trampled into the ground differentially.

The interpretation as to where the fish at WPS were coming from, and their relative abundance rests on the evidence of an ancient Tsodilo lake (see discussion of paleoenvironments in Chapter VII) situated within 300 m of the rock shelter and dated to ca. 7,500 B.P. (Brook 1992; Robbins et al. 1994). The interpretation of the method used to procure the fish was based on the presence of the bone points and the age and size ranges of the fish analyzed by K. Stewart. Stewart suggested that the WPS fish were taken during spawning runs (Robbins et al. 1994). Although, I believe that fish were clearly an important food source during this time, the presence of 27 types of mammals (Table 3) indicate that a fairly broad-based economy characterized this time period.

The lithic evidence from the "Upper Fish" levels contained consistent evidence of stone tool manufacture and use in the shelter environs. The majority of the stone tools were "microlithic" (Deacon 1984a, 1984b) including backed bladelets, backed points, crescents (segments), side and end scrapers, burins, awls, drills and notches. Beyond these retouched tools, these levels were dominated by non-retouched b

"Upper Fish

The most fr

bladelet co

these leve

cores reco

appeared f

reduced pi

(Table 9).

debitage p

quartzite;

chert or j

The p

was that

occupatio

overhang.

catfish (

90-110 cm

Square 31

cultural

debitage

recovered

evidence

Square 3

auger te

lithic a

the "Upp

retouched bladelets (Table 8). Cores associated with the "Upper Fish" deposits were predominantly quartz/quartzite. The most frequent were bipolar examples, followed by flat bladelet cores. Non-quartz cores were also fairly common in these levels with numerous bladelet cores and multi-platform cores recovered. Although not numerous, radial cores appeared for the first time and a large number of core reduced pieces indicate the extent of lithic reduction (Table 9). The majority of the lithic remains consisted of debitage predominantly from locally available quartz and quartzite; however, 21% of the material consists of imported chert or jasper (Table 10).

The picture that emerged of the "Upper Fish" deposits was that of a rather dense occupation or series of occupations that were not restricted to the shelter overhang. This interpretation was supported by evidence of catfish (calrius sp) bones in the outlying Square 30 between 90-110 cm which was located 50 m from the shelter wall and Square 31 located 70 m from the shelter wall, produced cultural evidence in the form of retouched tools and debitage in similar levels, although no fish bones were recovered. The soil auger probe tests did not pick up evidence of the "Upper Fish" levels in the areas between Square 31 and the paleo Lake Tsodilo shore. However, the auger test at 129.5 m from the shelter wall did contain lithic artifacts at approximately 80 cm which may be part of the "Upper Fish" deposits.

4) Low Den

Begin

the WPS de

fish remai

deposits d

130/140-20

quantities

quantities

encounter

egg shell

should be

terminate

However,

decrease

lithics f

level pe

debitage

130 and

(Table 1

clearly

standard

numbers

drops o

fragmen

170 cm)

the low

between

4) Low Density LSA: 130/140-200 cm

Beginning at approximately 130-140 cm another change in the WPS deposits was apparent. Generally, the density of fish remains and bone "harpoons" noted in the overlying deposits drops off substantially. These levels (between 130/140-200 cm) also contained dramatically reduced quantities of LSA lithics, and fauna. However, increased quantities of unworked ostrich egg shell fragments were encountered (Table 12) and there were also several ostrich egg shell beads and some evidence of bead manufacture. It should be mentioned that at 130 cm level, Squares 13-18 were terminated and the excavations reduced to 8 square m. However, this alone does not explain the substantial decrease in standardized density values per unit volume of lithics from 61 pieces of debitage and 5.9 tools per 10 cm level per 1 m square between 80 and 130 cm to 30 pieces of debitage and 4.1 tool per 10 cm level per 1 m square between 130 and 200 cm or the reduced numbers of bone fragments (Table 11) in the squares that were excavated. These units clearly showed a substantial drop off in artifact standardized density per unit volume. In addition, the numbers of fish bones and the ratio of fish to mammal bone drops off as well (Table 11). Only one barbed bone point fragment was recovered from these deposits (Square 12 160-170 cm). Artifact density per unit volume also decreased in the lower levels of the outlying units (Squares 30-31) (ie. between 130-150 cm, the depth where these squares were

Table 12 Wh
and Tortois
Information
Robbins and
N.J. Steven

Depth in cm
0-10
10-20
20-30
30-40
40-50
50-60
60-70
70-80
80-90
90-100
100-11
110-12
120-13
130-14
140-15
150-16
160-1
170-1
180-1
190-2
200-2
210-2
220-2
230-2
240-2
250-2
260-2
270-2
280-2
290-
300-
310-
320-
330-
340-
350-
360-
380-
390-
400-
410-
560
Tot

Table 12 White Paintings Shelter Unworked Ostrich Egg Shell and Tortoise Shell Fragments from Squares 10-23. Information on Ostrich Egg Shell was provided by Dr. L. Robbins and Tortoise Shell information was by L. Robbins and N.J. Stevens.

Depth in cm	# OES	% of site total	# Tortoise	% of site total	Cultural Designation
0-10	24		57		
10-20	30	4%	30	16%	Hist./Late
20-30	21		42		Prehist.
30-40	29		44		
40-50	22		42		
50-60	17	7%	62	34%	LSA contemp.
60-70	27		39		w/ EIA
70-80	38		92		
80-90	21		30		
90-100	42		39		
100-110	48	12%	56	30%	"Upper Fish"
110-120	66		61		LSA
120-130	61		67		
130-140	45		11		
140-150	31		10		
150-160	69		8		
160-170	82		9		
170-180	201	46%	5	9%	Low Density
180-190	175		8		LSA
190-200	141		6		
200-210	133		2		
210-220	155		14		
220-230	118		9		
230-240	117		10		
240-250	100	30%	52	11%	"Lower Fish"
250-260	45		5		early LSA
260-270	19		13		
270-280	15		5		
280-290	4		0		
290-300	5		0		
300-310	1		0		
310-320	0		0		
320-330	1		0		
330-340	1		1		
340-350	0		2		
350-360	0	0.70%	0	0.50%	"Large Blade"
360-370	0		0		MSA/early LSA
380-390	0		0		
390-400	1		0		
400-410	0		0		
410-420	0		0		
560-570	0		1		MSA
Totals:	1905		832		

terminated.

units were

contents d

between 13

material w

inside the

similar ag

that the c

often as t

seasonal

larger gr

200 cm) d

outlying

Belo

(1995) su

depositio

difficul

However,

support

ostrich

and UC,

follows:

170-180

190 cm

althoug

which g

Althoug

terminated) but less dramatically. These seven outlying units were only excavated to 150 cm, yet due to their contents demand further comment. Far from being sterile between 130-150 cm, these units contained amounts of material which were nearly identical to comparable levels inside the shelter itself (Appendix A). If we assume similar ages in comparable levels, it could be suggested that the outside areas of the site were being utilized as often as those inside the shelter. This may be due to seasonal shifts in habitation areas or rather short term larger group aggregation. Finally, these levels (130/140-200 cm) did not produce definitive artifacts in any of the outlying soil auger holes that reached this depth.

Below 120 cm at the White Paintings Shelter, Ivester (1995) suggested a ca. 25,000 year hiatus in the depositional history of the site. There was a real difficulty in explaining this phenomena archaeologically. However, the sediments, stratigraphy, and dates seem to support this hiatus. A series of three radiocarbon dates on ostrich egg shell (OES) from three different labs (SMU,UGa and UC, Riverside) were very consistent. The dates are as follows: WPS 150-160 cm 31,220+/-320 (UGa6731); Square 23 170-180 cm 33,470 +/-250 (URC3289); and Squares 11/12 180-190 cm 33,020 +/-270 (SMU2656). These ages seem quite old, although they fall within the LSA time range for the region which generally is thought to begin ca. 35,000-40,000 B.P. Although there was a substantial drop off in lithic density

below 130
technology
abandonmen
and raw ma
Although
the types
and other
analysis
discontin

With
densities
seemed to
I would s
and conce
the shel
fishing
may have
Lake Tso
(Ivester
the site
conditio

The
dominate
recovere
above 1
Other f
(segmen

below 130 cm, the raw materials, formal tools and reduction technology do not indicate such a lengthy period of site abandonment, unless a great deal of continuity in technology and raw material acquisition occurred during this period. Although this technological continuity may have occurred, the types of artifacts, core types, raw material preference, and other non-lithic data which were studied for this analysis were not generally supportive of such a great discontinuity in site occupation.

With this concern expressed, the drop off in lithic densities and aerial extent of archaeological materials seemed to indicate less intensive site use during this time. I would suggest that smaller groups were using the shelter and concentrating in the area under or directly adjacent to the shelter overhang. The overall reduction in evidence of fishing can be interpreted as a change in subsistence, that may have been necessitated by the desiccation of the paleo Lake Tsodilo during this time. The sediment analyses (Ivester 1995) did indicate evidence of dry conditions at the site between (127.5-157.5 cm), with relatively wetter conditions returning between (157.5-300 cm).

The lithic assemblage found in these deposits was dominated by burins and awls. Side and end scrapers were recovered in nearly equal proportions, whereas in the levels above 130 cm, side scrapers far outnumber end scrapers. Other formal tools included backed blades, crescents (segments), notches and drills, although none were as common as in the

As with th

cores and

assemblage

levels (Ta

recovered

flat blad

bladelet

radial co

recovered

intermitt

number o

and 10).

The

number,

the site

Ove

appeared

general

may hav

descrip

ethnoar

1981).

was ref

debita

as in the overlying deposits. No backed points were found. As with the other assemblages discussed so far, debitage, cores and unretouched bladelets dominated the lithic assemblage, but again, in reduced numbers from overlying levels (Table 8). The most frequent core categories recovered were quartz/quartzite bipolar types, as well as flat bladelet varieties. Non-quartz core types include bladelet cores, multi-platform cores, single platform and radial cores. In addition, the first blade cores were recovered in these levels (Tables 9). The interpretation of intermittent site use was strengthened when the overall number of formal tools and debitage are examined (Tables 8 and 10).

The fauna from these levels, although reduced in number, showed the most diversity of any general period at the site (Table 3).

Overall, below 120 cm the White Paintings Shelter appeared to have experienced a change in site use. The general drop off of artifact density indicate that the site may have served as a temporary camp similar to the descriptions of this site type in ethnographic and ethnoarchaeological literature (Yellen 1977; Silberbauer 1981). Again, this interpretation of intermittent site use was reflected in significantly reduced quantities of debitage as well as formal tools.

5) "Lower

Immed

very inte

area. In

were once

encounter

materials

with dept

concentra

These la

we believ

may have

and fish

economy.

very sim

there we

remains

mammal

(Table

reflect

time, a

the Xau

WPS. T

I belie

encoun

hunter

fish,

5) "Lower Fish": early LSA: 200-300 cm

Immediately below the 200 cm level at WPS, something very interesting seemed to have occurred in the Tsodilo area. In these levels, a series of early LSA deposits which were once again rich in fish bones and other artifacts were encountered in all excavated squares. The archaeological materials recovered increased in density per unit volume with depth (see Tables 13-16 in Chapter V) with the highest concentration between ca. 230-260 cm (Tables 7, 8, 9, 10). These layers were referred to as the "Lower Fish" levels and we believed that they represented a period when the climate may have been significantly cooler and wetter in the region and fishing once again played an important role in the economy. In many respects the "Lower Fish" deposits were very similar to the overlying "Upper Fish" levels, except there were not as many bone tools. The density of fish remains increased substantially, as did the ratio of fish to mammal bone, increasing to 31% in the 240-250 cm level (Table 11). The increase in fish bones was interpreted as reflecting the refilling of paleo Lake Tsodilo during this time, as the only other potential sources of fish were in the Xaudum/Ncameseri River located approximately 17 km from WPS. This is a rather long distance to a source of fish and I believe cannot explain the large quantities of fish bones encountered in these deposits. It would be very unusual for hunter-gatherers to travel such distances and return with fish, given what is known about hunter-gatherer economies of

both moder
procuremen
The c
fully res
relating
dates for
range of
Robbins e
Lake Tsod
and 17,50
at ca. 7
was from
in Squar
+/- 520
the "Low
paleo La
since th
radioca
TL and
28-37,0
Table 5
signif
lake d
al. ms
to bet
Late P
number

both modern as well as prehistoric groups and fish procurement practices among such groups (Kelley 1995).

The dating of the "Lower Fish" levels has not been fully resolved. Since I interpret these occupations as relating to the presence of paleo Lake Tsodilo, radiocarbon dates for the lake beds should logically fall within the range of dates for these deposits at WPS (Brook et al. 1992; Robbins et al. 1994). Brook's dates on calcretes for paleo Lake Tsodilo cluster between 22,500-19,200 B.P. (four dates) and 17,500-11,700 B.P. (six dates), with one Holocene date at ca. 7,500 B.P. The first date obtained for these levels was from a burned bone sample recovered in the central block in Squares 11/12 320-330 cm which produced a date of 20,340 +/- 520 B.P. (Beta 47866). This led us to concluded that the "Lower Fish" deposits were comparable in age to the paleo Lake Tsodilo dates (Robbins et al. 1994). However, since then we have obtained a number of ostrich eggshell radiocarbon dates, as well as OES protein diagenesis dates, TL and OSL dates which seemed to place these deposits in the 28-37,000 B.P. age range (Robbins et al. ms. in prep and Table 5). As is apparent, these age ranges are significantly older than the dates obtained from the Tsodilo lake deposits by Brook (1992). Currently, we (Robbins et al. ms in prep.) believe that these levels most likely date to between 38,000 and 33,000 B.P. and are related to the Late Pleistocene wet period in the region indicated by a number of cave speleothem and tufa ages (Brook et al. 1996).

In additio
comparativ
Adding fur
were the p
reedbuck i
and all of
of water.
at Morema
lake phas
the propo
Beyo
dating di
microlit
quantiti
worked b
(Robbins
barbed b
fragment
advance
WPS. A
1998) i
at leas
not rec
additio
artifac
This p
stage

In addition, Ivester's (1995) sedimentary analysis indicates comparatively wet conditions at the site for these levels. Adding further evidence to the comparatively wet conditions were the presence of wetland species including bushbuck and reedbuck in these deposits. Thus, the sediments, mammals and all of the fish bones are supportive of close proximity of water. Finally, Shaw et al. (1997) document a diatom bed at Moremaoto on the Boteti River which indicates two high lake phases between 32,000 and 27,000 B.P.. These support the proposed chronology for the WPS "Lower Fish" deposits.

Beyond the increasing evidence of fishing and the dating dilemma, these deposits contained a number of microlithic tools, cores, debitage, bone tools, and large quantities of unworked ostrich egg shell. A total of ten worked bone artifacts were discovered in these levels (Robbins and Murphy 1998), some of which were interpreted as barbed bone "harpoons". While these bone tools were often fragmentary, there was clear evidence demonstrating an advanced bone tool industry in late Pleistocene contexts at WPS. An analysis of these bone tools (Robbins and Murphy 1998) indicated several types including uniserial barbed and at least two varieties of barbless bone points which were not recovered in the "Upper Fish" levels of the site. An additional bone point was one of the most interesting artifacts in the deposits and deserves further comment. This point has a series of at least 36 incisions. At this stage of the analysis, we are not certain if the incisions were func

combinatio

This

The three

recovered

21 280-29

of two ci

260 cm, v

However,

fragment

some ind

"Lower F

Furtherm

from Squ

certain

Unl

levels,

to the

excavat

traces

augurin

bones o

soil au

wall) t

in the

the she

occupa

were functional or decorative and may in fact be a combination of the two (Figure 4.10).

This bone point was refit in the lab by L. Robbins. The three fragments of the artifact with old breaks, were recovered from Square 22 250-260 cm, 260-270 cm and Square 21 280-290 cm. In addition, a bone point base with traces of two circular incisions was recovered from Square 22 250-260 cm, which may also be a portion of this artifact. However, a missing section prevented the refitting this fragment. This refitting exercise was important, as it gave some indication of the amount movement of artifacts in the "Lower Fish" levels and thus, the integrity of the deposits. Furthermore, the recovery of two articulated fish vertebra from Square 21 240-250 cm also seemed to indicate that certain areas of the site were stratigraphically intact.

Unlike the "Upper Fish" deposits, the "Lower Fish" levels, seemed to be somewhat restricted to the areas nearer to the shelter itself, within the central block of excavations. The tests outside the shelter yielded only traces of artifacts at the appropriate depths in the soil auguring at the base of these units and furthermore, no bones of any kind were recovered. In the three outlying soil auger holes (129.5, 159.5 and 169.5 m from the shelter wall) that reached depths in excess of 2 m, all were sterile in the levels representing the "Lower Fish" deposits within the shelter. Therefore, it appeared that the "Lower Fish" occupations were intensive, but focused in or near the

Figure
Fish" l
Jackson

shelter

Th

lithic

habitat

artifac

include

bladel

end sc

notche

large

workin

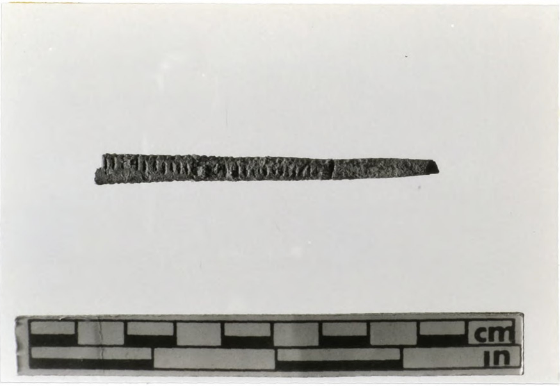


Figure 4.10 Barbless bone point with incisions from "Lower Fish" levels at White Paintings Shleter. Photo by Misty Jackson.

shelter.

The lithic materials from these levels mirror the non-lithic data and indicated longer-term and/or more intensive habitation, as well as the production and use of lithic artifacts at the site. The numerous retouched artifacts included: (14) crescents (segments); (14) backed bladelets; (13) backed points; (26) side scrapers; (10) end scrapers; (115) burins; (113) awls; (3) drills; (2) notches; (1) drill and (1) denticulate (Table 8). The large number of burins and awls indicate that bone or ivory working was an important activity at the site during this period.

the pres

assembla

continue

(Table 8

<12mm, J

in these

Co

quartz/c

there we

platfor

core as

varieti

(Table

No

occurre

units,

volume

nearly

preced

"Upper

materi

jasper

locall

T

WPS se

produc

period. Unretouched bladelets were very common. However, the presence of increased numbers of larger blades in the assemblage indicated a trend toward larger flake blades that continued and increased in the deeper levels of the site (Table 8). There were (214) unretouched bladelets (width <12mm, J. Deacon 1984) and (46) large blades (width >12mm) in these levels.

Cores types recovered continued to be dominated by quartz/quartzite bipolar cores and flat bladelet cores, and there were numerous examples of quartz/quartzite multi-platform cores recovered from these levels. The non-quartz core assemblage included multi-platform and bladelet varieties and significant numbers of core reduced pieces (Table 9).

Notable increases in lithic debris pre unit volume also occurred in levels below between 200-300 cm. In these units, each 10 cm level had an average density per unit volume of 56 pieces of debitage per square meter. This was nearly a two-fold increase in lithic debris compared to the preceding (Low Density LSA) levels and comparable to the "Upper Fish" levels in density per unit volume. The raw materials documented in the debitage were 24.1% non-local jasper, chert, chalcedony and silcrete with the remainder locally available quartz and quartzite.

These levels continued a trend apparent throughout the WPS sequence for the retouched tools to be predominantly produced on imported raw materials. For the site overall, 55% of t

material

tools we

chalcedo

large bl

appeared

were bei

inhabiti

persona

materia

will re

In

unit vo

(also s

in mate

used,

Tsodil

associ

betwee

355 cm

recove

"fish

there

at th

durin

assem

55% of the retouched tools were produced using exotic raw materials. In the "Lower Fish" levels, 59% of the retouched tools were produced on imported varieties of jasper, chert, chalcedony or silcrete. In addition, virtually all of the large blades were produced on exotic raw material. Thus, it appeared that when retouched tools and blades or bladelets were being produced, the early Late Stone Age peoples inhabiting WPS were selecting the exotic raw materials for personal or cultural preferences, or perhaps these raw materials possessed superior flaking characteristics. I will return to this issue in Chapter V.

In the levels below 280 cm the artifact density per unit volume dropped off substantially (Tables 7, 8, 9, 10) (also see Tables 13-16 in Chapter V). This marked decrease in material suggested that the site was only occasionally used, by a small number of individuals. Perhaps paleo Lake Tsodilo had dried out as a result of climatic changes associated with arid conditions indicated for the region between 43-38,000 B.P. (Brook et al. 1996) and between 300-355 cm for WPS (Ivester 1995). Fauna continued to be recovered although in reduced numbers compared to the two "fish rich" units described above. It should be noted that there was less than perfect preservation of faunal remains at this depth. All evidence points to intermittent site use during this and the upper levels of the "Large Blade" assemblage described below.

6. "Larg

Dur

excavato

below 3

assembla

"microli

"Lower F

large bl

occasion

density

blade s

are ove

shift w

morphol

large b

which i

crescen

blades

5.12 a

simila

Poort

type s

Wymer

assem

"Larg

not b

menti

6. "Large Blade": early LSA/transitional MSA: 300-420 cm

During the excavation of WPS it was apparent to the excavators, and has been confirmed during analysis, that below 3 m there was a technological shift in the lithic assemblage. This change involved a change from the "microlithic" technology typical of the overlying early LSA "Lower Fish" deposits, to an assemblage which consisted of large blades struck from prepared cores which were occasionally backed and retouched. While the overall density of blades was not great, the increase in overall blade size was dramatic. Some of the blades in these levels are over 6 cm in length. Interestingly, this technological shift was one more of scale than a shift in the overall morphology of the tools produced. This is apparent in the large backed blade shown in Figure 5.12 (A) in Chapter V, which in a general sense is similar to a greatly enlarged crescent (segment). Other notable tools included retouched blades, large scrapers, notches, burins and awls (Figures 5.12 and 5.13 in Chapter V). This lithic assemblage is similar in artifact morphology and size range to Howieson's Poort Industries reported from Klasies River Mouth and the type site of Howieson Poort in South Africa (Singer and Wymer 1982; Volman 1984). However, the Klasies River Mouth assemblage had many more formal retouched tools than the "Large Blade" assemblage at WPS and the WPS assemblage was not bracketed by Mode 3 MSA industries as it is at the sites mentioned above. In addition, based upon the current interpre

were lik

Thi

unretouc

The blac

the prim

included

side scr

denticul

Sid

percenta

from mor

continue

was a cl

which o

these t

quartz/

in lowe

bladele

quartz/

prepare

quartz

Th

chert,

(24.1%

remaind

quartzi

interpretation of the dating of these levels at WPS, they were likely more recent.

This was a truly blade-dominated assemblage with 55 unretouched blades (width >12mm) recovered in these levels. The blades, along with (78) burins and (68) awls round out the primary tool complement. Other notable retouched tools included (6) large crescents (segments), large scrapers (7 side scrapers and 7 end scrapers), notches (5), and one (1) denticulate (Table 8 and Figure 5.6).

Side and end scrapers were recovered in equal percentages, but were larger and less refined than those from more recent levels of the site. Unretouched bladelets continued to be produced during this period, although there was a clear trend toward the production of large blades which outnumber the bladelets toward the lower levels of these transitional levels (Table 8). Cores of both quartz/quartzite and non-quartz raw material were both found in lower percentages in these levels. Bipolar, flat bladelet and multi-platform varieties dominated the quartz/quartzite core assemblage, while multi- platform, prepared "tortoise" cores, and blade cores dominate the non-quartz core assemblage (Table 9 and Figures 5.3 and 5.4).

The 300-400 cm levels averaged 24.4% imported jasper, chert, chalcedony and silcrete, which was nearly identical (24.1% vs. 24.4%) to the overlying "Lower Fish" levels. The remainder of the debitage was locally available quartz and quartzite (Table 10). This seemed to indicate a great deal of conti

time per

the earl

seemed t

silcrete

larger i

producti

MS

numbers

the pre

technol

example

that th

and the

"Large

11, 12,

levels

unit v

nearly

the ov

indica

during

auger

31) pr

the re

calcre

of continuity in raw material acquisition throughout the time periods represented by these levels.

This trend toward exotic raw materials continued into the earlier upper MSA levels and actually increased, which seemed to indicate selection of these imported cherts and silcretes for blade and other tool production due to their larger initial size and flaking characteristics for the production of these tool forms.

MSA points do not appear at WPS in any significant numbers above 400 cm; however, large blades continued into the preceding or underlying upper MSA levels. This technological continuity, as well as other attributes, for example the consistency in core types, led me to believe that this material was transitional between the early LSA and the upper MSA. The density of lithic debitage from the "Large Blade" period from the seven (1) m squares (Squares 11, 12, 19, 20, 21, 22, 23) that sample the 300-400 cm levels at WPS only average 20 pieces of lithic debitage per unit volume or 10 cm level per square. This represented nearly a three-fold decrease in lithic material compared to the overlying "Lower Fish" levels. This was interpreted as indicating less frequent or shorter duration use of the site during this period. In the outlying test squares, the soil auger tests conducted in the base of test pits (Squares 30-31) produced no archaeological material below 310 cm. In the remainder of the outlying soil auger tests, solid calcrete was encountered above 300 cm and thus did not sample the

appeared t

inside or

Grind

fragment a

these leve

The prese

possible

grinding

Stra

overlain

pebbles b

pebbles p

evident i

levels we

cooler an

frost ac

(Ivester

410-420

layers o

typical

industry

environm

exfoliat

1995).

Nor

include

sample the "Large Blade" levels. Based on this data it appeared that the "Large Blade" occupation was concentrated inside or very close to the shelter overhang.

Grindstones were rare below 300 cm, however two (one fragment and one complete) specimens were recovered from these levels, along with one pitted cobble (Appendix D). The presence of these non-chipped lithics may indicate possible plant utilization or other activities requiring grinding implements during this time of site use.

Stratigraphically, the large blade assemblage was overlain and associated with approximately 30 cm of quartz pebbles beginning at a depth of 340 cm. These quartz pebbles probably fell from the large quartz veins which were evident in the roof of the shelter. We believe that these levels were laid down during, and were the result of a cooler and wetter period in the region when moisture and frost action increased weathering rates in the Tsodilo Hills (Ivester 1995). Immediately below the blade industry at 410-420 cm another geological feature consisting of two layers of schist falls (Figure 4.11) mark a transition to a typical Middle Stone Age industry. Thus, the large blade industry was clearly bracketed by moisture/temperature/ environmental events that caused increased rates of exfoliation from the roof of the rock shelter (Ivester 1995).

Non-lithic materials in the large blade industry included fauna, unworked ostrich egg shell, and one possible

Figure 4.11 Double schist fall indicated by arrow marking the boundary between the "Large Blade" and MSA assemblages at WPS.

bone tool
fragment
from the
preserva
of archa
(also se
preserva
identifi
300 and
three sp
hartebe
medium,
by spec
althoug
overlyi

Al
a fairl
indica
techno
occasi
the si
task e

T
comple
reasor
and l
refer

bone tool. This bone tool was a barbless bone point fragment recovered at 350 cm. Fauna was comparatively rare from these levels, which may be due to poorer conditions of preservation combined with an overall change in the density of archaeological material at the site (Tables 7, 8, 9, 10) (also see Tables 13-16 in Chapter V). Even with these preservation problems, seven types of mammals were identified by Klein and Milo (personal communication) in the 300 and 400 cm (Table 3) levels. These included: at least three springhare; one mongoose; one extinct giant hartebeest; one tsessebe; and seven bovids (three small to medium, 2 large to medium, and two large) not differentiated by species. Fish bones continued to be in evidence, although in significantly reduced numbers compared to the overlying "Lower Fish" levels (Table 11).

Although not extensive, this faunal evidence suggested a fairly broad-based hunting and gathering strategy and indicated that the inhabitants of WPS had the ability and technology to kill or scavenge rather large animals on occasion. I suggest that the blade industry represented at the site during this period of occupation would do either task effectively.

The dating of the "Large Blade" deposits are not completely resolved (Robbins et al. ms. in prep.). The reason for this dating dilemma rests on conflicting dates and lines of evidence which I will try to sort out below by referring directly to the forthcoming manuscript (Robbins et al. ms.

on bone

(Beta 4

28,890

"d
th
26
th
B.
be
co
dr
43
ar
be
ap
le
da
th
ov
A
sh
a
B
u
u
4
s
w
f
d
i
L
3
(

U

Blade'

simila

simil

from

locat

was d

al. ms. in prep.). First, there are two radiocarbon dates on bone (Squares 11/12 (320-330 cm) 20,340 +/- 520 B.P.) (Beta 47866) and ostrich egg shell (Square 11 390-400 cm 28,890 +/-300 B.P.) (UCR-3363) which we have:

> "discounted due to the fact that they are more recent than most of the overlying suite of dates between 150-260 cm. Due to these problems, our understanding of the most likely dates for these deposits (ca. 50-38,000 B.P.) is tied to the sediment analysis of the levels between 300-352.5 cm by Ivester (1995) indicating dryer conditions at Tsodilo and the corresponding widespread dry period documented by Brook et al. (1996) between 43-38,000 B.P. for the southern African winter rainfall area. There is generally good overall correspondences between the two data sets. In fact, these correlations appear to provide a firm basis for dating pre-Holocene levels at WPS, more so than do the various conflicting dating techniques. However, the dates suggested for the dry period appear to be supported by a range of overlying ostrich egg shell dates between 150-260 cm. At WPS, underlying sediments between 352.5 and 420 cm show a return to wetter conditions (Ivester 1995), and appear to be correlated with the wet period dated by Brook et al. (1996) to between 50-43,000 B.P. The underlying MSA deposits marked by characteristic unifacial and bifacial points begins at approximately 410/420 cm where it is associated with two prominent schist fall layers that originated from the shelter wall. The OSL date of 55,430 +/- 4070 (Feathers 1997) for 450 cm is generally supportive of the estimated dates based on this wet period. Based on this interpretation of the evidence, the early LSA/transitional MSA "Large Blade" assemblage in the 300-420 cm levels dates to between 50-38,000 B.P." (Robbins et al. ms. in prep.)

Using this interpretation of the dating of the "Large Blade" assemblage at WPS, as well as the technological similarity, make these levels generally comparable and similar in age to the "intermediate industry " described from unit 2C by Brook et al. (1990) at the pan site of Gi located to the southeast of Tsodilo. At Gi this assemblage was dated to ca. 34,000 B.P. which is only slightly younger than the

assembla

the MSA

formal t

The

blade in

unretouc

were rec

specula

years a

Makgadi

that co

35,000

by Robb

7) MSA

T

will a

al. ms

paper,

betwee

appare

at th

Middl

the M

unifa

than the suggested ages for the WPS "Large Blade" assemblage. The "intermediate industry", which lies above the MSA levels at Gi, was defined as having "blades but few formal tools" (Brooks et al. 1990:62).

The Depression site also had traces of a similar large blade industry near the base of the deposits. Here four unretouched chert blades similar to those recovered from WPS were recovered. Robbins and Campbell (unpublished) speculated that these deposits were laid down before 36,000 years ago and may correlate with the high Paleo Lake Makgadikgadi stage at 945 meters. At other regional sites that contain MSA artifacts, they typically date to between 35,000 and 120,000 years ago and the 36,000 date suggested by Robbins and Campbell was logical in this case.

7) MSA levels: 410/420-700 cm

The description of the MSA assemblage presented below will also appear as part of a forthcoming paper (Robbins et. al. ms. in prep.). As I wrote the MSA discussion for paper, the reader should be aware that some similarities between the following description and the paper may be apparent.

As mentioned above, the bottom of the last schist fall at the White Paintings Shelter marked the transition to the Middle Stone Age occupation of the site. In southern Africa the Middle Stone Age is recognized by the production of unifacial and bifacial points from prepared (tortoise) cores.

distribu

and Wyme

have bee

et al. 1

of the t

in the u

continui

Wha

Paintin

archaeol

7, 8, 9

overall

correspo

Stone A

total 7

sampled

large b

encount

concent

to be r

per uni

proport

Of

include

sightl

retouc

cores. These artifacts are readily recognizable and widely distributed throughout southern Africa (Kuman 1989; Singer and Wymer 1982; Volman 1984). These points are believed to have been hafted and used as knives or projectiles (Brooks et al. 1990). As noted previously, the large blades typical of the transitional MSA/early LSA period were also present in the upper Middle Stone Age levels, showing some continuity with the early Late Stone Age in the region.

What was most impressive about this period of White Paintings Shelter occupation was the dramatic increase in archaeological debris encountered in the MSA levels (Tables 7, 8, 9, 10) (see also Tables 13-16 in Chapter V). The overall increase in lithic debris was correlated with a corresponding increase in formal tools. Diagnostic Middle Stone Age points were found in rather high densities with a total 77 of these points from the six one m squares that sampled these levels (Figure 5.5). As mentioned above, large blades produced from prepared cores continued to be encountered to a depth of 7 m, however, they were concentrated above 620 cm. In addition, bladelets continued to be recovered to a depth of 660 cm, but in reduced density per unit volume compared to the early LSA assemblages and in proportion to the large blades.

Other important formal tools from the MSA levels at WPS included large side and end scrapers with side scrapers sightly more frequent than end scrapers. Other notable retouched tools recovered included burins and awls. Less common fo

denticula

The

cores. T

bipolar c

common.

and prep

(Table 9

material

Beginnin

into the

importec

chert.

platfor

blade c

cores a

was an

Finally

Middle

"exped

activi

W

Age le

MSA/ea

Throu

the r

This

common formal tools from the MSA levels included denticulates, notches and becs (Table 8).

The MSA levels at WPS also contained a large number of cores. The majority of the quartz/quartzite cores were bipolar or multi-platform, but blade cores were also fairly common. In addition, several quartz/quartzite disc cores and prepared (tortoise) cores were found in the MSA levels (Table 9 and Figure 5.1). The major differences in raw material selection was in the MSA non-quartz cores. Beginning in the "Large Blade" assemblage and continuing into the MSA levels, there was a clear preference for imported non-quartz raw materials, particularly silcrete and chert. The main core types from the MSA levels were multi-platform cores, prepared (tortoise cores), disc cores and blade cores (Figure 5.4). The increased frequency of both cores and debitage clearly indicated that tool manufacture was an important activity at the site during this period. Finally, a number of utilized flakes were recovered from the Middle Stone Age levels, indicating that these simple "expedient" tools were also important in everyday activities.

With the increase in lithic artifacts, the Middle Stone Age levels continued a trend noted in the transitional MSA/early LSA levels with regard to raw material selection. Throughout the Middle Stone Age levels, an average of 55% of the raw material was imported chert and silcrete (Table 10). This was very interesting, particularly when compared to the

more rece
Shelter,
almost ex
separate
the site
Fau
rare, bu
suid, an
springha
levels.
bovids
element
bone fr
oldest
the old
Kalaha
this d
animal
M
artifa
White
occup
and w
Brook
South
betwe
have

more recent Late Stone Age levels at White Paintings Shelter, where the local quartz and quartzite was utilized almost exclusively. This preference for exotic raw material separates the more recent from the more ancient levels of the site.

Faunal evidence from the Middle Stone Age levels was rare, but included reedbuck, warthog, an unidentifiable suid, and hartebeest or tsessebe. There was also a springhare tooth recovered in a flotation sample from these levels. Several small, medium, and large unidentified bovids were also recovered from these levels. Of note, fish elements were recovered to a depth of 460 cm. A catfish bone fragment found between 450 and 460 cm provided the oldest evidence of fishing at the site, as well as providing the oldest evidence in an archaeological context in the Kalahari. Due to less than perfect faunal preservation at this depth, I assume that this was only a sample of the animals actually consumed at the site.

My interpretation of the dramatic increase in lithic artifacts during the Middle Stone Age occupations of the White Painting Shelter was that a substantial increase in occupation of the area occurred between ca. 77-69,000 B.P. and was directly related to the moist period documented by Brook et al. (1996) from speleothem growth in the Transvaal, South Africa, and in Botswana, and by Ivester (1995) for WPS between 457.5 cm and 540 cm in depth. This wet period would have provided more favorable conditions in the region and perhaps

term occ

that WPS

during

one of

These l

of 66,3

Li

of the

recover

9, 10)

Age po

recove

were a

showed

(torto

contin

of del

the MS

consi

one m

11 fl

"expe

impor

Hills

recov

leve

perhaps a shift in site use from more temporary to longer term occupations of the site. It should also be mentioned that WPS could have provided shelter from the elements during these wetter periods, as it is one of the largest and one of few good shelters located at the base of the hills. These levels were dated by the U.B. luminescence (TL) date of 66,393 +/-9,411 from 500 cm at WPS.

Lithic evidence continued to be encountered to the base of the excavation at 7 m, but the types of material recovered changed significantly below 620 cm (Tables 7, 8, 9, 10). Below 620 cm, the number of diagnostic Middle Stone Age points dropped off substantially, with only five recovered from these eight levels. Other retouched tools were also rare (Table 8). Cores of all varieties also showed a substantial drop off and the last prepared (tortoise) cores were recovered at 620 cm. Retouched tools continued to be produced at the site as the moderate amounts of debitage and the occasional tool attest. In addition to the MSA points, the retouched tools from these levels consisted of two side scrapers, one combination tool, and one miscellaneous retouched piece (Table 8). In addition, 11 flakes with evidence of utilization indicated that this "expedient" technology was as important, or perhaps more important to the earliest known inhabitants of the Tsodilo Hills. A consistent density per unit volume of debitage was recovered from each 10 cm level averaging 42 items per level. A preference for imported raw materials continued in these le

cherts a

was tha

with de

and the

cm and

inhabit

stone s

to the

conside

Fa

last fa

sure i

earlie

minima

result

(appro

depth.

ca. 1

of 94

corre

Otavi

of wa

docum

condi

propo

these levels with an average of 46% of the lithics being cherts and silcretes. An interesting trend in these levels was that the percentage of imported raw materials increased with depth with the lowest (12%) from the 600-610 cm level and the highest (69%) from the two deepest levels (680-690 cm and 690-700 cm) (Table 10). Perhaps the early inhabitants of the hills continued to rely on traditional stone sources outside the hills although sampling error due to the small excavated area at this depth must also be considered.

Faunal evidence for this period was nonexistent as the last faunal elements were recovered above 580 cm. I am not sure if the levels below 620 cm meters represented an earlier period of the MSA or as mentioned above, if our minimal recovery of diagnostic Middle Stone Age artifacts resulted from sampling error due to the small size (approximately two square m) of the excavation units at this depth. I interpret the base of the excavations as dating to ca. 103-93,000 B.P. based on a U.B. luminescence (TL) date of 94,262 +/- 9411 at 600 cm at WPS. This period may be correlated with the ages of submerged speleothems in the Otavi Mountain Land caves in Namibia, presently under 9-40 m of water, and dune activity in the Etosha Kalahari region documented by Brook et al. (1996) indicating drier conditions between ca. 103-93,000 B.P. and Ivester (1995) proposes a dry period at WPS between 700-645 cm.

I have presented this overview to give a general account

the rem

detaile

The imp

has bee

were ph

period,

behavio

author

behavio

agreed

behavi

"

e

a

a

e

m

c

1

T

of the

Afric

chara

trans

begin

than

of Eu

the c

are p

account of the entire archaeological sequence at WPS. In the remainder of this dissertation, I will concentrate on a detailed discussion ot the Late MSA/early LSA assemblages. The importance of this period relates to the fact that it has been suggested that the inhabitants of southern Africa were physically or anatomically "modern" during the MSA time period, but that these people were not "modern" in their behavior until LSA times (Klein 1989, 1995). Other authorities such as H.J. Deacon (1989) interpret "modern" behavior occurring during the MSA. There is no universally agreed upon definition of what constitutes "modern" behavior. However, according to Robbins and Murphy (1998):

> "some often cited archaeological signposts include evidence of well-made bone artifacts, representational art, use of ornaments, emphasis on blades/microliths and more specialized economies such as fish exploitation...extensive use of non-local raw materials, utilization of body paint/cosmetics and complex burial of the dead" (Robbins and Murphy 1998:6).

These "signposts" were generally developed from studies of the Upper Paleolithic of Europe. However, in sub-Saharan Africa, the period when at least some of these characteristics first appear was during the late MSA/ transitional early LSA beginning some 50,000 years ago. The beginnings of the shift in behavior is earlier in Africa than the widely accepted beginning of the Upper Paleolithic of Europe which is in the 35-40,000 year range. This makes the data from WPS so important as comparatively few sites are known that have assemblages that date to these periods in south

The

next ch

associa

period.

well de

stone t

the exp

key ele

behavio

initia

VIII,

the cu

in southern Africa.

The assemblages summarized above and detailed in the next chapter have indicated blade based technology with associated burins during the earlier part of this time period. In the early LSA assemblages, the presence of a well developed bone technology, microlithic techniques of stone tool production, combined with the use of burins and the exploitation of aquatic resources show a number of the key elements when combined characterizing "modern" human behavior. I will return to a discussion of the issue of the initial appearance of "modern" behavior in Chapters VI and VIII, after I present the detailed account of the results of the current analysis.

THE MIDDLE

LATE STONE

If one

River Mouth

early Upper

anatomicall

the associa

the Middle

Rightmire

Grine et a

assemblage

dominated

prepared c

scrapers,

the contem

Europe and

Sub-S

Europe, ge

of persona

exception

Namibia (

Katanda R

Blombos C

with late

MSA termi

radiocarb

CHAPTER V

THE MIDDLE STONE AGE, THE TRANSITIONAL MSA/LSA AND EARLY LATE STONE AGE AT WHITE PAINTINGS SHELTER

If one accepts that the hominid fossils from Klasies River Mouth, Die Kelders and Equus Cave and several other early Upper Pleistocene sites in Southern Africa are in fact anatomically modern humans (Stringer and Andrews 1988), then the associated artifacts assemblages have been assigned to the Middle Stone Age (MSA) (Singer and Wymer, 1982; Rightmire 1978b, 1979b; Klein, 1975a; H.J. Deacon, 1989; Grine et al. 1991; Avery et al. 1997). The MSA assemblages in southern Africa and at WPS are generally dominated by flakes or flake-blades, often from well-prepared cores, and the primary retouched tools are scrapers, points, and denticulates similar to those found in the contemporaneous Mousterian (Middle Paleolithic) of Europe and the Near East (Sampson 1974; Volman 1984).

Sub-Saharan MSA assemblages, as with the Mousterian of Europe, generally lack formal bone or ivory tools and items of personal adornment or art objects, with the possible exception of painted stone slabs at Apollo 11 cave in Namibia (Wendt 1976:7), or the MSA bone artifacts from Katanda Republic of Congo (Brooks and Yellen (1996) and at Blombos Cave in South Africa where there are bone points with late MSA artifacts (Henshilwood and Sealy 1997). The MSA terminated at or beyond the range of conventional radiocarbon dating techniques based on numerous dates from a wide range of sites (Vogel and Beaumont 1972; Volman 1984; Klein 1989). An exception to this pattern was found at Rose Cottage Cave in South Africa where the MSA terminates at ca. 20,000 B.P. (A.M.B. Clark 1997).

The transition between the MSA/LSA in sub-Saharan Africa is much less well understood and dated than the end of the Mousterian (Middle Paleolithic) and the Upper Paleolithic in Europe and the Near East. According to Klein, "the interface or transition (between the MSA and LSA) may prove particularly difficult to study in Southern Africa, because many sites were abandoned in the 60-30,000 B.P. interval when it occurred" (1989:534). Klein believed that this abandonment was the result of widespread hyperaridity in the middle of the Last Glaciation. It is this lack of sites with transitional MSA/LSA materials in sub-Saharan Africa which makes the White Paintings Shelter (WPS) so interesting. At WPS these transitional lithic materials and associated paleoclimatic and faunal data are clearly present. It should be stressed that these assemblages were defined based on combined technological (lithic) and non-lithic artifacts, fauna, paleoclimatic information, absolute and relative dating techniques and comparative regional archaeological sequences for the early LSA "Lower Fish" assemblage and primarily technological (lithic), absolute and relative dating, and comparative regional archaeological sequences for the transitional MSA/early LSA "Large Blade" and upper MSA assemblages.

Utilizing lithic and paleoclimatological data from dated contexts, six major hypotheses are explored. The first posits that regionally across southern Africa, lithic assemblages undergo changes across the MSA/LSA boundary and that these changes incorporate:

1. A shift from direct percussion to indirect or pressure flaking techniques utilizing smaller cores.

2. Trends toward decreasing blade/tool sizes.

Thus, the first hypothesis is that at WPS:

H1- Procedures of lithic reduction will demonstrate a shift from prepared core direct percussion techniques producing large blades and flake tools to indirect percussion techniques producing smaller blades, flakes and microlithic tools.

The second pair of related hypotheses posit that:

1. The inhabitants of WPS were acquiring different raw materials for their specific technological features for tool production and/or different raw materials were available at different times in the past.

2. Raw material acquisition patterns will be directly associated with changing local paleoenvironmental conditions during the Late Pleistocene and Holocene, specifically with the presence or absence of paleo Lake Tsodilo.

3. The availability of raw materials to the inhabitants of WPS will be correlated with the changing environmental conditions in the region during the Late Pleistocene and Holocene specifically related to the probable periodic flooding of lithic source areas in fossil river basins and pans will affect lithic availability.

4. During the earliest phases of the occupation of WPS, the MSA people continued to acquire raw material from traditional raw material sources, before turning to or discovering sources closer to habitation sites at Tsodilo.

5. The lithic raw materials utilized by the inhabitants of WPS will show a general shift for technological reasons from imported varieties during the MSA, to more locally available raw materials during the LSA. Furthermore, that certain varieties of raw materials are specifically associated with the MSA and LSA.

Therefore the second and third hypotheses are:

H2-Raw material acquisition patterns will demonstrate a preference for imported raw materials during the MSA and the transitional period, then shift to more locally available sources during the LSA.

H3- Raw material sources/preferences will be correlated with availability of raw material related to periodic flooding of source areas through time.

The null hypothesis for the above is:

Ho- No change in local availability/preference of lithic raw material will occur between the MSA/LSA at WPS.

The final three related hypotheses posit that:

1. The inhabitants of WPS changed their subsistence, settlement, and mobility patterns through time in response to increases and decreases in rainfall as seen in the presence or absence of paleo Lake Tsodilo, site sediments, faunal and other regional paleoenvironmental indicators.

2. At WPS a high degree of residential mobility will be evident in the lithic assemblage during the drier phases of the past. Conversely, during the wetter phases of the past, evidence of more intensive long term occupations are expected in the lithic assemblage at WPS.

3. The changing mobility patterns for the inhabitants of WPS will be directly reflected in shifting raw material acquisition patterns and the tool types, variety, and the amount and types of lithic reduction carried out at the site through time.

Thus, the final set of hypotheses are associated with changes in the environment, resource distribution and abundance and are:

H4- A shift from a high degree of residential mobility evident in the artifact assemblage during the drier phases to more intensive long term occupations during the wetter phases of the past.

H5- WPS will conform to the dry season concentration/wet season dispersion patterns observed by Yellen (1977) and Brooks and Yellen (1987) for the !Kung.

H6- The alternative which is based on oral tradition of the use of WPS as a wet season aggregation site.

In order to test these hypotheses, I analyzed the changes in stone knapping behavior and raw material acquisition patterns or preferences through time at WPS. Also addressed was the placement of the WPS assemblage temporally and in relationship to other known regional artifact assemblages or industries.

To examine the problem of artifact distribution, the WPS lithic material was analyzed both vertically and horizontally both within and outside the shelter drip line. These data provided information on areas of stone knapping and other activities at the site, as well as shed new light on changes in raw material procurement, trade and tool fabrication characterizing the Middle Stone Age, the Transitional MSA/early LSA, and the early LSA at WPS and, more generally, in the interior regions of southern Africa. Finally, the WPS lithic assemblage assists in filling a gap currently found in the southern African interior and helps to tie the Kalahari in with the better documented regions of South Africa (Deacon 1984; Klein 1989; Phillipson 1985; Sampson 1974; Rightmire 1989; Volman 1981, 1984) and the Matopos Hills in Zimbabwe (Walker 1991, 1995).

LITHIC REDUCTION SEQUENCES AS AN AID TO THE ANALYSIS OF THE MSA/LSA TRANSITION AT WHITE PAINTINGS SHELTER

Since an understanding of changing lithic reduction strategies across the MSA/LSA boundary at WPS was one of the primary goals of this analysis, and the fact that in many of the applicable levels the vast majority of the debitage is quartz/quartzite, I shall begin by discussing this part of the assemblage, although I will refer to the non-quartz(ite) assemblages where comparison is necessary and appropriate. I will then turn to the imported raw materials with an emphasis on the reduction of these "exotics". Utilizing these data, the different types of stone knapping activities carried out at the site through time are presented. Then a comparison of the reduction strategies of the local versus imported raw materials is made. In Chapter VII I present data on raw material acquisition patterns through time and then I refer to these data to evaluate changing trade and exchange patterns through time as evidenced at WPS.

QUARTZ(ITE) LITHIC TECHNOLOGY

The physical properties of crypto-crystalline quartz and quartzite include natural cleavage planes within their crystalline structure. In addition, actual cracks can exist between individual crystal grains which often causes them to fracture in unpredictable ways. In examining the current literature for examples, there is a scarcity of published analyses of quartz(ite) lithic reduction sequences for southern Africa, with the exception of Bisson (1990) for an LSA sequence in Zambia. I feel that this lack of published analyses of quartz(ite) reduction sequences relates to the widely held belief that the evidence of the type of lithic reduction in quartz(ite) assemblages are easily masked by the noted tendency of quartz to shatter. These problems are avoided and reduction characteristics are more readily apparent in debitage produced from other fine grained and often more homogeneous raw materials like chert, jasper or chalcedony. This is combined with the large amount of effort required to analyze quartz assemblages, and the feeling that the effort will go unrewarded with less than adequate results.

If this is true, it certainly creates serious challenges to archaeologists who study the MSA and LSA in southern Africa, where various kinds of quartz were often the only suitable material available in the local areas for the manufacture of stone tools.

If one examines the geology of southern Africa (Truswell 1977), it is apparent that the comparative absence of finer quality raw material is related to the region's parent material which consists predominantly of Pre-Cambrian igneous and metamorphic rocks with granites and quartzites predominating. In many regions igneous basalts and the carbonate rocks in which chert and flint occur naturally is quite rare as are consolidated mudstones which can be used for stone tool production if they lack predominant bedding planes.

Obsidian certainly occurs in Africa but is restricted to areas of vulcanism in Eastern Africa and is extremely rare in most regions of southern Africa. The most common rock present is granite and it is very difficult to flake.

However, it did serve as an important raw material for hammerstones and grindstones throughout the MSA and LSA and into the Iron Age.

As a result in many areas of southern Africa we are left with quartz and quartzite. It is my experience in trying to knap Tsodilo quartzite, that it does produce a mediocre conchoidal fracture, yet tends to be coarse-grained and less brittle when compared to my experience working with many of the fine-grained North American types of quartzite. African quartzite is certainly adequate for the production of heavy cutting tools like handaxes or large scrapers, but when smaller tools are attempted, the force of the impact of the hammer on the platform makes flakes which are suitable for retouch difficult to produce without breaking the artifact.

Quartzites and basalt, which are all coarse-grained raw materials, are common in Oldowan or Acheulian (Early Stone Age) assemblages in southern Africa, where large cutting or chopping tools and large scrapers dominate assemblages. However, beginning in the Middle Stone Age (MSA) when assemblages indicate a greater emphasis on retouched flake tools from prepared cores, other finer grained and more brittle materials were being sought. In many cases, where other materials were lacking, this material was quartz and quartzite.

Quartz and quartzite is probably the most common mineral found in southern Africa. According to Bisson

(1990) "veins of it can be found outcropping in almost every basement complex hill" (Bisson 1990:104). In areas where no bedrock is exposed, I have observed quartz(ite) remaining in the soil resulting from the decomposition of the parent material. This is due to chemical composition of quartz(ite), which makes is almost impervious or very resistant to weathering. It also occurs as pebbles in gravels in current or fossil streams or in river valleys.

The quartz and quartzite found in these deposits varies greatly, even within the same source. Most quartz or quartzite deposits in southern Africa, as elsewhere in the world, is vein quartz which is silicon dioxide deposited by hydrothermal fluids in fissures in the parent material (Pough 1996). At Tsodilo, within such veins I have observed fairly large clear quartz crystals, although they are rare and usually do not exceed 4 cm in length. Some of this vein quartz is crypto-crystalline and relatively fine grained, but the vast majority is a more coarse crystalline variety. Both crypto-crystalline and the coarser varieties of quartz are formed by a large number of crystals that have grown together (Pough 1976). "Their texture can differ depending on the size of the individual crystals and the degree to which they have been subject to geological pressures after the initial formation of the vein" (Broadbent 1979:50). The textures vary from fine-grained, which produces a good to fair conchoidal fracture and is suitable for stone tool manufacture, to the coarse varieties which are sugary and do

not fracture conchoidally at all or very poorly. Cryptocrystalline quartz and quartzite do occur in massive vein deposits at Tsodilo (Figure 1.3) and often weather out in medium or even large chunks, however, the material usually has many cracks or other flaws caused by deformation and weathering. Workable pieces without flaws can be obtained from such deposits, but require the production of a great deal of "angular waste" and the workable piece is generally quite small and thus limits the size of the tools that can be produced.

Frequencies and weights of both lithic debitage and angular waste are summarized in Table 10 and Appendix B. As is apparent, the lithic frequencies do not remain constant and increase or decrease abruptly at various depths. As will be discussed, the shifting frequencies and average weights are interpreted as indicating changing reduction strategies which may also be related to the intensity of site use through time at WPS.

A total of 1671 retouched tools were recovered from the White Paintings Shelter excavation from all levels of Squares 10-29. The ones produced on quartz or quartzite constitute 45.36% of the flaked lithic specimens in the collection (Table 13), although quartz and quartzite constitutes the vast majority (69.6%) of the debitage and angular waste. I will return to this topic in a later section. The major categories of retouched tools produced on quartz(ite) include awls (298), burins (248), side

Table 13 WPS Quartz(ite) Versus Non-Quartz Raw Materials for Retouched Tools and Blades/Bladelets. Squares 10-29. Note: Squares excavated to different depths.

Tool Type	Number Quartz(ite)	Number Non-Quartz	Total	% Quartz(ite)
Awls	298	127	425	70.12%
Becs	6	9	15	40.0%
Bked Bladelets	8	35	43	18.6%
Bked Points	11	23	34	32.35%
Burins	248	196	444	55.86%
Combo. Tools	9	32	41	21.95%
Crescents	25	53	78	32.05%
Denticulates	4	21	25	16.0%
Drills	5	7	12	41.67%
End Scrapers	29	53	82	35.37%
Notches	9	27	36	25.0%
Points	10	74	84	11.9%
Side Scrapers	65	160	225	28.89%
Misc. Retouch	31	96	127	24.41%
Totals:	758 (45.36%)	913	1671	Avg. 32.44%

Blade(lets)	Number Quartz(ite)	Number Non-Quartz	Total	% Quartz(ite)
Totals:	386	722	1108	34.84%

scrapers (65), end scrapers (29) as well as unretouched blades(lets) (386). Several backed elements including crescents (segments) (25), backed points (11) and backed bladelets (8) were occasionally produced using quartz(ite) but were usually produced on the fine quality crystal quartz.

The 94 scrapers produced on quartz or quartzite were represented by 65 side and 29 end forms representing 30.62% of the total scrapers being produced on quartz or quartzite. Many of these scrapers appeared to be rather poorly made and had somewhat irregular edge profiles. Notches (9) also tended to be irregular in form. Denticulates were primarily made on large flakes or on expended cores. Twenty five percent of the notched tools and 16% of the denticulates were made of quartz or quartzite.

Backed elements were the least common class of tools (Table 13) produced on quartz(ite). Most were microlithic in size averaging 1.86 cm in length. Crescents (segments) were the most frequent (25), followed by backed points (11) and backed bladelets (8). A total of 27.67% of the microliths were made of crystal quartz or fine grained quartzite, with the remainder made on exotic raw materials.

The most common quartz(ite) tools were awls (298) and burins (248). The awls were frequently bipolar and averaged 1.46 cm in length. The burins were made of both crystal quartz and quartzite and average 1.60 cm in length. Of interest, the various retouched tools were not distributed uniformly throughout the 7 m in which lithics occur. It was evident that backed tools, and microliths, as well as unretouched bladelets, were much more frequent in the LSA and early LSA levels of the site. Whereas points, scrapers, notches and denticulates, as well as unretouched blades, increased dramatically in the transitional early LSA/MSA and MSA levels of the site below the 300 cm level (Table 7).

In addition, the raw material preferences for tool production shifted throughout the sequence. Table 14 compares the frequencies of major tool classes and raw materials in the early LSA, transitional early LSA/MSA and the Upper MSA levels at the White Paintings Rock Shelter. This table includes both quartz(ite) and non-quartz raw materials. Although this dissertation focuses on the MSA/early LSA transition, in consultation with Dr. Larry Robbins it was decided to sample the upper levels of the MSA in detail to provide a comparison to the transitional MSA/early LSA material, thus the Upper MSA refers to the levels between 420-450 cm although MSA material continued to be recovered to at least 620 cm in the excavation.

As I mentioned in the introduction to this chapter, I will continue and conclude the discussion of the quartz(ite) assemblages before turning to a complete discussion of the non-quartz assemblages. Yet I shall continue to make comparisons between the two types of raw materials when it is important to the interpretation of the WPS lithic assemblages.

Table 14 Tool Raw Materials From The "Lower Fish" (200-300cm) Large Blade (300-420 cm) and Upper MSA (420-450 cm). Squares 10-12 and 19-23.

R.M.*	BLT	BL	BB	CR	BP	PT	SS	ES	DE	NO	BE	BU	AL	DR	CT	MR	Total
200-210 cm "Lower Fish"																	
QTZ*	6	1	0	0	0	0	1	1	0	0	0	2	1	1	0	0	13
BC	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
CH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TWBF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BLC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
MCC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OFG	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
210-220 cm																	
QTZ	8	2	1	0	1	0	1	1	0	0	0	1	0	0	0	0	15
BC	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
CH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JA	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
TWBF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BLC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
MCC	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
OFG	3	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	6
220-230 cm																	
QTZ	5	2	0	1	0	0	1	0	1	0	0	2	7	0	1	0	20
BC	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	3
CH	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
JA	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
TWBF	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2
BLC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL	4	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	5
MCC	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2
OFG	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	5
230-240 cm																	
QTZ	18	1	0	1	1	0	0	0	0	0	0	3	6	1	0	1	32
BC	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	2
CH	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
JA	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
TWBF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BLC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL	2	1	0	1	1	0	0	0	0	0	0	0	1	0	0	0	6
MCC	5	3	0	0	0	0	0	0	0	0	0	0	0	0	1	2	11
OFG	7	1	0	0	0	0	0	0	0	0	0	2	1	0	0	0	11
240-250 cm																	
QTZ	29	4	1	0	0	0	4	1	1	0	0	9	17	0	0	2	68
BC	1	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	4
CH	2	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	4
JA	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
TWBF	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2
BLC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL	0	2	1	0	1	0	2	0	0	0	0	1	1	0	0	1	9
MCC	6	1	0	0	0	0	2	0	0	0	0	1	0	0	1	0	11
OFG	5	2	2	0	0	0	0	1	0	0	0	3	2	0	0	0	15

Table 14 cont. Tool Raw Materials From The "Lower Fish"(200-300 cm), Large Blade (300-420 cm) and Upper MSA (420-450 cm). Squares 10-12 and 19-23.

R.M.*	BLT	BL	BB	CR	BP	PT	SS	ES	DE	NO	BE	BU	AL	DR	CT	MR	Total
250-260 cm "Lower Fish" cont.																	
QTZ	19	1	0	1	3	0	3	2	0	0	1	25	24	0	2	0	81
BC	6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
CH	5	1	0	0	3	0	0	0	0	0	0	2	0	0	0	0	11
JA	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	3
TWBF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BLC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
MCC	1	2	2	0	0	0	0	0	0	0	0	1	0	0	1	0	7
OFG	6	1	1	2	0	0	0	0	0	0	0	1	3	0	0	0	14
260-270 cm																	
QTZ	17	0	1	0	1	0	2	1	0	0	1	15	11	0	0	1	50
BC	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
CH	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	4
JA	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
TWBF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BLC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL	2	1	1	1	0	0	0	0	0	0	0	1	1	0	0	1	8
MCC	2	1	0	0	1	0	0	1	0	0	2	1	0	0	0	0	8
OFG	3	0	0	0	0	0	0	1	0	0	0	3	2	0	0	2	11
270-280 cm																	
QTZ	6	3	0	0	0	23	1	0	0	0	1	12	7	0	0	0	53
BC	1	0	0	2	1	0	0	1	0	0	0	0	0	0	0	0	5
CH	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
JA	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
TWBF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BLC	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
SL	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	2
MCC	0	1	0	0	1	0	0	0	0	0	0	3	0	0	0	0	5
OFG	4	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	7
280-290 cm																	
QTZ	5	0	0	0	0	0	1	2	0	0	0	7	9	0	0	0	24
BC	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
CH	2	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	4
JA	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
TWBF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BLC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	2
MCC	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	2
OFG	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
290-300 cm																	
QTZ	4	1	0	0	0	0	0	0	0	0	1	8	16	0	0	0	30
BC	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
CH	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
JA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TWBF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BLC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
MCC	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
OFG	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2

Table 14 cont. Tool Raw Materials From The "Lower Fish"(200-300 cm), Large Blade (300-420 cm) and Upper MSA (420-450 cm). Squares 10-12 and 19-23.

R.M.*	BLT	BL	BB	CR	BP	PT	SS	ES	DE	NO	BE	BU	AL	DR	CT	MR	Total
300-310 cm Large Blade																	
QTZ	0	1	0	0	0	0	0	1	0	0	0	6	1	0	0	0	9
BC	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
CH	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
JA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TWBF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BLC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
MCC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
310-320 cm																	
QTZ	0	0	0	0	2	0	0	0	0	0	0	3	0	0	0	0	5
BC	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
CH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TWBF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BLC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MCC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OFG	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
320-330 cm																	
QTZ	2	0	0	0	0	0	1	3	0	1	0	2	3	0	0	1	13
BC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JA	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
TWBF	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
BLC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MCC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OFG	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
330-340 cm																	
QTZ	1	1	0	0	0	1	0	1	0	0	0	3	4	0	0	0	11
BC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CH	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
JA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TWBF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BLC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
MCC	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	2
OFG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
340-350 cm																	
QTZ	4	0	0	1	0	0	1	1	0	0	1	4	10	0	0	0	22
BC	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
CH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TWBF	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
BLC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL	0	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0	4
MCC	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	4
OFG	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2

Table 14 cont. Tool Raw Materials From The "Lower Fish"(200-300 cm), Large Blade (300-420 cm) and Upper MSA (420-450 cm). Squares 10-12 and 19-23.

R.M.*	BLT	BL	BB	CR	BP	PT	SS	ES	DE	NO	BE	BU	AL	DR	CT	MR	Total
350-360 cm Large Blade cont.																	
QTZ	4	1	0	1	0	0	0	0	0	1	0	8	9	0	0	0	24
BC	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
CH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TWBF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BLC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MCC	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	3
OFG	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
360-370 cm																	
QTZ	2	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	5
BC	2	0	0	0	0	0	1	1	0	0	0	2	0	0	0	0	6
CH	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
JA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TWBF	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
BLC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MCC	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
OFG	0	3	0	0	0	0	1	0	1	0	0	0	1	0	0	0	6
370-380 cm																	
QTZ	1	0	0	0	0	0	0	0	0	0	0	3	2	0	0	0	6
BC	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	2
CH	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
JA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TWBF	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
BLC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	3
MCC	1	1	0	0	0	0	0	0	0	0	0	4	1	0	0	0	7
OFG	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
380-390 cm																	
QTZ	2	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	5
BC	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
CH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
TWBF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BLC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
MCC	4	2	0	0	0	0	0	1	0	1	0	1	0	0	0	0	9
OFG	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
390-400 cm																	
QTZ	4	2	0	0	0	0	1	0	0	1	0	3	3	0	0	0	14
BC	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	3
CH	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	2
JA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
TWBF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BLC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
MCC	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4
OFG	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4

Table 14 cont. Tool Raw Materials From The "Lower Fish"(200-300 cm), Large Blade (300-420 cm) and Upper MSA (420-450 cm). Squares 10-12 and 19-23.

R.M.*	BLT	BL	BB	CR	BP	PT	SS	ES	DE	NO	BE	BU	AL	DR	CT	MR	Total
400-410 cm Large Blade cont.																	
QTZ	2	0	0	0	0	0	0	0	0	0	0	6	5	0	0	0	13
BC	0	2	0	0	0	1	0	0	0	0	0	1	1	0	0	0	5
CH	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
JA	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2
TWBF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BLC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL	2	2	0	0	0	0	2	0	0	0	0	0	3	0	0	0	9
MCC	0	3	0	1	0	0	0	0	0	0	0	0	1	0	0	0	5
OFG	1	1	0	1	0	0	2	0	0	0	0	1	1	0	0	0	7
410-420 cm																	
QTZ	2	2	0	0	0	0	2	0	0	0	0	7	10	0	0	0	23
BC	0	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0	4
CH	0	3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	4
JA	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2
TWBF	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
BLC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL	1	3	0	0	0	1	0	0	0	0	0	2	1	0	0	0	8
MCC	1	1	0	0	0	0	0	0	0	0	0	2	2	0	0	0	6
OFG	2	1	0	0	0	0	0	1	1	0	0	1	2	0	0	0	8
420-430 cm Upper MSA																	
QTZ	1	1	0	0	0	0	0	1	0	1	0	7	6	0	1	0	18
BC	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
CH	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
JA	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
TWBF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BLC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL	3	2	0	0	0	1	1	1	0	1	0	3	1	0	0	2	15
MCC	1	2	0	0	0	0	1	0	0	0	0	5	1	0	1	2	13
OFG	2	1	0	0	0	0	0	0	0	0	0	2	1	0	0	0	6
430-440 cm																	
QTZ	2	0	0	0	0	0	1	0	0	0	0	4	2	0	0	0	9
BC	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
CH	2	3	0	0	0	0	0	0	0	0	0	1	0	0	0	0	6
JA	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
TWBF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BLC	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
SL	2	1	0	0	0	1	2	1	0	1	0	0	1	0	1	0	10
MCC	0	3	0	0	0	4	0	0	0	0	0	1	0	0	1	0	9
OFG	0	1	0	0	0	1	0	0	0	0	0	2	1	0	0	1	6
440-450 cm																	
QTZ	3	1	0	0	0	0	1	0	0	0	0	4	14	0	1	1	25
BC	2	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	5
CH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JA	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	2
TWBF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BLC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SL	0	4	0	0	0	3	3	0	0	1	0	0	2	0	1	1	15
MCC	1	1	0	0	0	0	2	0	1	0	0	1	1	0	0	1	8
OFG	0	3	0	0	0	3	0	0	0	0	0	3	2	0	0	0	11

Table 14 cont. WPS Tool Raw Materials From The "Lower Fish" (200-300 cm), "Large Blade" (300-420 cm) and Upper MSA (420-450 cm) Squares 10-12 and 19-23. Note Squares excavated to different depths.

Key:

BLT = Bladelets
BL = Blades
BBL = Backed Blades/Bladelets
CRS = Crescents (Segments)
BPTS= Backed Points
PTS = Points
SS = Side Scrapers
ES = End Scrapers
DENT = Denticulates
NOT = Notches
BEC = Becs
BUR = Burins
AWL = Awls
DRL = Drills
COM = Combination Tools
MRT = Miscellaneous Retouched Pieces

QTZ = Quartz(ite)
BC = Brown Chert
CH = Chalcedony
JA = Jasper
TWBF= Transparent w/ Black Flecks
BLC = Black Chert
SL = Silcrete
MCC = Multi-Color Chert
OFG = Other Fine Grained Raw Material

LITHIC DEBITAGE ANALYSIS

In order to determine if there were difference in lithic technology or reduction techniques across the MSA/LSA levels at WPS, I examined lithic debitage, cores and finished tools. The analysis of lithic debitage (literally waste) ultimately sought to demonstrate the mechanical steps that were employed in taking a piece of raw material and producing a finished tool. This process is considered the lithic reduction sequence. The production of stone tools is a "reductive technology" (Rovner 1975), thus, the process requires the incidental production of large amounts of lithic waste, or debitage in the act of tool fabrication. This subtractive process is one in which flakes of stone are removed from a larger piece in a systematic manner either to reduce the core to a desired shape or to produce flakes of a desired shape. Successful stone knapping thus requires adherence to a pattern of manufacture appropriate to the ultimate goal, although the steps to the ultimate outcome may vary between individuals. The successful stone knapper must often vary these patterns to fit special circumstances. The idea of lithic reduction sequences has been recognized for a number of years and began to be explicitly studied in the 1970's (for example see Cooke 1976). The basic assumptions that underlie studies of lithic reduction are that manufacturing patterns can be broken down and recognized. That is, there is a set of clearly demarcated stages, and that these stages represent the intentional goals of the prehistoric stone workers. Furthermore, these stages result in distinct by-products that can be identified by the trained lithic analyst.

However, the application of lithic reduction models to African MSA/LSA assemblages is not an easy task. Bruce Bradley (1975) discussed lithic reduction models and indicated that to get the most information out of an assemblage, it must have an identifiable implement typology and an equally identifiable lithic reduction sequence or sequences. When dealing with the quartz assemblage from WPS and the rather simple nature of many of the tool forms, combined with the erratic nature of quartz and quartzite discussed above, Bradley's conditions were relatively difficult to meet. As a result, I adopted a modified version of lithic reduction proposed by Michael Collins (1975) and also employed by Michael Bisson (1990) for Zambian LSA quartz assemblages. Collins (1975) advocated a linear process in which the more complex the final tool forms, the greater the amount of reduction it required. In its most general form, Collins' (1975) model was composed of five steps:

1. Acquisition of raw material
2. Core preparation and initial reduction
3. Optional primary trimming
4. Optional secondary trimming and shaping
5. Optional maintenance and modification

It was necessary to modify Collins model to fit the conditions at WPS. In this case I was particularly interested in determining if there were any changes in lithic reduction techniques or sequences between the upper MSA, the transitional MSA/early LSA, and the early LSA assemblages at WPS.

For my analysis, three classes of debitage were recognized: cores; flakes; and angular waste, with blades and bladelets treated separately. Because most of the quartz(ite) available at WPS was of rather poor quality, only two of these, cores and flakes, were subjected to detailed analysis. However, during sorting all specimens were visually inspected for unusual features including macroscopic (10X hand lens) indications of utilization. Angular fragments and broken flakes were excluded based upon the assumption that they were not produced intentionally and resulted from the many flaws in the Tsodilo Hills vein quartz(ite).

There are numerous sources of workable raw material in the immediate vicinity of WPS. Quartz and quartzite veins outcrop above the shelter and at numerous areas in the Tsodilo Hills (Figure 1.3). There was no apparent evidence of attempts to quarry quartz, however specularite was intensively mined in the hills during the Late Holocene (Robbins et al. 1998). I believe that the main sources of quartz(ite) raw material for the inhabitants of WPS were the angular quartz rubble exposed by erosion throughout the Tsodilo Hills. Individual chunks range in size from a few cm in diameter to more than 25 cm. As mentioned above, within these quartz chunks are rare but beautiful quartz crystals which range in size from quite small to over 4 cm in length. The clear crystal quartz was the material of choice for the manufacture of backed elements.

The vein quartz(ite) is by far the most common raw material represented in the archaeological debitage assemblages. Flaking experiments carried out by the author on some of the weathered rubble in the immediate vicinity of the shelter and elsewhere in the Tsodilo Hills, indicated that it has a large number of cracks and other flaws. I would suggest that the procurement strategy employed by the inhabitants of WPS involved going to the outcrop areas in the hills and visually inspecting, then testing the material for pieces with obvious flaws which were discarded at the site of acquisition. Selected pieces were then brought back to the shelter for flaking. It appears that poor quality specimens were still brought back to the shelter based on the presence of a great deal of the material in the archaeological collections appearing to have broken along natural cracks. These specimens do not show points of percussion of other obvious signs of flaking. The presence of pieces with remaining cortex also indicates that not a great deal of reduction of raw material was taking place at the source area, if these were away from the immediate area of the shelter. This interpretation was further supported by the numerous pieces of angular waste (Table 10) found in the shelter. Again this indicates that a number of flawed pieces were not identified by preliminary inspection and testing.

QUARTZ CORES

The 2,253 quartz cores from the WPS assemblage were classified using a variation of the system developed by Phillipson (1976) for his analysis of LSA collections from southern Africa. Phillipson's (1976) system was utilized to maintain consistent nomenclature for the region and it also accurately described the range of variation found in the WPS quartz(ite) cores. Ten types of cores were identified, each representing a slightly different set of mechanical processes or order of flake removal (Figure 5.1). These core types were also fully described and illustrated in Chapter III (Figure 3.1).

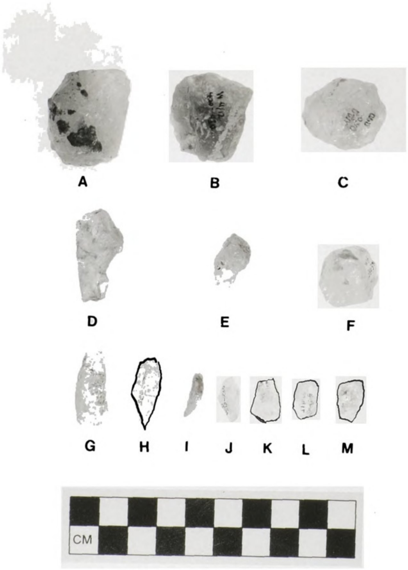


Figure 5.1 Quartz(ite) Cores. A, Minimal Core; B, Unilateral Single Platform Core; C, Radial Core; D-E, Bipolar Cores; F, Multi-Platform Core; G, Blade Core; H-J, Bipolar Bladelet Cores; K-M, Flat Bladelet Cores.

The totals for the distribution of quartz(ite) cores by level at WPS was presented in Table 9 and the Quartz/Quartzite core totals per unit volume for the "Lower Fish", "Large Blade", and Upper MSA levels is presented in Table 15. In most of the quartz(ite) core categories, there was no clear separation between upper MSA, the "Large Blade" transitional MSA/early LSA and the early LSA "Lower Fish" levels, although changes in overall core densities per unit volume were quite apparent. As will be discussed below, the lack of systematic variation apparent in the quartz(ite) core categories was in direct contrast to the non-quartz core categories. This was particularly clear between both the upper MSA Levels (450-420 cm) the transitional "Large Blade" (420-300 cm) in the presence of tortoise cores, blade cores and single platform cores in these assemblages and the predominantly microlithic early LSA "Lower Fish" assemblages (300-200 cm) and a dominance of bladelet cores, multi-platform cores, and core reduced pieces in this assemblage (Figure 5.1).

Returning to the quartz(ite) core assemblages, bipolar quartz cores dominated all three assemblages, although the densities per unit volume varied considerably with the highest densities in the early LSA "Lower Fish" levels. Quartz(ite) flat bladelet cores were consistently represented in both the transitional MSA/early LSA "Large Blade" assemblages and the early LSA "Lower Fish" levels. Of note the density per unit volume of this core category

Table 15 Quartz/Quartzite Core Totals Per Unit Volume Squares 10-12 and 19-23 (1 sq. m).

Depth	* BP	MC	FBL	SPC	R/D	LC	MPC	BLT	BL	CRP	Total
Lower Fish											
200-210	2.13	0	0.4	0	0	0	0.4	0	0	0	2.88
210-220	2.63	0.5	0.3	0	0	0	0.3	0.1	0	0	3.75
220-230	4.38	0.38	0.4	0	0	0	0.4	0	0	0.3	5.78
230-240	6.75	1.25	0.5	0	0	0	0.8	0.6	0	0.4	10.3
240-250	8.25	1.13	0.8	0	0	0	1	0.3	0	0.6	12
250-260	14.1	1.38	1.9	0	0.1	0	1.3	0.1	0	0.4	19.3
260-270	8.57	0.57	0.9	0	0	0	0.9	0.3	0	0.6	11.7
270-280	2.57	0.43	0.9	0	0	0	0.6	0	0	0.6	5
280-290	1.29	0.57	0.1	0	0	0	0.1	0	0	0.1	2.2
290-300	1.71	1.14	0.1	0	0	0	0	0	0	0.4	3.39
Large Blade											
300-310	1	0.1	0.3	0	0	0	0.1	0	0	0.1	1.59
310-320	0.71	0.57	0	0	0	0	0.4	0	0	0	1.71
320-330	0.86	0.43	0.6	0	0	0	0.1	0	0	0	1.96
330-340	2.43	0.57	0.4	0	0	0	0.1	0	0	0.1	3.63
340-350	2.17	0.33	1	0	0	0	0.5	0.2	0.2	0.3	4.67
350-360	2.83	0.33	0.5	0	0	0	0.2	0	0	0.3	4.17
360-370	1.5	0.5	0.2	0.2	0	0	0.2	0	0	0	2.5
370-380	2.67	0.5	0.3	0	0	0	0.2	0	0	0	3.67
380-390	1.33	0.67	0.2	0	0	0	0.5	0	0	0.2	2.83
390-400	0.83	0.67	0.5	0	0	0	0.7	0	0	0	2.67
400-410	1.33	0.33	0	0	0	0	0.7	0	0	0	2.33
410-420	2.33	0.33	0	0	0	0	0.5	0	0	0.3	3.5
Upper MSA											
420-430	0.5	0.5	0.3	0	0	0	0.7	0	0	0.2	2.17
430-440	4	0	0	0.4	0	0	0.2	0.2	0	0.2	5
440-450	4.4	0.6	0.2	0	0.2	0	1	0	0	0.2	6.6

* BP = Bipolar Cores
MC = Minimal Cores
FBC = Flat Bladelet Cores
SPC = Single Platform Cores
R/D = Radial/Disc Cores
LC = Levallois Cores
MPC = Multi-Platform Cores
BLT = Bladelet Cores
BL = Blade Cores
CRP = Core Reduced Pieces

was substantially reduced in the upper MSA levels. Bladelet cores were most frequent in the early LSA "Lower Fish" levels (10), but overall these cores accounted for 1.7% of the total from these levels. Blade cores were only present in the upper MSA and "Large Blade" levels, however only four quartz(ite) specimens were found in the upper MSA levels and one example was recovered from the "Large Blade" assemblage, which was not a sufficient sample size to draw any definitive conclusions.

The most common core forms in all three assemblages were bipolar cores, minimal cores, multi-platform cores and flat bladelet cores. A chi-square test of all core types from the "Large Blade" levels and the "Lower Fish" levels was attempted. However, in the contingency table over one-third of the total statistic was generated by a composite total of diverse core types (blade, single platform, radial) that were rare and were lumped together to avoid duplication cell values. A second chi-square test of core type frequencies between the upper MSA and "Large Blade" levels at WPS was also attempted, but again, sample size between the two assemblages made drawing conclusions based on these statistics misleading and thus they were discarded. There does appear to be slightly less difference between the upper MSA and the "Large Blade" transitional MSA/early LSA assemblages, but this would be expected. The overall picture was one of no real variation in the distribution of quartz(ite) core types between the upper MSA and the "Large

Blade" assemblages and a slight variation between the "Large Blade" levels and the "Upper Fish" at WPS. Individual technological attributes of cores such as striking platforms and scar patterns, which were used to separate the various core categories, all show patterns proportional to that of core types and do not vary much between the upper MSA, "Large Blade" or "Lower Fish" assemblages at the site.

FLAKES

Since one of the primary goals of this analysis was the examination of the MSA/early LSA transition at WPS, I conducted a comprehensive analysis of all 5306 complete flakes recovered from the upper MSA, the transitional MSA/early LSA "Large Blade", and early LSA "Lower Fish" levels at WPS (450-200 cm). Observations were made on five discrete variables. The discrete variables are:

1. Striking platform: (Figure 5.2) (also described in Chapter IV)
   - plain (single facet)
   - dihedral (simple facet)
   - multi-facet
   - point
2. Dorsal surface condition: (Figure 5.2)
   - flaked non-cortical
   - partially cortical
   - fully cortical
3. Dorsal scar patterns: (Figure 5.2)
   - parallel (scars originate on one side only, ridges are parallel)
   - convergent (scars originate on one side only, ridges converge towards opposite edge)
   - opposed (scars originate on two opposite edges and converge at the center or are parallel, this is believed to be the product of the bipolar technique)

- radial (scars originate on the entire perimeter of the flake, ridges converge at the center)
- irregular (scars originate on one or two sides in a irregular fashion). This also served as the residual category.

4. Relative thickness calculated using Beaumont's (1979a) formula. $\frac{(\text{Mean T/Mean L}) + (\text{Mean T/Mean W})}{2}$
5. Miscellaneous discrete attributes: these include micro-flaking caused by utilization and "pot-lid" fractures caused by fire cracking.

The details of the flake analysis are presented in Tables 16, 17, 18, 19. The following section will summarize the important results. The type of quartz(ite) used in tool production did not change substantially throughout the sequence, however higher frequencies of quartzite in the "Large Blade" and upper MSA levels corresponded to the larger numbers of scrapers and denticulates, both of which were often made of this material, while crystal quartz was more frequent in the predominantly microlithic early LSA "Lower Fish" levels of the site.

The relative thickness indices and frequencies of quartz(ite) flakes (Table 19), compared to non-quartz flakes (Table 22), show higher frequencies and lower relative thickness indices of non-quartz flakes in the lower (upper MSA and "Large Blade") levels of the site. These findings are explicable in terms of the nature of the raw material. For example, silcrete occurs in larger, more homogeneous blocks than quartz(ite). Thus, a piece of silcrete can produce more flakes than quartz(ite) because it was initially larger and, being less flawed, could be used longer before discard. This was clearly reflected in the

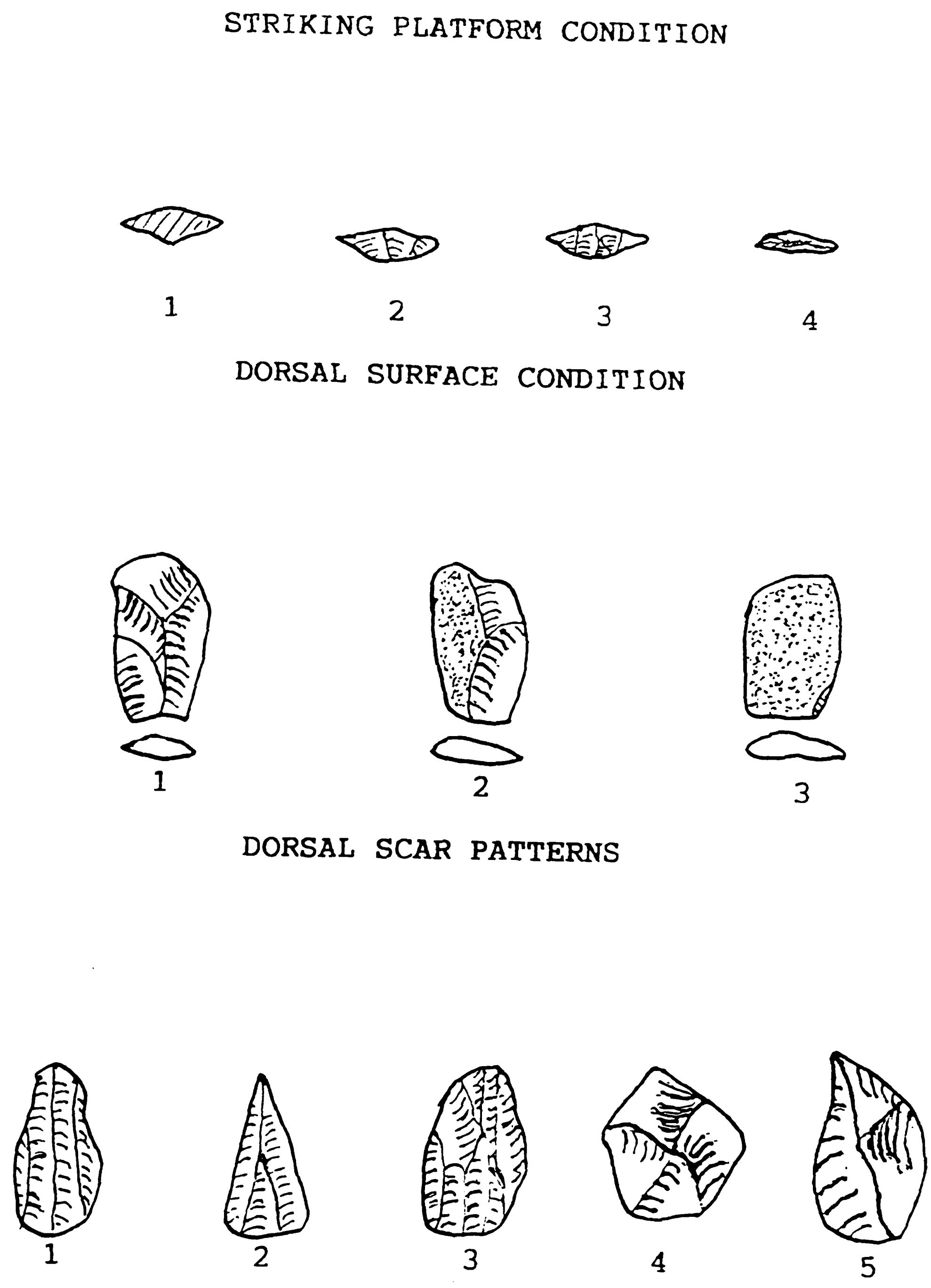


Figure 5.2 Flake attributes (After Clark 1974:80, and Bisson 1990:125). Striking platform condition - 1: plain (single facet); 2: dihedral (simple facet); 3: multi-facet; 4: point. Dorsal surface condition - 1: flaked (non-cortical); 2: partially cortical; 3: fully cortical. Dorsal scar patterns - 1: parallel; 2: convergent; 3: opposed; 4: radial; 5: irregular.

Table 16 WPS Striking Platform Characteristics On Quartz(ite) Flakes For The "Lower Fish", "Large Blade" and Upper MSA Assemblages.

Depth in cm	Sample Number	Plain	% of total	Simple Facet	% of total	Multi-Facet	% of total	Point	% of total
"Lower Fish"									
200-210	142	112	78.9	12	8.5	3	2.1	15	10.6
210-220	257	191	74.3	35	13.6	6	2.3	25	9.7
220-230	264	203	76.9	17	6.4	7	2.7	37	14
230-240	596	453	76	77	12.9	3	0.5	63	10.6
240-250	758	542	71.5	64	8.4	38	5	114	15
250-260	762	562	73.8	35	4.6	24	3.1	141	18.5
260-270	299	223	74.6	38	12.7	6	2	32	10.7
270-280	216	158	73.1	12	5.6	8	3.7	38	17.6
280-290	152	112	73.7	17	11.2	2	1.3	21	13.8
290-300	130	96	73.8	12	9.2	3	2.3	19	14.6
"Large Blade"									
300-310	57	40	70.2	5	8.8	2	3.5	10	17.5
310-320	41	31	75.6	3	7.3	1	2.4	6	14.6
320-330	64	49	76.6	5	7.8	2	3.1	8	12.5
330-340	100	80	80	2	2	4	4	14	14
340-350	119	90	75.6	8	6.7	4	3.4	17	14.3
350-360	120	91	75.8	9	7.5	4	3.3	17	14.2
360-370	56	42	75	4	7.1	2	3.6	8	14.3
370-380	77	58	75.3	4	6.5	2	2.6	13	16.9
380-390	92	70	76.1	7	7.6	3	3.3	12	13
390-400	142	117	82.4	5	3.5	0	0	20	14.1
400-410	189	154	81.5	7	3.7	3	1.6	25	13.2
410-420	173	141	81.5	7	4	3	1.7	22	12.7
Upper MSA									
420-430	131	99	75.6	11	8.4	3	2.3	18	13.7
430-440	128	81	63.3	14	10.9	3	2.3	30	23.4
440-450	241	123	51	56	23.2	10	4.1	52	21.6

Table 17 Quartz(ite) and Non-Quartz Dorsal Surface Characteristics From The "Lower Fish", "Large Blade" and Upper MSA Assemblages.

	Sample Number	Complete Cortical	% of total	Partial Cortical	% of total	Non-Cortical	% of total
Quartz(ite) Early LSA 200-300 cm	3576	254	7.1	1091	30.51	2231	62.39
Non-Quartz Early LSA 200-300 cm	870	4	0.046	14	1.61	852	97.93
Quartz(ite) Large Blade 300-420 cm	1230	144	11.71	283	23.01	803	65.28
Non-Quartz Large Blade 200-300 cm	557	3	0.054	10	1.8	544	97.67
Quartz(ite) Upper MSA 420-450 cm	500	26	5.2	127	25.4	347	69.4
Non-Quartz Upper MSA 420-450 cm	461	5	1.085	12	2.6	444	96.31

Table 18 WPS Quartz(ite) Dorsal Scar Patterns For Flakes From The "Lower Fish", "Large Blade", and Upper MSA Assemblages.

Depth in cm	Sample Number	Para.	% of total	Con.	% of total	Opp.	% of total	Radi.	% of total	Irreg.	% of total
"Lower Fish"											
200-210	142	19	13.4	3	2.11	105	73.94	0	0	15	10.56
210-220	257	26	10.1	6	2.33	180	70.04	0	0	45	17.51
220-230	264	17	6.44	8	3.03	201	76.14	0	0	38	15.45
230-240	596	65	10.9	17	2.85	392	65.77	0	0	122	20.47
240-250	758	63	8.31	21	2.77	521	68.73	0	0	153	20.18
250-260	762	79	10.4	21	2.76	559	73.36	5	0.07	98	12.86
260-270	299	29	9.7	7	2.34	219	73.24	0	0	44	14.72
270-280	216	37	17.1	5	2.31	111	51.39	0	0	63	29.17
280-290	152	10	6.58	4	2.63	86	56.58	0	0	52	34.21
290-300	130	5	3.85	4	3.08	65	50	0	0	56	43.08
"Large Blade"											
300-310	57	10	17.5	1	1.75	33	57.89	0	0	13	22.81
310-320	41	0	0	1	2.44	17	41.46	0	0	23	56.1
320-330	64	18	28.1	1	1.56	27	42.19	0	0	18	28.13
330-340	100	12	12	1	1	65	65	0	0	22	22
340-350	119	34	28.6	1	0.84	55	46.22	0	0	29	24.37
350-360	120	10	8.33	6	5	82	68.33	0	0	22	18.33
360-370	56	11	19.6	3	5.36	34	60.71	0	0	8	14.29
370-380	77	11	14.3	4	5.19	56	72.73	0	0	6	7.79
380-390	92	5	5.43	5	5.43	43	46.74	0	0	39	42.39
390-400	142	36	25.4	8	5.63	44	30.99	0	0	54	38.03
400-410	189	14	7.41	12	6.35	108	57.14	0	0	55	29.1
410-420	173	0	0	11	6.36	115	66.47	0	0	47	27.17
Upper MSA											
420-430	131	30	22.9	9	6.87	30	22.9	0	0	62	47.33
430-440	128	5	3.9	8	6.25	102	79.69	0	0	13	10.16
440-450	241	7	2.9	16	6.64	160	66.39	7	2.9	51	21.16

Table 19 WPS Relative Thickness Of Quartz(ite) Flakes From The "Lower Fish", "Large Blade" and Upper MSA Assemblages.

Depth cm	Sample Number	Mean Length	Mean Width	Mean Thickness	Relative * Thickness x 100
"Lower Fish"					
200-210	142	1.69	0.96	0.41	33.48
210-220	257	1.48	0.98	0.36	30.53
220-230	264	1.67	0.98	0.41	33.19
230-240	596	1.47	0.83	0.32	30.16
240-250	758	1.54	0.85	0.37	33.78
250-260	762	1.65	0.97	0.39	31.92
260-270	299	1.42	0.88	0.34	31.29
270-280	216	1.61	0.99	0.36	29.36
280-290	152	1.48	1.01	0.45	37.48
290-300	130	1.28	0.82	0.39	39.01
"Large Blade"					
300-310	57	1.71	1.13	0.4	29.4
310-320	41	1.73	1.18	0.37	26.37
320-330	64	1.95	1.31	0.53	33.82
330-340	100	1.43	1.07	0.51	41.67
340-350	119	1.38	0.87	0.4	37.48
350-360	120	1.31	0.84	0.36	35.17
360-370	56	2.42	0.6	0.26	27.04
370-380	77	1.34	0.98	0.36	31.8
380-390	92	2.29	1.07	0.5	34.28
390-400	142	1.86	1.05	0.38	28.31
400-410	189	1.49	0.78	0.35	34.18
410-420	173	1.24	0.91	0.43	40.97
Upper MSA					
420-430	131	2.06	1.19	0.49	32.48
430-440	128	1.47	0.91	0.36	32.03
440-450	241	1.58	0.94	0.37	31.39

* Relative Thickness was calculated using Beaumont's (1979a) Formula. $\frac{(\text{mean T/mean L}) + (\text{mean T/mean W})}{2}$

flakes to cores ratios of the different raw materials in the collections. For quartzite, the most coarse material with the highest number of flaws, there were 6.58 flakes per core in the upper MSA levels, 5.54 flakes per core in the "Large Blade" levels and 6.08 flakes per core in the "Lower Fish" levels. For the non-quartz raw materials, (excluding silcrete) which are finer grained and with a more predictable fracture, but usually occur in smaller nodules, there were 7.83 flakes per core in the upper MSA levels, 8.88 flakes per core in the "Large Blade", and 6.34 flakes per core in the "Lower Fish" levels. For silcrete, occurring in larger chunks and generally free of flaws, 6.67 flakes per core in the upper MSA, 9.63 flakes per core in the "Large Blade levels, and 10.88 flakes per core were observed in the "Lower Fish" levels.

Returning to quartz(ite), the striking platforms (Table 16) displayed remarkable consistency from the upper MSA through the "Large Blade" transitional early LSA/MSA and into the early LSA "Lower Fish" levels. According to a number of researchers, striking platform morphology is one of the best indicators of overall flaking technology (Barham 1989; Bisson 1990; Flenniken 1981; Kobayashi 1975). The precentages for the various platform characteristics identified (Table 16) also generally corresponded to the precentages of core types in the three assemblages (Table 9). By experiment, I know that the various types of unilateral single platform (Bladelet, Blade, Single

Platform, Radial), as well as minimal cores, will often produce flakes with plain striking platforms. Unilateral cores account for 19.7% of the cores in the upper MSA assemblage and 63.3% of the flakes had simple or plain platforms. In the "Large Blade" assemblage 16.67% of the cores were of a unilateral type and 77.13% of the flakes have plain of single-facet platforms and in the "Lower Fish" assemblage 11.56% of the cores were unilateral and 74.66% of the flakes had plain or single-facet platforms.

Multiple platform cores produce some flakes with plain platforms, yet often result in dihedral or multi-facet forms. Multi-platform cores (including tortoise "Levallois" cores) constituted 13.16% of the upper MSA core assemblage and 17.07% flakes were dihedral or multi-facet. In the "Large Blade" core assemblage 11.71% of the cores were multi-platform and 8.74% of the flakes were simple or multi-facet and the "Lower Fish" assemblages contained 7.31% multi-platform cores and 11.8% of the flakes had dihedral or multi-facet platforms.

Bipolar cores and flat bladelet cores will often produce point facets or crushed platforms, however they may also produce plain, simple and multiple facets on the opposing ends. For this reason, the vast majority of the point facets were viewed as being produced by the bipolar method of reduction. In addition, replication experiments by L. Barham (1989) and the author, indicate that core reduced pieces were often the result of bipolar reduction.

In the upper MSA assemblages, the cores were 67.1% bipolar types and average 19.57% point facets on the flake platforms. The trend of high percentages of bipolar core forms continued in the "Large Blade" assemblage with 71.62% of the cores of a bipolar type. In these levels the flakes averaged 14.28% point facets and finally, in the "Lower Fish" assemblage, fully 81.11% of the cores were bipolar, flat bladelet cores or core reduced pieces. In these levels 13.51% of the flakes had point facets. The stratigraphic homogeneity of this variable was rather surprising and suggests that no major change in this basic technological tradition of quartz(ite) reduction occurred during the MSA/early LSA sequence at WPS.

A similar pattern of no apparent variation between levels was found with dorsal surface characteristics (Table 17), with complete cortical and partial cortical examples averaging 30.6% in the upper MSA levels (450-420 cm), 34.72% in the "Large Blade levels (420-300 cm) and 37.61% in the "Lower Fish" levels (300-200 cm). There did seem to be a slight trend toward more cortical examples with decreasing depth, but this was a subtle trend.

Dorsal scar patterns and relative thickness indices however, seem to indicate something quite different (Tables 18 and 19). Dorsal scar patterns, particularly the parallel and convergent patterns, clearly separated the three assemblages. Flakes with parallel dorsal flake scars averaged 5.27% in the upper MSA levels, 15.79% in the "Large

Blade, and 9.68% in the "Lower Fish" levels. I interpreted this as indicating an emphasis on the production of blades in the "Large Blade levels. Flakes with convergent dorsal scars also showed a clear trend with depth. Beginning in the upper MSA levels, 6.58% of the flakes possessed convergent dorsal scars, in the "Large Blade" levels, 3.91% of the flakes had convergent dorsal scars and in the "Lower Fish levels, flakes with convergent dorsal scars averaged 2.62%. I interpreted this as indicating an emphasis on the production of MSA points by the use of prepared cores in the upper MSA levels at WPS.

Opposed dorsal scar patterns are produced by bipolar reduction, but may also be produced by bilateral flaking as in the production or maintenance of unifacial or bifacial artifacts. Flakes with opposed dorsal scar patterns dominated all three assemblages, however some trends were discernable. In the upper MSA levels 56.33% of the flakes had opposed dorsal scar patterns. In the "Large Blade" levels this number dropped to 53.82% and in the "Lower Fish" levels the percentage rebounded to 65.92% of the quartz(ite) flakes having opposed dorsal scars. Perhaps this was a result of the production or maintenance of MSA points in the MSA assemblage.

Metric attributes among the quartz(ite) element of the three assemblages showed little variation with relative thickness averaging 31.97 mm in the upper MSA levels, 33.37 mm in the "Large Blade" levels and 33.02 mm in the "Lower

Fish" levels. I believe this was raw material related and will return to this issue later in my discussion of non-quartz lithic reduction. Of the miscellaneous discrete attributes, utilization showed a systematic pattern and increased with depth although there was a wide range of variation between levels (Appendix D). Fire cracking (evidenced by "pot lids") was very rare, but was present in small quantities (>1%) in the upper MSA levels of the site. This feature was almost totally absent from the "Large Blade" assemblage and then present again and actually concentrated in the "Lower Fish" levels of the site where it averaged about 2%. Although I cannot prove this, I would speculate that these attributes could relate to site use with less fire or less intensive fire use in the upper MSA and "Large Blade" levels of the site.

QUARTZ LITHIC REDUCTION AT WPS

When the results of the analysis of the quartz(ite) reduction sequence at WPS was combined with the analysis of the retouched tools, it was apparent that the quartz(ite) reduction sequence at WPS was rather uncomplicated and involved a minimum number of steps. Raw material was obtained locally from a nearby source and possibly tested to find cores with no obvious natural flaws. These cores were returned to the shelter and further tested prior to reduction and then reduced. This process produced large quantities of "angular waste" which was discarded. The

pieces that survived this initial reduction were then utilized as is or were retouched into tools. Homogeneous pieces could be further flaked, resulting in the production of cores. These were primarily unilateral or multi-platform forms, which when no further reduction was possible working from one or several platforms, a bipolar technique was employed until the cores were totally exhausted.

The products of the bilateral and multi-platform cores were whole flakes, broken flakes, and smaller angular fragments. The angular waste was certainly discarded, but the flakes could have been either utilized as is or retouched into backed flakes, scrapers, denticulates, notches or other tools. By experiment I know that the bipolar technique almost exclusively produces scaled pieces which would require no further retouch and could have been utilized as awls. However, experimental use studies (Flenniken 1981) and ethnographic observation (White 1968) do not support the assumption that bipolar cores were widely used as tools. Evidence of use, however, has been reported for core reduced pieces from Boomplass Cave in the southern Cape (Binneman 1982; Thackeray 1981) and further microwear studies could clarify this issue.

Unilateral cores produce whole flakes including quadrilateral long (blade) forms, broken flakes, as well as angular fragments. These could also have been retouched, utilized, or discarded as detailed above. The blades and bladelets were often selected for the production of

geometric forms of microliths (crescents or segments).

This reduction sequence involved a minimum number of steps and was employed to produce flake blanks with a minimum amount of retouch. Flaking of this material was a relatively high risk-low return activity. The more times a piece was struck to produce a tool, the greater the chance that it would break. However, even in this rather simple reduction sequence, individual variation was possible, particularly in the choice of flaking cores unifacially or from multiple platforms, as well as the use of bipolar techniques.

The analysis of the quartz debitage generally agreed with the results obtained with the cores and tools. That is, there is evidence of both technological continuity and change throughout the WPS sequence.

The utility of the quartz debitage analysis was quite evident when the results were compared with the non-quartz lithic assemblages from the site. The raw materials used for artifact production at WPS overall included an abundance of quartz(ite) (69.58% already discussed), silcrete (8.49%), and a number of other fine-grained rocks which were primarily chert (several varieties) (10.08%), chalcedony (2.84%), and jasper (2.8%).

A distinctive preference for imported raw materials was evident in the earlier upper MSA levels of the site (450-420 cm) and this trend continued into the "Large Blade" assemblage (420-300 cm). Of all lithic artifacts, excluding "angular waste", the percentages of quartz(ite) accounted for 51.89% in the upper MSA levels, 73.64% in the "Large Blade" levels between 420-300 cm (note that between 420-360 cm the percentage was 62.59%) and 78.64% in the "Lower Fish" levels between 300-200 cm.

Finally, it should be mentioned that although quartzite dominates the "Large Blade" assemblage quartz(ite), non-quartzite raw materials approached sub-equal frequencies in the debitage in the lowest "Large Blade" levels and the distinctive large blades were almost exclusively made of non-quartz raw materials (51 of 59 or 86.44%). In addition, although other formal tools were rare in the "Large Blade" levels, the majority of these were made of quartzite (Table 14).

Some of this variability apparent in the use of quartz(ite) and non-quartzite raw materials may be due to sampling error or idiosyncratic cultural preferences, but as will be discussed below, it is possible that some of this variability may also reflect change through time in the availability of different raw materials, particularly as influenced by exposure and resubmergence of the source areas under differing paleoclimatological conditions or changes in mobility patterns or exchange systems.

NON-QUARTZ TECHNOLOGY

The proportion of small flakes and chipping debris were very high in some levels of the WPS assemblages, while in others they were almost absent (see Table 8). In the levels where debitage was abundant per unit volume, this was interpreted as reflecting an increase in the importance of stone-working at the site during these periods (Table 20). Non-quartz complete cortical or partial cortical flakes were rare in the WPS assemblages averaging 1.66% (14 of 870) in the "Lower Fish", 1.85% (13 of 557) from the "Large Blade" and 3.69% (17 of 461) in the upper MSA levels. The totals for the dorsal surface conditions of the non-quartz flakes are combined with Quartz(ite) flakes in Table 17 above. I interpreted this as reflecting the almost complete absence of initial stone working of non-quartz raw material at the site.

It seems likely that most non-quartz raw materials were prepared as cores at the site of acquisition located outside the immediate vicinity of Tsodilo and that only successful efforts were brought to the site for further flake removals. The interpretation was consistent with the large numbers of cores at or near the point of exhaustion and the high flake/debris ratios for non-quartz material from the site discussed above. Moreover, the extent to which most of the cores were reduced during the manufacturing process was revealed by the presence of many flakes too large to be fitted to any of the cores in the collection. This was

Table 20 Lithic Debitage and Angular Waste Per Unit Volume (1 sq. m) For The "Lower Fish", "Large Blade" and Upper MSA Assemblages. Squares 10-12 and 19-23.

Depth	*QAW	QD	BCD	CHD	JAD	TBF	BLC	SD	MCD	OFGD	Total
"Lower Fish"											
200-210	6.5	17.8	1	0.3	0.5	0	0	3.3	1.5	1.4	32
210-220	6.9	32.1	1	0.3	0.8	0.1	0	3.8	3.3	1.9	50.25
220-230	7.3	33	1	0.4	0.4	0.1	0	2	2	2.9	48.63
230-240	12	74.5	1	1.6	0.9	0.6	0	3.5	3.8	1	98.13
240-250	20	94.8	2	2.4	1.1	0.6	0	3.4	5.3	2.4	132.3
250-260	20	95.3	2	2.1	1.5	0.5	0.8	4	6.8	5.3	137.6
260-270	11	42.7	1	1.3	1.1	0.6	0.3	1.7	5.4	1.4	66.4
270-280	7.9	30.9	0	0.6	1.1	0.1	0.1	1	5.4	1.7	49.28
280-290	3.1	21.7	0	0.9	0.4	0.1	0	0.4	2.4	1.6	31
290-300	11	18.6	1	0.3	0	0	0.1	0.6	1.9	0.6	34
"Large Blade"											
300-310	4.7	8.14	0	0.1	0	0.1	0	0.4	0.7	0.1	14.38
310-320	1.3	5.86	0	0	0	0	0	0.6	0.1	0.6	8.855
320-330	7.6	9.14	0	0.1	0.1	0	0	0.1	0	0.3	17.53
330-340	12	14.3	1	0.1	0	0	0	1.3	0.4	0.6	29.85
340-350	17	19.8	1	0	0	0	0	0.8	0.2	0.5	39
350-360	7.8	20	1	0.2	0.3	0.2	0	1	1.2	0.8	32
360-370	5.8	9.33	0	0.7	0.2	0	0	1.2	1.2	1	19.5
370-380	6.2	12.8	1	0.8	0.7	0	0.2	2	1.2	1.8	26.5
380-390	1.7	15.3	1	0	0.2	0.5	0	1.7	5.2	1.5	26.83
390-400	4.7	23.7	1	0.8	1	0.2	0.3	4.3	4.3	1.7	42.16
400-410	5	31.5	1	0.3	0.7	0.3	0	7	4.7	1.7	52
410-420	9	28.8	2	1.3	2.8	1.7	0.2	9.7	6	3.7	64.83
Upper MSA											
420-430	5.2	21.8	1	0.8	1.8	0.3	0	12	5.8	1.8	51
430-440	1.6	25.6	2	0.4	1.4	1.2	0	4.4	10	1.4	48.4
440-450	9.4	48.2	3	2.8	5.4	2	0	13	11	5.8	99.8

*QAW = Quartz Angular Waste
QD = Quartz Debitage
BCD = Brown Chert Debitage
CHD = Chalcedony Debitage
JAD = Jasper Debitage
TBF = Transparent w/ Black Flecks Debitage
BLC = Black Chert Debitage
SD = Silcrete Debitage
MCD = Multi-Color Chert Debitage
OFGD = Other Fine Grained Debitage

especially true for some of the core rejuvenation flakes that were struck from cores to regularize a platform for further flake removals. It appeared that the Late MSA/early LSA inhabitants of WPS took a good deal of care to set up cores from which a large number of flakes could be struck. This production strategy was particularly evident in a density per unit volume of radial cores and cores with one or more platforms prepared for parallel and sub-parallel flake or blade removals (Table 21 also see Table 10) (Figure 5.3). The emphasis on the removal of a large number of flakes from most cores was also reflected in the low frequency of non-quartz cores with obvious evidence of preparation for just one major flake removal. Prepared (tortoise) cores (also termed "Levallois" cores), were rare in the assemblages concerned, with only two recovered from "Large Blade" levels and four from the upper MSA levels (Figure 5.4). Below 450 cm, they were fairly common (24) but, like in the Upper MSA levels, they were usually in the most exhausted phase of reduction.

In addition, the proportion of convergent flakes which averaged 2.79% in the "Lower Fish" levels, 4.77% in the "Large Blade" levels and 10.39% in the upper MSA levels was consistent with a reduction strategy designed for multiple flake removals (Table 22). These convergent flakes are often considered characteristic of MSA assemblage and they are concentrated in the MSA levels at WPS. Furthermore, they were relatively uncommon in the Late MSA/early LSA

Table 21 Non-Quartz Core Totals Per Unit Volume (1 sq. m) For The "Lower Fish", "Large Blade" and Upper MSA Assemblages. Squares 10-12 and 19-23.

Depth	* SPC	R/D	LC	MPC	BLT	BL	CRP	Totals
"Lower Fish"								
200-210	0	0	0	0.3	0.3	0	0	0.6
210-220	0	0	0	0.8	0.1	0	0.1	1
220-230	0	0	0	0.6	0.8	0	0.6	2
230-240	0	0	0	0.8	1	0	0.4	2.2
240-250	0	0	0	1.9	0.5	0	0.5	2.9
250-260	0	0.1	0	1.1	1.3	0	1.3	3.8
260-270	0	0	0	0.6	1	0.1	0.1	1.8
270-280	0	0	0	0.3	0.3	0	0.4	1
280-290	0	0	0	0.3	0	0	0	0.3
290-300	0	0	0	0.1	0.1	0	0.4	0.6
"Large Blade"								
300-310	0	0	0	0.1	0.1	0.1	0	0.3
310-320	0	0	0	0	0	0.1	0	0.1
320-330	0	0	0	0	0	0	0	0
330-340	0	0	0	0.1	0.1	0	0	0.2
340-350	0	0	0	0	0	0	0	0
350-360	0	0	0	0	0	0.2	0	0.2
360-370	0	0	0	0.2	0	0	0	0.2
370-380	0	0	0	0.5	0	0.5	0	1
380-390	0	0	0.2	0.8	0.3	0	0.2	1.5
390-400	0	0	0	0.5	0.5	0.7	0.3	2
400-410	0.2	0	0	1	0	0.5	0.5	2.2
410-420	0	0	0.2	1	0.2	0	0.7	2.1
Upper MSA								
420-430	0	0.3	0.5	1.5	0.3	0.5	1	4.1
430-440	0	0	0.2	0.6	0.8	0	0	1.6
440-450	0	0.4	0	1.6	0.8	0.2	2.8	5.8

*SPC = Single Platform Cores
R/D = Radial/Disc Cores
LC = Levallois Cores
MPC = Multi-Platform Cores
BLT = Bladelet Cores
BL = Blade Cores
CRP = Core Reduced Pieces

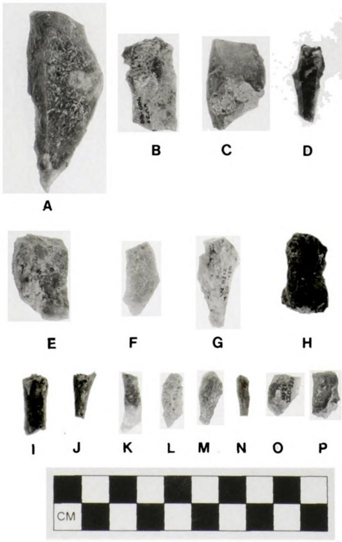


Figure 5.3 Non-Quartz Blade and Bladelet Cores. A-H, Blade Cores; I-N, Bladelet Cores; O-P, Flat Bladelet Cores.

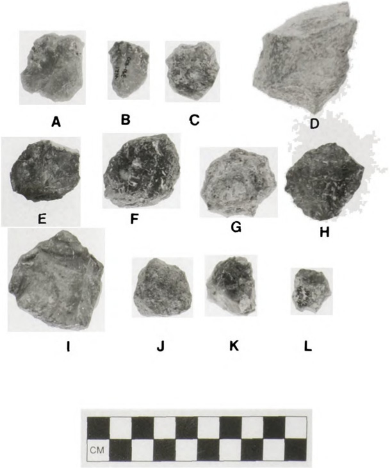


Figure 5.4 Non-Quartz Cores. A-B, Single Platform Cores; C-D, Radial/Disc Cores; E-H, "Tortoise" Prepared Cores; I-L, Multi-Platform Cores.

Table 22 WPS Non-Quartz Dorsal Scar Patterns For Flakes From the "Lower Fish", "Large Blade" and Upper MSA Assemblages.

Depth in cm	Sample Number	Para.	% of total	Con.	% of total	2 Dir. Irreg.	% of total	Radi.	% of total	1 Dir. Irreg.	% of total
"Lower Fish"											
200-210	62	31	50	1	1.61	30	48.4	0	0	0	0
210-220	90	13	14.4	2	2.22	63	70	0	0	12	13.33
220-230	67	25	37.31	3	4.48	18	26.9	0	0	21	31.34
230-240	95	45	47.37	3	3.16	30	31.6	0	0	17	17.89
240-250	139	24	17.27	4	2.88	94	67.6	0	0	17	12.23
250-260	182	61	33.52	5	2.75	50	27.5	6	3.2	60	32.97
260-270	90	55	61.11	2	2.22	26	28.9	0	0	7	7.78
270-280	74	21	28.38	2	2.7	19	25.7	0	0	32	43.24
280-290	43	0	0	1	2.33	39	90.7	0	0	3	6.98
290-300	28	6	21.43	1	3.57	4	14.3	0	0	17	60.71
"Large Blade"											
300-310	11	7	63.64	0	0	4	36.4	0	0	0	0
310-320	12	10	83.33	0	0	1	8.33	0	0	1	8.33
320-330	6	4	66.7	1	16.7	1	16.7	0	0	0	0
330-340	22	11	50	1	4.55	9	40.9	0	0	1	4.55
340-350	12	7	58.33	0	0	4	33.3	0	0	1	8.33
350-360	25	20	80	1	4	2	8	0	0	2	8
360-370	26	19	73.08	1	3.85	5	19.2	0	0	1	3.85
370-380	45	23	51.11	2	4.44	15	33.3	0	0	5	11.11
380-390	69	15	21.74	4	5.8	41	59.4	1	1.45	8	11.59
390-400	83	42	50.6	5	6.02	22	26.5	0	0	14	16.87
400-410	93	21	22.58	5	5.38	36	38.7	0	0	31	33.33
410-420	153	13	8.5	10	6.54	67	43.8	12	7.84	51	33.33
Upper MSA											
420-430	144	29	20.14	17	11.81	50	34.7	13	9.03	35	24.31
430-440	106	33	31.13	13	12.26	39	36.8	8	7.55	13	12.26
440-450	211	36	17.06	15	7.11	43	20.4	15	7.11	102	48.34

assemblages at WPS. As with the quartz assemblage, the orientation of dorsal scars were consistently recorded. It was apparent that certain non-quartz flakes resulted from the purposeful attempts at the production of triangular flakes with convergent dorsal scars in an attempt to produce points. These included 45 flakes with a triangular plan form and a dorsal ridge running to the distal tip from the upper MSA levels. These scars could either be from the proximal or the distal end of a central flake scar. In addition, broken pieces with a small portion of the distal tip missing were included if it appeared likely that they had originally conformed to these criteria. These broken pieces were fairly common and make up to one third of the simple point totals. The few pieces that were retouched and met the criteria presented above were also included.

Retouched points were fairly common in the upper MSA levels (420-450 cm), with a total count of 14 (Figure 5.5). All but a few of these were complete enough to allow length and width measurements, so a comparison of their contribution to the total count of measurable flakes gave a good indication of their relative frequencies in the MSA/LSA levels (Table 22). A rather clear three part division of the WPS sequence was indicated. Points were most common in levels between 420-450 cm (actually between 420-600 cm but, these are not included in this discussion) and were rare (3) in the levels between 300-420 cm, and non-existent in the 200-300 cm levels. This was also associated with the

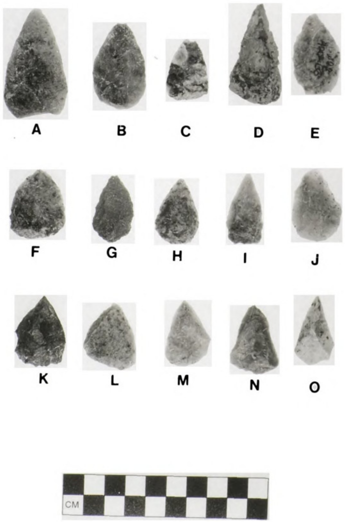


Figure 5.5 MSA Points. A-C, Bifaces; D-K, Unifaces; L-O, "Levallois" Points.

incidence of multiple faceting of platforms (Table 23). Multiple faceting was most common in the upper MSA levels (12.1%) followed closely by the "Large Blade" levels (10.03%) and relatively low proportions (6.84%) in the "Lower Fish" levels.

There were notable differences in the metrical variables between non-quartz and quartz flakes in the three assemblages in the length and relative thickness of the flakes (Table 24). The most apparent was the longer length and lower relative thickness indexes of the non-quartz artifacts compared with those made of quartz(ite) in the "Large Blade" and upper MSA assemblages. In the "Lower Fish" levels quartz(ite) flakes averaged 1.53 cm. in length with relative thickness ratios averaging 33.02, while non-quartz flakes from these same levels averaged a comparable 1.66 cm, with relative thickness ratios of 28.28. In the "Large Blade" levels, quartz(ite) flakes averaged 1.68 cm with relative thickness ratios of 33.37, while non-quartz flakes from these levels averaged 1.78 cm in length with relative thickness ratios of 25.43. In the upper MSA levels, quartz(ite) flakes averaged 1.70 cm in length and relative thickness ratios of 31.97 and non-quartzite flakes averaged 1.99 cm with relative thickness ratios of 27.99.

The "Large Blade" levels (300-420 cm) contained some of the largest flakes in the collection, with one level (360-370 cm) having non-quartz flakes averaging 2.47 cm in length and quartz(ite) flakes averaging 2.42 cm in length, but

Table 23 WPS Striking Platform Characteristics On Non-Quartz Flakes For The "Lower Fish", "Large Blade" and Upper MSA Assemblages.

Depth in cm	Sample Number	Plain	% of total	Simple Facet	% of total	Multi-Facet	% of total
"Lower Fish"							
200-210	62	45	72.6	15	24.2	2	3.2
210-220	90	65	72.2	22	24.4	3	3.3
220-230	67	46	68.7	18	26.9	3	4.5
230-240	95	66	69.5	25	26.3	4	4.2
240-250	139	83	59.7	47	33.8	9	6.5
250-260	182	109	59.9	62	34.1	11	6
260-270	90	54	60	28	31.1	8	8.9
270-280	74	44	59.5	23	31.1	7	9.5
280-290	43	26	60.5	12	27.9	5	11.6
290-300	28	17	60.7	8	28.6	3	10.7
"Large Blade"							
300-310	11	7	63.6	3	27.3	1	9.1
310-320	12	8	66.7	3	25	1	8.3
320-330	6	4	66.7	1	16.7	1	16.7
330-340	22	17	77.3	4	18.2	1	4.5
340-350	12	9	75	2	16.7	1	8.3
350-360	25	19	76	5	20	1	4
360-370	26	16	61.5	7	26.9	3	11.5
370-380	45	27	60	13	28.9	5	11.1
380-390	69	39	56.5	23	33.3	7	10.1
390-400	83	47	56.6	27	32.5	9	10.8
400-410	93	48	51.6	33	35.5	12	12.9
410-420	153	79	51.6	54	35.3	20	13.1
Upper MSA							
420-430	144	77	53.5	48	33.3	19	13.2
430-440	106	59	55.7	37	34.9	10	9.4
440-450	211	105	49.8	77	36.5	29	13.7

Table 24 WPS Relative Thickness Of Non-Quartz Flakes From The "Lower Fish", "Large Blade" and Upper MSA Assemblages.

Depth in cm	Sample Number	Mean Length	Mean Width	Mean Thickness	Relative * Thickness x 100
"Lower Fish"					
200-210	62	1.49	0.91	0.29	25.67
210-220	90	1.27	0.89	0.33	31.53
220-230	67	2.26	1.18	0.39	25.15
230-240	95	1.38	1.02	0.35	29.84
240-250	139	1.73	1.14	0.39	28.38
250-260	182	1.89	0.97	0.38	29.64
260-270	90	1.88	1.09	0.38	27.54
270-280	74	1.73	1.17	0.43	30.8
280-290	43	1.77	0.95	0.38	30.73
290-300	28	1.21	1.09	0.27	23.54
"Large Blade"					
300-310	11	1.35	1.43	0.4	28.8
310-320	12	1.81	2.03	0.45	23.51
320-330	6	1.9	2.1	0.5	25.06
330-340	22	1.86	1.41	0.47	29.3
340-350	12	1.64	1.29	0.38	26.31
350-360	25	1.18	1.05	0.38	34.2
360-370	26	2.47	1.49	0.43	23.13
370-380	45	1.93	1.37	0.44	27.46
380-390	59	1.85	1.28	0.44	29.08
390-400	83	1.55	1.36	0.41	28.3
400-410	93	1.79	1.33	0.43	28.18
410-420	153	2.06	1.42	0.42	24.98
Upper MSA					
420-430	144	1.8	1.38	0.42	26.88
430-440	106	2.09	1.62	0.5	27.39
440-450	211	2.08	1.62	0.53	29.1

* Relative Thickness was calculated using Beaumont's (1979a) Formula. $\dfrac{(\text{mean } T/\text{mean } L) + (\text{mean } T/\text{mean } W)}{2}$

there was only an average density per unit volume of 8.2 pieces of non-quartz debitage and 8.5 pieces of quartz(ite) per 10 cm level in one m square. This may indicate that not a great deal of lithic reduction was carried out at the site during this time (ca. 38-50,000 B.P.).

A comparison of the average weights between the quartz(ite) and non-quartz cores from the three assemblages found that the non-quartz cores were consistently smaller than the quartz(ite) forms. For example, a comparison of core weights between quartz(ite) and non-quartz multi-platform cores, one of the most frequent core categories, shows quartz(ite) multi-platform cores averaged 11.1 gm in the "Lower Fish" levels, 13.33 gm in the "Large Blade" levels and 18.45 gm in the Upper MSA levels. In the same assemblages, non-quartz multi-platform cores averaged 9.16 gm, 12.74 gm and 14.17 gm respectively. Clearly both quartz(ite) and non-quartzite cores were larger with depth, but non-quartz specimens were consistently smaller.

Another observation was that some of the non-quartzite cores were quite small, particularly the bladelet cores. In the "Lower Fish" levels the 41 bladelet cores averaged 1.1 gm, in the "Large Blade" levels the 8 bladelet cores again averaged 1.1 gm and in the upper MSA levels the 10 bladelet cores recovered averaged 0.83 gm. This strongly suggests that the MSA and early LSA inhabitants of WPS had some use for small bladelets which were smaller in size than the vast majority of the flakes that have secondary retouch. Thus,

the large numbers of small unretouched artifacts should not be regarded as mere by-products of tool manufacture. That is, I believe that some were produced intentionally for use in their own right, rather than as by-products resulting from the production or maintenance of larger tools. Whatever tasks for which these small pieces were employed, recognizable sign of utilization were not produced on their edges. The vast majority of the unretouched flakes at WPS lack definite evidence of utilization, however it seems doubtful that these flakes were all waste, but their uses remain unknown.

The flaking properties of the different raw materials were also evident in the WPS sequence. This was especially noticeable in the relative absence of elongated flakes (blades) produced with quartz(ite) as opposed to non-quartz raw materials, as 51 of 58 of the blades from the "Large Blade" levels were produced using non-quartz raw material (Figure 5.6). In addition, the relatively large amount of debris resulting from the knapping of quartzite, as compared with silcrete and other fine-grained rocks and the relatively low proportions of non-quartz flakes with cortex, as mentioned above, suggested that most initial core preparation of non-quartz raw materials took place outside the rock shelter, most likely at the site of acquisition.

I have already discussed the shift in the relative frequencies of the non-quartz(ite) raw materials beginning in the lower levels of the "Large Blade" assemblages and how

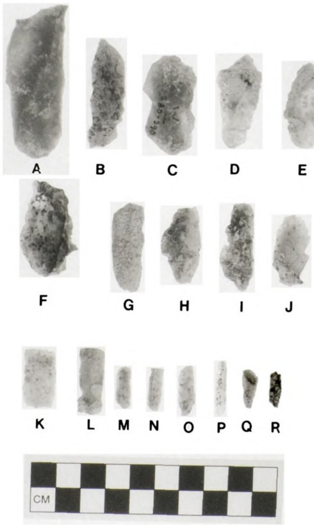


Figure 5.6 Blades and Bladelets from the "Large Blade" Levels. A-L, Blades; M-R, Bladelets.

this trend continued and intensified in the Upper MSA levels where non-quartz flakes made up roughly 48% of the debitage. I will return to this topic below.

It seems likely that the punched blade technique was employed for the production of many of the large flake blades at WPS. According to Volman "this technique was widespread in the southern Cape by the beginning of isotope stage 5" (ca. 128,000 B.P.) (Volman 1981:259). Volman noted that the use of the punch technique was apparent in the narrow thin striking platforms and diffuse bulbs of percussion on the elongated, thin blades (Volman 1981:259-260). Based on observation of these characteristics by Volman (1981) for a number of southern Cape MSA assemblages and Wymer and Singer (1982) for Klasies River Mouth MSA assemblages, these authors concluded that they reflected the use of an intermediate punch in their production. "The production of elongated blades with parallel and sub-parallel dorsal scars by means of indirect percussion seems a widespread feature of Upper Pleistocene MSA assemblages" (Volman 1981:260). Thus, it appears that this form of punched blade technique was already being used before the Howieson's Poort backed and truncated pieces appear and "that they represent another use for a blank type already in production and which continued to be made long after Howieson's Poort segments and allied forms were no longer produced" (Volman 1981:260).

The large blades (Figure 5.7) and backed tools

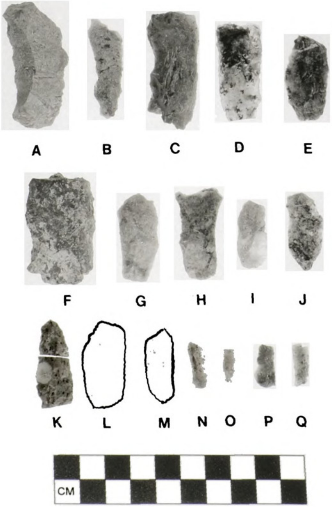


Figure 5.7 Blades and Bladelets from the Upper MSA Levels. A-M, Blades; N-Q, Bladelets.

including crescents(segments) (see Figure 5.9 A-B) in the WPS late MSA/early MSA, as with the southern Cape Howieson's Poort assemblages, were two to three times larger than those in the LSA assemblages. Since it is generally assumed that Howieson's Poort segments were the functional equivalents of segments in LSA assemblages, these artifacts may have been hafted. Although no mastic was observed on any of the segments or allied forms from WPS, mastic has been preserved on some LSA segments from southern Africa (H.J. Deacon, 1976). Since the late MSA/early LSA backed tools were generally much larger than their LSA counterparts, it is not clear if they were in fact hafted. However, this seems likely since a number of the WPS artifacts were retouched on their proximal ends which may have facilitated hafting.

If these backed tools were part of composite tools, then it seems that this innovation reflects a major technological advance. However, this interpretation has been challenged based upon the fact that Howieson's Poort assemblages "were temporally restricted and followed by a long period during which MSA peoples apparently got along perfectly well without small backed artifacts" (Volman 1981:264).

Singer and Wymer (1982) interpreted the Klasies River Mouth Howieson's Poort industry as being produced by an intrusive human population. Others, like J. Deacon (1979b:1) viewed the Howieson's Poort as representing a developmental stage in the MSA sequence. H.J. Deacon and J.

Deacon (1978, 1984) suggested that major changes in the LSA sequences were correlated with climatic changes which created new habitats and brought about change in human adaptations. Volman (1981) suggested a similar situation for the MSA, yet he noted "there is no necessary correlation between the extent of the changes in adaptation and stone artifacts" (Volman 1981:265-266).

In reference to WPS it appeared that similar changes to those observed in the southern Cape MSA and early LSA sequences occurred at roughly the same times at sites far to the north, indicating widespread changes in technology in response to regional environmental changes and possibly other factors. However, since these environmental changes were not the same everywhere, it seems likely that the observed temporal and technological variability in the southern African late MSA/early LSA sequences were not completely the result of a local adaptation. Furthermore, documented widespread gradual changes, for example the decrease in flake length during the LSA, can been viewed as changes in technology and reduction techniques stimulated by adjustments of local groups to the changing local environments.

There is not a great deal of theory about or ethnographic parallels for the explanation of technological change through time during the MSA and LSA of southern Africa. As a result, several assumptions had to be made. First, since WPS is a rock shelter and it is believed that

the occupants were remote ancestors of the modern San who are migratory hunter-gatherers, it is more than likely that WPS assemblages do not represent the full range of annual activities of the people who periodically occupied the site. Another assumption was that the assemblages of stone artifacts at WPS were only a small sample of the total numbers of artifacts made and discarded at the site and furthermore, were only a small fraction of the number of artifacts made during the lifetimes of the people who periodically inhabited the site. Finally, I assumed that the artifacts from certain stratigraphic units were broadly contemporary. However, I did not interpret them as all being made by the same group of people. That is, the assemblages were interpreted as cumulative products over many generations. Therefore, my observations will stress long term patterns of technological change during the late MSA and early LSA.

Another assumption concerned the function of the stone tools. Tools were undoubtably made for the food quest and the working of other materials such as bone, skins or wood. It is also implicit in my classification scheme that the formal tool classes were designed for specific tasks. Although I acknowledge that the tool classes could have been used for other tasks as well (Hayden 1977; O'Connel 1977; R.A. Gould 1980). However, it was apparent that certain design features were considered desirable for a range of tasks throughout the time periods under consideration.

Thus, a scraper was viewed as better suited for skin working than a blade or segment. In addition, as mentioned in Chapter III, microwear studies by Dr. Randolph Donahue of a sample of WPS artifact types, indicated a good association between morphometric tool classes and tool use, particularly between scraper retouch and skin polish; wood and meat polishes and blade tools; and impact damage and armatures like MSA points and backed points (Dr. Randolph Donahue personal communication and ms. in prep).

The primary aim of this analysis was to trace changes in stone tool technology and the ways in which tools were made and used. With this in mind, I assumed that formal retouched tools were designed for a limited range of activities which required the repetitive use of a well-designed and efficient tool. During the early LSA and perhaps during the Late MSA, these stone tools were standardized in size to fit into hafts which imposed size constraints on the artifacts. This led to the development of more standardized retouch techniques in order to shape the tools most efficiently.

Finally, I assumed that formal retouched tools were not designed for the full range of tasks performed at the site, however, they do provide a notion of patterned behavior. This is not to say that they can tell more about what people were doing at a particular site, but they do give a consistent record of design preferences and insight into stone tool technology.

RAW MATERIAL:

As I mentioned in the introduction, I believe that raw material frequencies reflect preferences of the tool-makers, the range of raw materials available in the vicinity of the site, and the distances travelled by some exotic materials. Thus, I assumed that changes in raw material frequencies through time should be a good indicator of changing preferences and availability, as well as distances traveled by the site inhabitants and the nature of exchange networks. R. A. Gould (1980) studied raw material usage in the Western Desert of Australia and proposed a series of rules which contributed to the quantity of raw material that is discarded at a living site. Gould (1980) suggested that deliberately quarried stone and stones with distinctive appearance were more likely to be transported to a living site than those that were more locally available. However, this pattern may not apply when sources of usable stone are located close to a living site. According to Gould, in these cases "the frequency of this raw material far outweighs that of other materials" (1980:124). Thus, according to Gould (1980), the frequency of raw materials at a site had as much to do with availability in the immediate vicinity and the area ranged by the group as with the properties of the stone.

Certainly the properties of the stone had some bearing on the use to which it was put, and the hardness will affect the amount of retouch necessary, as well as the pattern of damage to the edge during use. The flaking properties of some materials will result in the discard of proportionately more waste than others, and the initial size of the nodules in which the material was found has a bearing on the size of the artifacts produced. The choice of raw material can therefore have an affect on the performance of the tool as well as the quantity, size and shape of the tools and the debris produced during tool manufacture. I assumed that the tool makers were well aware of these factors and that at different times in the past they selected certain raw material for specific tasks.

In assessing the changes in relative proportions of raw materials at WPS I did not assume that each of the raw materials were available or could be procured with similar ease throughout the sequence. For example, it is argued that changes in environmental conditions (the periodic flooding of source areas like the Boteti river silcrete quarries) may have covered or exposed raw material sources at different times in the past. In this analysis emphasis was given to the significance of the variability at the site level, which was assumed to reflect changes in preferences and/or changes in territorial ranges through time. In this section on raw material, I will only discuss relative frequencies of raw materials. Later, I shall discuss the effects these choices have on the tools and the debris created.

Changes in raw material usage at WPS were clearly evident in the relative frequencies of fine-grained materials like chert, jasper, chalcedony and silcrete, when compared with the constant and for the most part dominating presence of quartz(ite) derived from the Tsodilo Hills themselves and even forming part of the roof and part of the walls of the shelter.

The data on raw material usage are summarized in Table 25. The dominance of quartz(ite) is apparent in the "Lower Fish" levels (200-300 cm) where 78.64% of the debitage (excluding angular waste) is composed of quartz(ite) and in the "Large Blade" assemblage (300-420 cm) where quartz(ite) accounted for 73.64% of all debitage. However, quartz(ite) debitage dropped to 62.59% between 360-420 cm in the lower levels of the "Large Blade" assemblage and in the upper MSA levels (420-450 cm) quartz(ite) only averaged 51.89%. The dominance of quartzite was undoubtedly due to its easy availability and confirms Gould's (1980) observations concerning local sources of raw material near a base-camp where the ease of procurement will outweigh other factors. These factors make the relatively high frequencies of non-quartz raw materials in the lower levels of the "Large Blade" assemblage and the upper MSA assemblages all the more interesting. Particularly in view of the fact that quartzite was constantly available. I believe the reason for this was the deliberate selection of finer-grained materials or those with larger initial core sizes for the manufacture of a particular range of stone tools.

Table 25 Debitage (Excluding Quartz(ite) Angular Waste) From Squares 10-29. Note that squares excavated to different depths.

Depth in cm	*QD	BCD	CHD	JAD	TWBF	BL	SD	MCCD	OFGD	Total	%QTZ
0-10	185	10	7	6	1	0	4	8	9	230	0.8
10-20	209	1	1	10	1	0	6	5	11	244	0.86
20-30	392	4	4	25	0	0	11	19	26	481	0.81
30-40	551	7	8	18	2	1	8	16	40	651	0.85
40-50	662	11	6	24	0	1	16	30	39	789	0.84
50-60	577	32	17	20	3	0	17	31	33	730	0.79
60-70	594	34	15	30	1	1	26	20	44	765	0.78
70-80	764	39	31	30	6	3	27	45	43	988	0.77
80-90	567	36	16	24	2	0	28	51	30	754	0.75
90-100	491	31	16	28	4	1	29	43	44	687	0.71
100-110	568	52	29	29	7	3	89	68	105	950	0.6
110-120	573	50	33	46	8	4	111	109	130	1064	0.54
120-130	529	59	37	45	5	2	113	114	141	1045	0.51
130-140	316	14	5	17	1	1	35	40	36	465	0.68
140-150	280	14	4	12	7	0	28	18	15	378	0.74
150-160	110	14	5	14	1	1	21	21	26	213	0.52
160-170	126	10	5	7	0	0	28	12	24	212	0.59
170-180	212	25	14	12	4	0	63	40	21	391	0.54
180-190	182	16	6	9	1	4	103	19	24	364	0.5
190-200	159	12	6	6	4	0	46	12	12	257	0.62
"Lower Fish"											
200-210	142	7	2	4	0	0	26	12	11	204	0.7
210-220	257	10	2	6	1	0	30	26	15	347	0.74
220-230	264	5	3	3	1	0	16	16	23	331	0.8
230-240	596	4	13	7	5	0	28	30	8	691	0.86
240-250	758	18	19	9	5	0	27	42	19	897	0.85
250-260	762	15	17	12	4	6	32	54	42	944	0.81
260-270	299	7	9	8	4	2	12	38	10	389	0.77
270-280	216	3	4	8	1	1	7	38	12	290	0.74
280-290	152	2	6	3	1	0	3	17	11	195	0.78
290-300	130	4	2	0	0	1	4	13	4	158	0.82
"Large Blade"											
300-310	57	0	1	0	1	0	3	5	1	68	0.84
310-320	41	3	0	0	0	0	4	1	4	53	0.77
320-330	64	1	1	1	0	0	1	0	2	70	0.91
330-340	100	5	1	0	0	0	9	3	4	122	0.82
340-350	119	3	0	0	0	0	5	1	3	131	0.91
350-360	120	3	1	2	1	0	6	7	5	145	0.83
360-370	56	1	4	1	0	0	7	7	6	82	0.68
370-380	77	5	5	4	0	1	12	7	11	122	0.63
380-390	92	5	0	1	3	0	10	31	9	151	0.61
390-400	142	7	5	6	1	2	26	26	10	225	0.63
400-410	189	5	2	4	2	0	42	28	10	282	0.67
410-420	173	10	8	17	1	1	58	36	22	326	0.53
Upper MSA											
420-430	131	8	5	11	2	0	72	35	11	275	0.48
430-440	128	12	2	7	6	0	22	50	7	234	0.55
440-450	241	13	14	27	10	0	63	55	29	452	0.53

Table 25 cont. Debitage (Excluding Quartz(ite) Angular Waste From Squares 10-29. Note that squares excavated to different depths.

Depth	*QD	BCD	CHD	JAD	TWBF	BLC	SD	MCCD	OFGD	Totals	% QTZ
450-460	139	15	6	9	6	1	52	37	34	299	0.4649
460-470	137	13	6	10	7	0	73	51	41	338	0.4053
470-480	160	7	19	15	7	0	83	57	44	392	0.4082
480-490	112	13	20	23	8	0	84	78	27	365	0.3068
490-500	95	8	13	9	4	0	55	42	36	262	0.3626
500-510	70	6	12	6	1	2	53	32	26	208	0.3365
510-520	46	4	8	7	2	0	37	25	28	157	0.293
520-530	71	7	22	17	8	0	80	29	30	264	0.2689
530-540	76	11	18	12	8	0	71	35	35	266	0.2857
540-550	58	17	26	16	7	3	80	34	46	287	0.2021
550-560	43	16	13	8	3	0	47	35	20	185	0.2324
560-570	87	18	9	18	3	0	64	30	41	270	0.3222
570-580	50	6	0	9	3	0	41	15	24	148	0.3378
580-590	85	7	2	5	0	0	26	10	15	150	0.5667
590-600	49	9	1	4	1	0	30	5	7	106	0.4623
600-610	46	3	1	4	0	0	10	0	10	74	0.6216
610-620	55	3	3	3	0	0	16	7	23	110	0.5
620-630	22	1	0	2	3	0	7	6	7	48	0.4583
630-640	27	0	1	1	1	0	4	0	0	34	0.7941
640-650	22	0	0	0	0	0	1	4	4	31	0.7097
650-660	43	4	5	4	0	0	3	4	9	72	0.5972
660-670	33	2	2	3	0	0	12	4	7	63	0.5238
670-680	35	3	0	6	3	0	8	12	1	68	0.5147
680-690	12	0	0	8	0	0	10	4	12	46	0.2609
690-700	9	1	5	2	0	0	3	16	0	36	0.25
Totals:	14895	801	583	754	182	42	2284	1870	1669	23080	

*QD=Quartz Debitage
BCD=Brown Chert Debitage
CHD=Chalcedony Debitage
JAD=Jasper Debitage
TWBF=Transparent w/ Black Flecks Debitage
BLC=Black Chert Debitage
SD=Silcrete Debitage
MCCD=Multi-Color Chert Debitage
OFGD=Other Fine Grained Debitage

Chert, chalcedony, jasper and silcrete occurred in relatively small quantities in all units except the lower levels of the "Large Blade" assemblage and the upper MSA assemblages. In these levels (360-420 cm) silcrete accounted for 11.54% of the assemblages and in the upper MSA levels (420-450 cm) silcrete averaged 16.51%. The rarity of silcrete in the "Lower Fish" levels, where silcrete averaged 4.62% of the assemblage, may imply that an important source was covered by rising lake levels and renewed river activity. As will be discussed below and again in Chapter VIII, the primary known sources of silcrete are within pans and river channels. Or, these raw material sources may have been seasonally covered in the rivers and perhaps silcrete was obtained during the "dry season" when rivers were low, even though the climate was wetter than today. In addition, these changing frequencies could reflect the establishment or discontinuance of exchange networks with people who had access to the sources of the exotic materials. Another possibility which I will discuss in further detail below is the possibility that changes in "home ranges" occurred coupled with changes in the distances people traveled due to changing climatic conditions. Chalcedony was consistently in use throughout the WPS sequence, albeit in small quantities. It can be found in small nodules in the areas west of the Tsodilo Hills as we observed it in borehole tailings in 1996, but it was buried. Perhaps it was not buried in the past.

The extent to which quartz(ite) and non-quartz raw materials were used for formal tool manufacture are contrasted against their frequency in the debitage categories is presented above in Table 13. As already discussed, this demonstrated that exotic raw materials were consistently selected for the production of formal tools, whereas quartz(ite) was consistently more common in the waste or debitage categories. There was another interesting contrast in the percentage frequencies of quartz(ite) versus other raw materials and that was that one replaced the other in the upper MSA levels and there was an even greater selection of chert and silcrete for formal tools in the earlier assemblages.

Certainly a greater amount of effort was involved in obtaining silcrete as this was supported by the fact that it only accounts for 9.9% of the total sample from WPS. Only in the MSA levels (below 420 cm) was quartz(ite) second in importance to imported raw materials within the debitage categories. The high frequencies and the fact that silcrete and other fine grained rocks were highly selected for retouched tools manufacture (67.56% of the retouched tools and 65.16% of the blade(lets) were produced on non-quartz raw materials), indicated that they were deliberately sought and exchanged or transported from source areas, some of which were located significant distances from the site.

The major changes observed in raw materials in the WPS sequence were the relatively high incidence of chert, silcrete and other fine-grained raw material in the lower levels of the "Large Blade" and the upper MSA assemblages (below 360 cm) ca. 43-50,000 B.P. and these raw materials subsequent replacement by quartz(ite) in the Late Pleistocene levels (200-360 cm) ca. 30-43,000 B.P., although non-quartz raw materials were still favored for formal retouched tools. I interpreted these results as indicating a shift linked to the smaller initial size of nodules of chert, chalcedony and jasper and the superior quality of these raw materials for the manufacture of formally retouched microlithic tools in the early LSA. In a similar way I interpreted the preference for silcrete and chert in the upper MSA levels and the "Large Blade" assemblages as due to these raw materials larger initial nodule size and the production of larger formal tools. Thus, it seemed likely that these changes in raw material usage at WPS were the result of a deliberate choice on the part of the tool makers and therefore assumed some cultural significance.

In the three assemblages under consideration, chalcedony, chert and jasper combined exceeded 15% of the assemblages in the "Lower Fish" units where they account for 15.41% of the debitage; in the "Large Blade" levels these raw materials represented 20.05% of the debitage; and in the upper MSA levels they accounted for 30.09% of the debitage. The timing of this higher incidence in the "Lower Fish" levels in the late Pleistocene was correlated with the production of microlithic backed tools and bladelets from

bladelet cores. In the "Large Blade" assemblage these raw materials were associated with the production of blades from blade cores, and in the upper MSA deposits they were correlated with prepared "tortoise" and blade cores and the production of MSA points and flake blades. Although the sources or distances to the sources of many of these raw materials are currently unknown, it appeared that there was an early development of extensive trade or exchange networks of lithic raw material in the MSA which continued with less emphasis during more recent times. Another possibility is that the early LSA inhabitants may have occupied the site longer which indirectly caused them to increasingly use local raw material out of necessity, while the earlier people came in larger groups and brought the raw material with them, yet stayed for shorter periods, thus using less of the local raw material. I will return to this issue in Chapter VII.

It was clearly evident that the three lithic assemblages under consideration demonstrated changes in raw material preferences through time, although there were notable continuities between the three assemblages. With the exception of the upper MSA, each was dominated by the most readily available raw material. Quartz(ite) dominated the waste category in the "Large Blade" and "Lower Fish" assemblages, while the raw materials that came from greater distances were more common in the formal tool categories (Table 14). This was also true for the other Tsodilo sites of Rhino Cave and Depression (Robbins 1990, Robbins et al. 1996). There was also a clear tendency for raw materials that produce larger flakes (silcrete and chert) for the upper MSA assemblages and "Large Blade" to occur most commonly in units dating between 69-38,000 B.P., while the smaller nodules of fine grained materials like jasper and chalcedony were more abundant in the late Pleistocene "Lower Fish" levels dating to 38-30,000 B.P..

There was some correspondence between the incidence of particular raw materials and the incidence of formal tools (Tables 13 and 14), and it appeared that certain raw materials were preferred for some formal tool classes although not exclusively. There also appeared to be additional parallels between raw material and the flaking technique used to produce artifacts, but not between the abundance of any particular raw material and a specific formally retouched or utilized tool class. Several reasons may account for changes in raw material usage. These could include: changes in the size or location of the territory covered by a particular group of people who occupied the site at various times; the covering or exposure of raw material sources due to environmental changes and the deliberate selection of a material for its specific properties and finally, the development of exchange networks that link together previously separated peoples and raw material sources. I will return to and elaborate on these issues in Chapter VII.

NON-QUARTZ REDUCTION

The attributes and relative frequencies of debitage and core categories were analyzed to explore variability and changes in reduction techniques and to correlate shifts in raw materials and reduction techniques at WPS through time. It was expected that shifts through time in the choice of raw materials in the three assemblages ("Lower Fish", "Large Blade" and upper MSA) were the result of deliberate changes in the toolmaking techniques and if this was the case, we should find some covariation in the choice of raw material and the relative frequencies of core types and the nature of the flaking debris. In addition, there should be changes in the size and shape of the flakes in the three assemblages. Thus, the emphasis here was on the nature of these changes, on the correlation of the variables and on the timing of the shifts in relative frequencies and metric attributes through time at WPS.

The methods chosen for lithic reduction, which may have been influenced by the range of raw materials available, as well as by the range of methods known to the tool makers are believed to be detectable in the range and frequency of core types and sizes of flakes, platform condition and dorsal scar patterns in the three assemblages. The details of size, relative thickness and dorsal scar patterns in the non-quartz assemblages have already been discussed and will be only generally referred to below. It has been noted by some researchers (Barham 1987; J.D. Clark 1974; J.Deacon

1984; Hayden 1979; R.A. Gould 1980) that there is a minimal relationship between final core shape and the size and shape of the flakes struck from it. These researchers noted that flakes with facetted striking platforms may be struck as often from unprepared cores as from prepared ones of the "Levallois" type. The main differences noted by Clark (1974), J.Deacon 1984, Hayden (1979) and Gould (1980) were between blade and bladelet types and other types of cores. They also discussed the incidence of core reduced pieces (pieces esquillees) as another indicator of a distinctive reduction technique. Therefore, in this analysis blade and bladelet cores were treated as distinct from other core types and radial cores and tortoise ("Levallois") prepared cores were recognized as separate core types in my consideration of the non-quartz assemblages from WPS (see Figures 5.3 and 5.4).

The non-quartz core class frequencies were summarized in Tables 10 and 21. What was apparent was that multi-platform and bladelet cores together accounted for 73.6% of the cores in the "Lower Fish" levels. The most obvious shift in core classes occurred among the blade cores which accounted for 21.67% in the "Large Blade" levels and only 1.6% of the "Lower Fish" levels. In addition, the notable presence of tortoise ("Levallois") cores only in the lower levels (below 380 cm) of the "Large Blade" and upper MSA assemblages. It was clear that these shifts corresponded broadly with the increased incidence of non-quartz raw materials and with the incidence of blades, as well as the association of certain raw materials (silcrete and chert) and blade cores. Raw material appeared to have a close relationship to the incidence of bladelets, as can be seen in (Table 14), which presented the percentages of tools and raw material types. The data indicated that for bladelet production, that it was not one specific raw material that was selected, but several, the most important being chert, chalcedony, silcrete and crystal quartz, depending on the level.

I believe that it was logical to assume that blade cores were the primary means by which blades were produced and thus when both blades and blade cores were recovered, a close correspondence between the frequency of blade cores and the frequency of blades was expected. This assumption was clearly supported in the "Large Blade" levels (Tables 10, 14, 21). It was also apparent that different reduction techniques were emphasized in the "Lower Fish" levels than in the "Large Blade" levels. In the "Lower Fish" levels 32.8% of the cores were microlithic bladelet cores, while the "Large Blade" levels only contained 13.3% and the upper MSA levels had 16.1% bladelet cores.

As was the case with cores, it was the incidence of non-quartzite elements which signaled change in the sequence and this was also supported by size ranges of flakes. All complete untrimmed flakes from each level were measured for the variables of length, width, and thickness. Relative thickness indices, dorsal surface characteristics, dorsal scar patterns, and striking platform characteristics were also recorded. This analysis was identical to that performed for the quartz(ite) assemblage. The method for measurement was detailed above in the quartz(ite) section. The data are summarized in Tables 17, 22, 23, 24. These data indicated a clear trend toward longer flakes with increasing depth. In the "Lower Fish" levels, flakes averaged 1.66 cm; in the "Large Blade" levels flakes averaged 1.78 cm; and this trend continued into the upper MSA levels where flakes average 1.99 cm. The "Large Blade" assemblage flakes were comparatively thin and narrow and thus more "blade-like" than those in the overlying levels, as indicated by relative thickness values averaging 28.28 in the "Upper Fish" levels, 27.36 in the "Large Blade" levels and an intermediate 27.79 average value for the upper MSA levels.

There was also some indication that changes in core types and the nature of the lithic reduction debris were related to changes in the size and shape of the flakes produced. This was seen in the incidence of blade cores and the mean length of all untrimmed flakes (Tables 10, 21 and 24), with the shorter flakes occurring in samples where bladelet cores were relatively common (ie. the "Lower Fish" levels).

Clear trends were also evident in dorsal scar patterns from the three assemblages and these are summarized in

Table 22. What was very interesting was that the percentages of flakes with parallel dorsal scars peaked in the "Large Blade" levels. The percentage of flakes with parallel dorsal scar patterns averaged 37.44% in the "Lower Fish" levels, 47.16% in the "Large Blade" levels and 22.78% in the upper MSA levels. This clearly highlights the emphasis on blade production in the "Large Blade" levels. Another interesting pattern was evident in the percentages of convergent flakes from the three assemblages. Beginning with the "Lower Fish" assemblage flakes with convergent dorsal scars averaged 2.79%, the percentage rose to 4.77% in the "Large Blade" assemblage and peaked in the upper MSA assemblage at 10.39%. This is interpreted as indicating an increased emphasis placed upon the use of prepared cores in the lower levels of the "Large Blade" assemblage and even more emphasis on this reduction technique in the upper MSA levels.

Striking platform characteristics also showed some definite trends. These are summarized in Table 23. In general, these trends indicated decreasing average percentages of flakes with plain striking platforms from 64.33% in the "Lower Fish" assemblage, to 63.59% in the "Large Blade assemblage, and 53% in the upper MSA assemblage. This was mirrored by an increase with depth for flakes with multi-faceted platforms ranging from averages of 6.84% in the "Lower Fish" assemblages, 10.03% in the "Large Blade" assemblages, to a high of 12.1% in the upper MSA assemblages. This appears to coincide with the incidence of tortoise ("Levallois") cores in the lower depths of the "Large Blade" levels and concentrated in the upper MSA levels.

Another interesting calculation was that of the number of flakes per core in the three assemblages. In the "Lower Fish" assemblage 6.96 flakes per core were recovered, in the "Large Blade" assemblage 9.12 flakes per core were represented and in the upper MSA assemblage 7.44 flakes per core were recovered. Thus, the numbers of flakes per core were highest in the "Large Blade" levels and cores from this assemblage were the largest of the three assemblages examined averaging 8.14 gms per core. In comparison, the "Lower Fish" assemblage cores averaged 6.37 gms per core and in the upper MSA assemblage they averaged 8.1 gms per core. This is interpreted as indicating that stone workers during the "Large Blade" period were able to get more flakes per core, but may have had larger cores to begin with. In addition, the average weight of the upper MSA cores was nearly identical to the "Large Blade" levels, yet fewer flakes were produced. Perhaps the prepared core technique in evidence in these levels was less efficient in the use of raw material than the blade production in use in the more recent periods or perhaps more of the flakes were used and lost elsewhere assuming that the desirable raw material was at a premium.

Analysis of the variability within the debitage and core categories for non-quartz raw materials indicated both continuity and change within the WPS assemblages. The changes in reduction techniques coincided with changes in the choice of raw materials, potentially suggesting some functional link. Figure 5.8 demonstrates the relationships in the timing of these changes with the incidence of retouched tools, blades and blade cores, bladelets and bladelet cores and the mean length of unretouched flakes, timing of raw material changes, and the proposed ages and environmental changes.

Even though the actual frequencies per unit volume vary considerably between levels and assemblages, general trends through time were apparent. This assisted in formulating some generalizations about both continuity and change through time in lithic reduction techniques between 70,000 B.P. and 30,000 B.P. at WPS, and perhaps more broadly to the interior regions of southern Africa. Beginning with the oldest assemblage, the upper MSA levels (450-420 cm) dated to roughly 69-50,000 B.P., non-quartz raw materials were in near equilibrium with quartz(ite). These levels had diagnostic MSA points and prepared tortoise ("Levallois") cores. Blades and blade cores were also recovered in these levels indicating continuity with the overlying "Large Blade" levels. The unretouched flakes were relatively long, but they were wider and less blade-like with decreasing depth than those in the more recent assemblages.

The period between ca. 50-43,000 B.P. (420-360 cm)

Depth	Lithic Changes	Climate	Proposed Ages	Lithic Assemblages
200-300 cm	bladelets bladelet cores microlithic tools shortest mean flake length quartz(ite) dominates	Wet	30,000-38,000 B.P.	"Lower Fish" early LSA
300-350 cm 350-420 cm	large blades blade cores large backed tools longest mean flake length 300-350 cm quartz(ite) dominates 350-420 cm. increasing % of non-local raw materials	Dry Wet	38,000-43,000 B.P. 43,000-50,000 B.P.	"Large Blade" transitional MSA/early LSA
420-450 cm	MSA points prepared tortoise cores large blades intermediate mean flake length quartz(ite) and non-local raw materials near equilibrium	Dry	50,000-69,000 B.P.	Upper MSA

Figure 5.8 The relationship in the timing of changes in the incidence of retouched tools, blades and blade cores, bladelets and bladelet cores, raw material, mean flake length and environmental situation in the region.

continued the trend noted in the upper MSA levels with relatively high incidences of non-quartzite raw materials (chalcedony, chert, jasper and silcrete) and the flakes become progressively longer, narrower and more "blade-like" and there were a number of associated blade cores. The period between ca. 43-38,000 B.P (360-300 cm) continued the trend of large blades produced on exotic raw materials. However, raw material percentages represented in the debitage was dominated by quartz(ite).

The most recent period dating to ca. 30-38,000 B.P. (300-200 cm) was characterized by a shift to a high incidence of bladelet cores which were often made on exotic raw materials but crystal quartz forms also occurred. This assemblage was associated with the predominance of bladelets, of which only a small proportion were retouched.

These early LSA "Lower Fish" levels (300-200 cm) had a general reduction in the length, width and thickness of flakes through time, however flakes of blade and bladelet proportions continued to be produced. These factors indicate that the reduction technique used between 38-30,000 B.P. was geared toward more local raw materials and a more intensive use of nodules of raw material that result in fewer formal cores, smaller flakes and a higher incidence of angular waste. This could be partly correlated with the use of locally available quartz(ite) during this period of time and with different mobility patterns or changes in exchange networks. I will return to these topics in Chapter VII.

However, theoretically the inhabitants of WPS may have preferred to work chert or silcrete, but used what was available and easy to obtain. The fact that this pattern was associated with a lower proportion of formal tools as compared to debitage, may indicate that retouching after flakes were struck had replaced the more careful core preparation techniques that seem to have been the preferred technique in the upper MSA and "Large Blade" assemblages. This may be tied into the production of composite tools and the production of standardized geometrics, crescents or segments in a microlithic mode in the early LSA.

In order to further test the interpretation of changing reduction techniques through time at WPS, I again utilized relative thickness indexes advocated by Beaumont (1978) as being the most sensitive to changes in reduction techniques through time (Table 24). This analysis indicated that in the non-quartz assemblages, the highest relative thickness ratios occurred in the early LSA "Lower Fish" assemblages where they averaged 28.28 and the lowest relative thickness ratios occurred in the transitional early LSA/MSA "Large Blade" assemblage where they averaged 27.36, and the upper MSA assemblage fell in between and averaged 27.79. In the quartz(ite) assemblages, the highest relative thickness ratios occurred in the "Large Blade" assemblage where they averaged 33.37, followed by the "Lower Fish" assemblage where they averaged 33.02 and the lowest relative thickness ratios occurred in the upper MSA assemblage where they averaged 31.97.

When the WPS assemblages were compared to Beaumont's (1978) for the MSA and early LSA samples of Border Cave, no definitive fit was apparent. Beaumont's (1978) observations indicated progressively lower relative thickness ratios with decreasing time. The WPS quartz(ite) assemblages however, appeared to oscillate with the oldest upper MSA levels having comparatively low relative thickness ratios. The "Large Blade" and the "Lower Fish" assemblage did fit Beaumont's (1978) observations with decreasing relative thickness ratios through time. As discussed above, it appeared that overall, there was a great deal of continuity between the three assemblages in quartz(ite) reduction.

In the non-quartz elements of the lithic assemblages a reduction in relative thickness indices was apparent between the upper MSA and the "Large Blade" assemblages which fits Beaumont's (1978) scenario, but the "Lower Fish" assemblage reversed this trend. It appears that in the non-quartz assemblages a great deal of consistency in reduction techniques was indicated between the upper MSA and the "Large Blade" assemblages. Based upon these results the relative thickness indices proved quite valuable. They indicated no real changes in quartz reduction strategies through time at WPS and clearly indicated similar reduction strategies in the non-quartz raw materials between the upper MSA and the "Large Blade" assemblages where non-quartz raw materials predominate and they also support a different reduction strategy being employed in the "Lower Fish" assemblage.

When relative thickness indices of quartz(ite) and non-quartz raw materials were compared, it was apparent to the analyst that the relative thickness of the flakes was closely related to limits associated with the raw materials. Quartz(ite) flakes tended to have the highest relative thickness ratios throughout the sequence and non-quartz raw materials were consistently the lowest. This seems to indicate that the type of raw material utilized played as much a factor as the reduction technique on the size and shape of the flakes produced. Finally, particular raw materials were apparently selected for particular reduction techniques.

RETOUCHED TOOLS

Formally retouched tools were recovered far less often compared to debitage, however, they provided important information on technological changes and patterned behavior on a measurable scale. The fact that the percentages of retouched tools compared to debitage were low is consistent with findings at many other LSA/MSA sites in Africa. The formal tool classes recognized at WPS were defined in Chapter III and include crescents, backed bladelets, end scrapers, side scrapers, unifacial and bifacial points, drills, notches, burins, denticulates, awls, combination tools, and miscellaneous retouched pieces (Figure3.2).

As mentioned above, non-quartz raw materials appeared to be selected for the manufacture of formal tools (Tables 13 and 14). Therefore, the range of raw materials selected and the flaking method used accounted in part for the shape and size of the formal tools.

Throughout the sequence at WPS, it appeared that the flaking method used when formal tools were being produced was directed toward the production of standardized flakes that could be modified into formal tools with a minimum of retouch. There also appears to be an analogous parallel between the range of cores and the size of flakes and formal retouched tool in the three assemblages examined in detail. In addition, there was a slight correspondence between the length of unretouched flakes and scrapers and points. If blades and bladelets were included, which were not generally retouched, then a resulting parallel exist between flake length and blade length.

The attributes measured for formal tools were presented in Chapter III and descriptive statistics for each are summarized in Appendix A. A fairly high frequency per unit volume of formal tools were recovered in both the upper MSA (450-420 cm) and the "Lower Fish" (300-200 cm) at WPS in comparison to the "Large Blade" levels (420-300 cm) (Table 26). In the "Lower Fish" levels, the formal tools were not only more numerous, they were reduced in size and also highly standardized in their metric attributes (Appendix A).

Table 26 WPS Tool Totals Per Unit Volume (1 sq. m) For The "Lower Fish", "Large Blade" and Upper MSA Assemblages. Squares 10-12 and 19-23.

Depth	*BLT	BL	BB	CR	BP	PT	SS	ES	DE	NO	BE	BU	AL	DR	CT	MR	Totals:
"Lower Fish"																	
200-210	1	0.3	0	0	0	0	0.1	0	0	0	0	0.4	0.1	0.1	0	0	2
210-220	1.9	0.4	0.1	0	0.1	0	0.1	0.3	0	0	0	0.3	0.3	0	0	0.1	3.5
220-230	1.4	0.6	0	0.3	0	0	0.5	0	0.1	0	0	0.5	0.5	0	0.4	0.4	4.625
230-240	4.6	0.8	0	0.3	0.3	0	0.1	0	0	0.1	0	0.6	1	0.1	0.1	0.4	8.375
240-250	5.5	1.5	0.5	0	0.1	0	1.1	0.3	0	0	0	1.9	2.6	0	0.3	0.4	14.125
250-260	5	1	0.4	0.4	0.9	0	0.4	0.3	0.1	0	0.1	3.8	3.4	0	0.4	0	16
260-270	4	0.4	0.3	0.1	0.3	0	0.4	0.4	0	0.1	0.4	2.9	2	0	0	0.7	12.085
270-280	1.9	0.6	0.1	0.4	0.1	0	0.1	0.1	0	0	0.1	2.6	1	0	0.3	0	7.23
280-290	1.6	0	0	0	0.4	0	0.4	0.3	0	0	0.1	1.1	1.4	0	0	0.1	5.43
290-300	0.7	0.6	0	0	0	0	0	0	0	0	0	1.4	2.4	0	0	0.1	5.22
"Large Blade"																	
300-310	0.1	0.1	0	0.1	0	0	0	0.1	0	0	0	1.1	0.1	0	0	0	1.68
310-320	0	0.1	0.1	0	0.3	0	0	0	0	0	0	0.4	0	0	0	0	0.9
320-330	0.3	0	0	0	0	0	0.1	0.4	0	0.3	0	0.3	0.4	0	0	0.1	1.88
330-340	0.4	0.4	0	0	0	0.1	0	0.1	0	0	0	0.6	0.9	0	0	0.1	2.56
340-350	1.3	0.8	0	0.2	0	0	0.2	0.2	0	0	0.2	1.3	1.8	0	0	0	6.05
350-360	0.8	0.7	0.2	0.2	0	0	0	0	0	0.2	0	1.7	1.7	0	0	0	5.41
360-370	0.8	0.7	0	0	0	0	0.3	0.2	0.2	0.2	0	0.5	0.5	0	0	0	3.42
370-380	0.3	0.3	0	0	0	0	0.2	0	0.2	0.2	0	1.8	0.7	0	0	0	3.75
380-390	1.2	0.7	0	0.2	0	0.2	0	0.2	0	0.2	0	0.5	0	0	0	0.2	3.32
390-400	1.2	1.5	0	0	0	0	0.3	0	0	0.2	0	0.7	0.7	0	0	0.5	5.01
400-410	0.8	1.7	0	0.3	0	0	0.8	0	0	0	0	1.3	1.8	0	0	0.3	7.14
410-420	1	2.3	0	0	0	0.3	0.7	0.3	0.3	0	0	2.3	2.5	0	0	0	9.81
Upper MSA																	
420-430	2	1.2	0	0.2	0	0.2	0.3	0.3	0	0.3	0	3	1.5	0	0.3	0.7	10
430-440	1.6	1.6	0	0	0	1.2	0.6	0.2	0	0	0	1.8	0.8	0	0.4	0.2	8.4
440-450	1	2	0	0	0	1.4	1.2	0.4	0.2	0.2	0	1.6	0.4	0	0.4	0.6	9.4

* BLT = Bladlets	BP = Backed Points	DE = Denticulates	AL = Awls
BL = Blades	PT = Points (MSA)	NO = Notches	DR = Drills
BB = Backed Blade(lets)	SS = Side Scrapers	BE = Becs	CT = Comb. Tool
CR = Crescents(Segments)	ES = End Scrapers	BU = Burins	MR = Misc. Retouch

When the frequency data standardized by unit volume from the three assemblages were compared (Table 26), it was evident that most of the major retouched tool classes found in the Upper MSA assemblage (Figures 5.9-5.11) continued to be recovered in the "Large Blade" levels (Figures 5.12 and 5.13) but in substantially reduced numbers. The basic retouched tool types also continued into "Lower Fish" assemblage (Figures 5.14-5.16), however, as mentioned above they were reduced in size and more standardized in their metrical attributes (Appendix A). Of all retouched tool types examined, scrapers had the most variance particularly in the "Large Blade" levels, reflecting a wider size range and less standardization for this tool class.

Analysis of the incidence of raw material indicated that some raw materials were preferentially selected for formal tools, but that these preferences were not the same for each of the units, and they changed through time (Table 14). Two trends were clear: there was a fairly constant relationship between the relative use of the most abundant non-quartz raw material in the debitage in each of the three assemblages and the utilized and formal tool categories throughout the sequence. The frequency of quartz(ite) in the formal tool category declined markedly where the range of formal tools extend beyond the microlithic range, which occurred in the "Large Blade" assemblage. The second noticeable trend was the shifting preferences in imported raw material usage from silcrete and chert in "Large Blade"

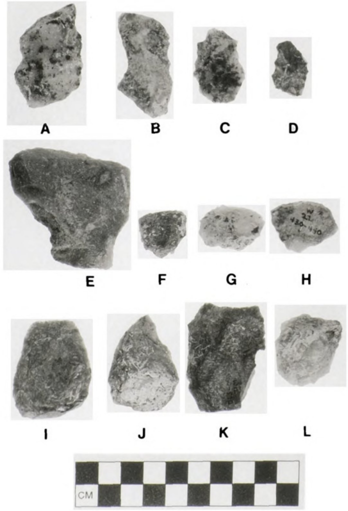


Figure 5.9 MSA Denticulates, End and Side Scrapers. A-D, Denticulates; E-H, End Scrapers; I-L, Side Scrapers. (Note that I and J are Side Scrapers produced on points)

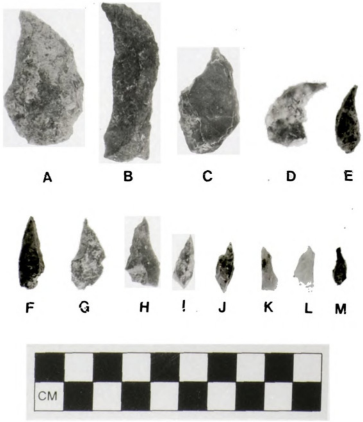


Figure 5.10 MSA Bec's and Awls. A-E, Bec's; F-M, Awls.

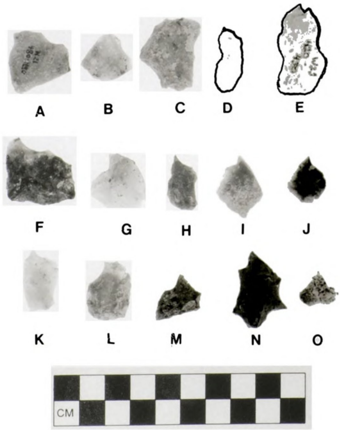


Figure 5.11 MSA Notches and Burins. A-E, Notches; F-O, Burins.

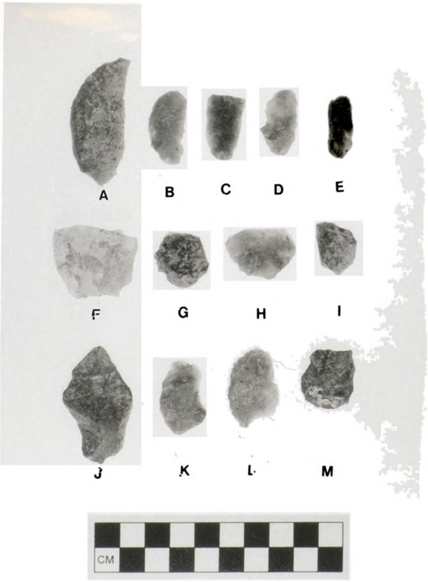


Figure 5.12 "Large Blade" Assemblage Crescents (Segments), Retouched Blades, Naturally Backed Blades and End and Side Scrapers. A-B, Large Crescents (Segments); C-D, Retouched Blades; E, Naturally Backed Blade; F-I, End Scrapers; J-M, Side Scrapers.

Figure 5.13 "Large Blade" Assemblage Notches, Bec's, Burins and Awls. A-D, Notches; E, Bec; F-J, Burins; K-P, Awls.

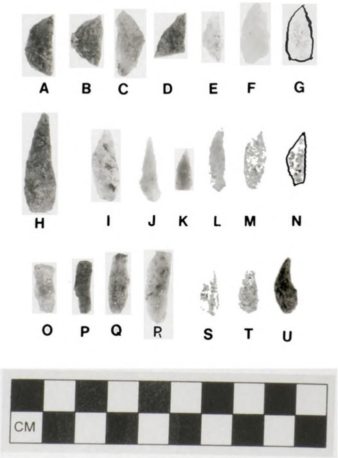


Figure 5.14 "Lower Fish" Assemblage Crescents (Segments), Distally Backed Points, Backed Bladelets, Retouched Bladelets, Drills, and Bec's. A-G, Crescents (Segments); H-N, Distally Backed Points; O, Backed Bladelet; P-R Retouched Bladelets; S, Drill; T-U, Bec's.

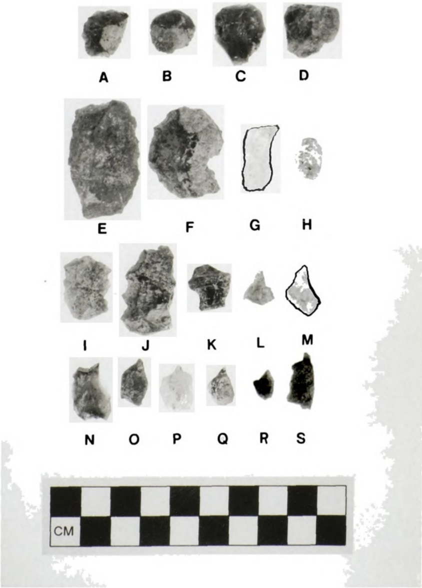


Figure 5.15 "Lower Fish" Assemblage End and Side Scrapers, Denticulates, Notches, and Burins. A-D, End Scrapers; E-H, Side Scrapers; I-J, Denticulates; K, Notch; L-S, Burins.

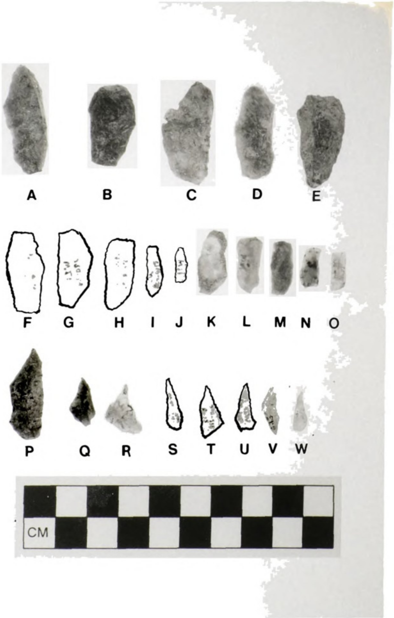


Figure 5.16 "Lower Fish" Assemblage Blades, Bladelets and Awls. A-E, Blades; F-O, Bladelets; P-W, Awls.

assemblage to chert, jasper, and chalcedony in the "Lower Fish" assemblage. This trend was also reflected in the selection of certain raw materials for the manufacture of particular formal tools, particularly large blades and MSA points (Table 14).

Having established that raw material had a clear influence on the incidence of formal tools, the relationship between formal tools and flaking technique was examined. First, prepared tortoise ("Levallois") cores were most common in the upper MSA assemblage as was the amount of secondary retouch on individual tools. In both the upper MSA and "Large Blade" assemblages, the incidence of blades and blade cores was high and the number of bladelet cores and unretouched bladelets were comparatively low. A different flaking technique was apparent in the "Lower Fish" late Pleistocene assemblages with bladelets produced from standardized bladelet cores, with very few of these being retouched. This suggests that the desired size and shape of blades and bladelets was achieved by flaking techniques in the "Lower Fish" and "Large Blade" assemblages and that this was achieved by prepared tortoise core flaking techniques and secondary retouch in the MSA.

In all three units, burins, scrapers and awls were the most common formal tools. There was also an apparent trend in scraper size through time. Large scrapers were found in the upper MSA and "Large Blade" levels. Characteristic forms included elongated end scrapers and those with steep side retouch. Small convex forms were dominant in the "Lower Fish" assemblage, but were present throughout the sequence (Figure 5.15 A-D).

A comparison of unretouched flake lengths and the frequency of formal tools at WPS indicated that high formal tool frequencies were found in samples with medium-sized unretouched flakes in the upper MSA and "Large Blade" assemblage, while the unretouched flakes were in the smaller size range in the "Lower Fish" assemblage. Samples in which high formal tool frequencies occurred have relatively thick flakes, which indicated that the flakes selected for formal retouch were flakes from a later stage in the reduction process. This implied that careful core preparation to produce unretouched tools was more important where formal tools were rarely made rather than when they were more common. It should also be noted that the mean thickness of scrapers and MSA points was consistently higher than the mean thickness of unretouched flakes, which indicates that thicker flakes were selected for at least one of the most common formal tools types.

The increasing standardization and smaller size range of tools recovered in the more recent assemblages, when compared to the older assemblages, appear to parallel a decrease in the frequency of formal tool types. A functional interpretation of these results would be that larger tools last longer than smaller ones, which had to be replaced in their hafts more often. The hafting of microliths then is viewed as being coupled with the increasing standardization of tool forms. Hayden (1977) noted that "retouching and resharpening of stone tools in Australian assemblages is closely related to the incidence of hafting" (Hayden 1977:180). Using Hayden's (1977) model, it could be suggested that the smaller size and range of tools in the "Lower Fish" assemblage and the greater size range of formal tool classes in the upper MSA assemblage was related to a change in the incidence of hafting. That is, a change in tool design and the method of use. This could have involved the hafting of microlithic expendable, disposable stone tools in the early LSA "Lower Fish" assemblage. These types of tools have been widely documented for the southern Africa LSA by H.J. Deacon (1976) and J. Deacon (1984). The microlithic tools of the LSA are opposed to the larger and perhaps longer lasting tools characteristic of the upper MSA assemblages that may have been predominantly hand held (J. Deacon 1984:159; Volman 1981). This was supported at WPS by the consistent presence of extensive resharpening of these larger upper MSA tools, which I believe supports this interpretation. Furthermore, if one accepts this interpretation, this would have involved less acceptable variability in the size and shape of tools to be placed in hafts, which would have introduced size constraints not present in earlier designs. Conversely, more variability would be acceptable and expected in tools not designed to fit into hafts.

LITHIC ARTIFACT DISTRIBUTION

The distribution of stone artifacts at a site is usually, but not always (ie. Schiffer 1976), the result of the pattern of artifact manufacture, use, and discard at the site during the time the site was occupied. Thus, the changes in frequency of debitage and artifacts could reflect changes in stone knapping activities and the patterns of use and discard of the lithic artifacts through time at WPS. However, it is accepted that these patterns can be altered by post-depositional factors that tend to obscure the original contexts (Schiffer 1976). Schiffer referred to these post-depositional factors that obscure the original contexts as "n" natural and "c" cultural transforms (1976:28). In some cases, such as the presence of animal burrows or human-made pits, it may be possible to isolate and exclude the material in the disturbed contexts in rock shelter deposits like WPS. However, in other cases it is not possible to distinguish natural from cultural transforms.

The data base available on the pattern of discard at modern San camps in the Kalahari (Yellen 1977; Kent 1984, 1987, 1991), are the only available to date. Brooks and Yellen (1987) also examined the preservation of activity areas in archaeological contexts. Yellen (1977) and Kent's (1991) observations were made over a relatively short time and they relate exclusively to open-air sites. Furthermore, the inhabitants only used a limited range of ground stone tools and no flaked stone tools. Thus, the interpretation of the distribution patterns from Stone Age rock shelters is limited to a certain extent by the available ethnographic and ethnoarchaeological data and the fact that San peoples no longer inhabited rock shelters at the time of these studies. However, several of the points observed by both Yellen (1977) and Kent (1991) may be relevant to the interpretation of WPS.

Yellen (1977), noted that "... it is not surprising to observe that the total number of LS:SAs (Limited Areas of Scatter:Special Activity Areas) are closely related not to the number of social units present but to the length of time a camp was occupied" (1977:120). However, I feel that the equations for calculating group size and length of occupation related by Yellen (1977:125) would be only of limited applicability to a rock shelter site such as WPS because it would be virtually impossible to isolate the particular artifacts and occupational debris from a specific occupation for all except the most recent levels of the site when oral history of site use was available. In addition, Yellen (1977) questions the value of testing occupational debris distributions for San camps because he could find no evidence of spatial segregation of activities within a single camp (1977:134).

Yellen's (1977) conclusions seem to support Whallon (1973) who suggested that is difficult to interpret spatially segregated clusters of debris and artifacts at

Stone Age sites. Therefore these interpretations must still rely to a great extent on ethnographic analogy. Problems of interpretation may also be encountered due to the fact that modern hunter-gatherers like the San may not be conducting some of the activities today that were performed in the past. In addition, the early LSA and MSA deposits being examined at WPS may not be related to the current San living in the region making general rather than specific analogy more appropriate for the archaeological record at WPS (Kent 1991). Finally, due to the problems mentioned above, analogy from other regions of the world (ie. Gould 1968a, 1978 from Australia; Thomas 1972,1973 from the Great Basin of North America; Binford 1978, on the Nanamiut) could be more applicable than Yellen's (1977), Brooks and Yellen's (1987) or Kent's (1991) data on the San.

Even with the limitations mentioned above, because this study focused on diachronic change, it was felt worthwhile to compare artifact distributions within WPS to test whether there were any noticeable changes in site use through time. The two variables chosen for consideration were standardized number of stone artifacts and lithic debris per unit volume for selected artifact classes per horizontal square meter in each excavated unit. It was hypothesized that the distribution of debitage and retouched tools from the upper MSA, the "Large Blade and the "Lower Fish" levels should show different amounts of evidence of tool production and perhaps use. If there were identifiable concentrations of formal tools and/or debitage in a few squares or levels, this might indicate the location of special activity areas or the location of "toss zones".

The distribution analysis utilized the total number of artifacts in each level standardized by unit volume, with the expectation that if the distribution of artifacts distribution patterns of all artifacts, both tools and debitage, were roughly the same, this would indicate that the focus of stone tool manufacture and tool use were the same, or that some form of natural transform was responsible (ie. deflation). However, this problem could be level specific and may not effect the entire sequence of site use.

The total amount of debitage and tools for each square are presented in Figures 5.17 and 5.18 and each excavated level in each square in Appendix B. In addition standardized vlaues per unit for cores, debitage and tools for the three assemblages are presented in Tables 15, 20 and 26 above. I concentrated on the levels between 450-200 cm including the upper MSA, "Large Blade", and "Lower Fish" assemblages. In addition, this avoided the post-depositional disturbances that may have occurred below the 120/130 cm levels proposed by Ivester (1995). Some interesting differences in the distribution patterns of artifacts were observed from the three principal assemblages.

The upper MSA levels showed a clear patterning which was in certain respects quite similar to the "Large Blade"

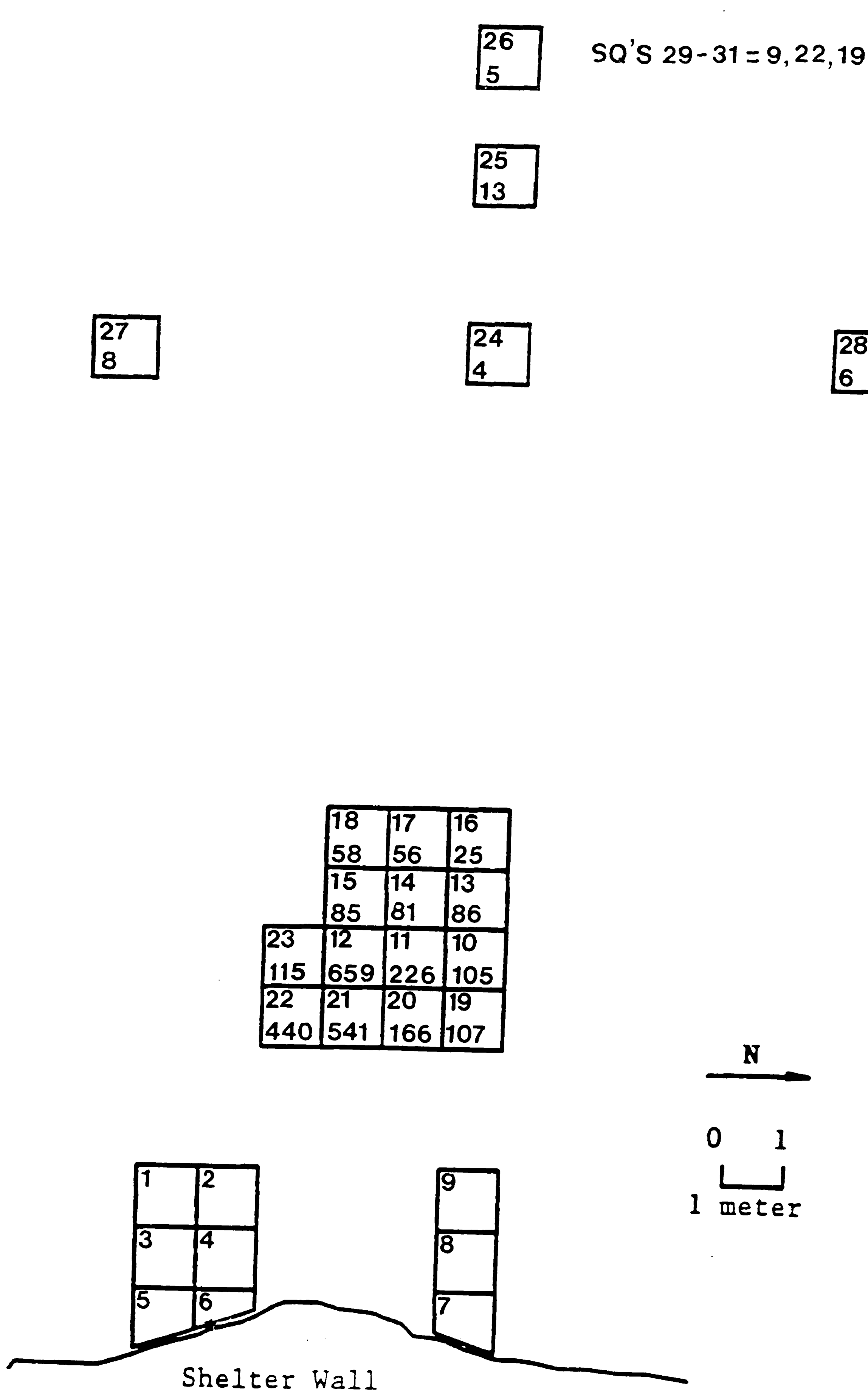


Figure 5.17 WPS Tool Totals for the 1991-1993 Excavations.

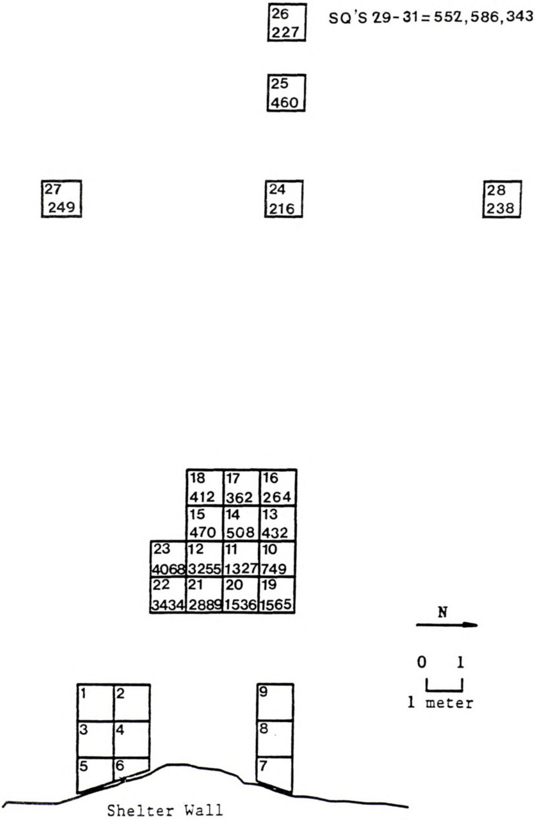


Figure 5.18 WPS Debitage Totals for the 1991-1993 Excavations.

and "Lower Fish" levels discussed below, however the upper MSA sample size was only 5 square m and I only examined 30 cm of the deposits intensively. Due to the small sample size, I am cautious about the interpretation offered below. The average density per unit volume of tools from these levels was 11 per 10 cm level per square. The tools were concentrated in Squares 12, 21 and 22 with 62, 50 and 46 tools respectively. Squares 20 and 23 only contained 4 and 3 tools respectively from these 3 10 cm levels. Notable tools from Squares 12, 21 and 22 included (11) MSA points, (14) scrapers (4 end and 10 side), (33) awls, and (32) burins. These squares also contained (22) blades and (29) bladelets.

The upper MSA levels per 10 cm level per square had an average density of 9.2 cores (5.1 quartz(ite) and 4.1 non-quartz) and 65.1 pieces of lithic debitage (33.3 quartz(ite) and 31.8 non-quartz). The cores were concentrated in Square 11/12 with 65 cores or 21.6 cores per 10 cm level. The next highest Square was Square 21 which contained 26 cores or 8.6 cores per level. Debitage was more evenly distributed but was concentrated in Squares 23 and 22 with an average density of 106 and 85.3 pieces of debitage per 10 cm level respectively. The next highest concentration came from Square 11/12 with an average density of 59 pieces of debitage per 10 cm level.

This concentrated area of lithic debris seemed to indicate an area of intensive stone knapping activity in the area encompassing Squares 11/12, 22 and 23. Perhaps this distribution indicates specialized activities although the small excavated area at this depth must be considered as a possible factor in this interpretation. Based on this small sample, this location served as an area of stone knapping and other activities involving stone tools. Furthermore, this area is removed from the interior of the shelter where other activities may have been taking place.

The "Large Blade" levels showed a pattern of low-density living floors, but once again the artifacts were concentrated in Squares 22 and 21, averaging 9.6 and 8.8 lithic artifacts per 10 cm level respectively and to a lesser extent Square 12 averaging 6.3 lithic artifacts per 10 cm level. The next highest concentration of artifacts came in Square 20 averaging 2.7 lithic artifacts per level. The most common artifacts from the "Large Blade" levels in Squares 21 and 22 were burins (62) and awls (47). Of the 6 1 m squares that sampled these levels, these two squares (21 and 22) contain 72.7% of the scrapers (9 end scrapers, 15 side scrapers). If Square 12 is included, which had 3 end scrapers and 2 side scrapers, these three squares possess 29 of 30 or 96.6% of the scrapers. Large blades were much more evenly distributed: Square 11 (4); Square 12 (8); Square 20 (7); Square 21 (9); Square 22 (12); and Square 23 (4). Overall there were differences between the distribution of blades and scrapers, the latter showing higher concentration than the former. This may be the result of sampling error, as the "Large Blade" levels have consistently smaller samples sizes than both the overlying and underlying units. Nevertheless, it could be culturally significant and indicate localized activity areas involving scrapers, while the remainder of the excavated area indicated a more casual pattern of stone tool utilization.

In the "Lower Fish" assemblages the density of artifacts was considerably higher than in the underlying units and the lithic artifacts, as well as most of the faunal remains, were clustered in levels (230-260 cm) and a few squares (Squares 21 and 22), rather than being more evenly distributed. Squares 21 and 22, yielded 16.8 and 14 lithic artifacts per 10 cm level respectively, which was considerably higher than the average density per unit volume of the next highest square (Square 12 averaged 8.7 lithic artifacts per 10 cm level). Notable artifacts recovered from the 10 "Lower Fish" levels from Squares 21 and 22 included (8) side scrapers, (6) end scrapers, (7) crescents, (5) backed bladelets, (70) burins, (60) awls, (124) unretouched bladelets, and (24) other tools. The presence of the "drip line" is believed to have encouraged occupation of this area of the site (Figure 1.8). This is supported by the fact that the non-lithic artifacts were distributed in a similar way. For example, Square 21 averaged 230.4 mammal bone fragments and Square 22 averaged 176.6 mammal bone fragments per 10 cm level. These were the highest averages for the "Lower Fish" levels and seems to support the argument that the squares in which high numbers of both lithic artifacts and faunal remains were recovered were favored for both artifact manufacture and their use in a general way rather than as loci for specialized activities. This by itself is interesting, in that it can be interpreted as indicating the immediate use of artifacts after manufacture, rather than indirect use of the tools manufactured here and used elsewhere.

The apparent increase in artifact density in both the upper MSA and "Lower Fish" levels may also be due in both cases to the sampling of units in which occupation was spatially restricted. In the case of the lower levels, the presence of a large rock-fall may have restricted occupation to the front of the shelter near the drip line. However, the distribution of scrapers, cores, and debitage in the upper MSA units could very well represent localized concentrations of activity in which stone knapping occurred and in which scrapers were used. A similar situation was noted for the MSA at Rhino Cave (Robbins et al. 1996).

Finally, I do not believe it is a coincidence that the lithic materials were concentrated in Squares 21, 22 and to a lesser extent Square 11/12, in all three assemblages examined. Clearly, the area near the drip line was a focus of activity involving lithic artifacts for a considerable period of time.

SUMMARY OF RESULTS OF FORMAL STONE TOOL AND LITHIC REDUCTION ANALYSES

In the foregoing discussion changes through time were demonstrated in: the methods of lithic reduction; in preferences of raw materials; in the design and range of formal retouched tools produced; and in the vertical and horizontal distributions of lithic artifacts.

Beginning with the earliest assemblage considered, the upper MSA assemblage (450-420 cm) dated to ca. 69-50,000 B.P., lithic reduction focused on the prepared core technique and the production of MSA points, and to a lesser extent on the production of blades from both prepared cores and blade cores. The raw material preferences focused on silcrete and chert which indicated that these were linked to some extent to the production of certain artifact classes particularly in upper MSA and continuing into the "Large Blade" assemblages. Although the correlation was not exactly linear, it was possible to predict the range, as well as the frequency of certain formal tools classes from raw material frequencies in the upper MSA and continuing into the "Large Blade" assemblages at WPS.

In the "Large Blade" levels dating to ca. 50-38,000 B.P. prepared cores were generally replaced by large single platform blade cores, however bladelet cores and bladelets were also being produced but in very low frequencies. The mean length of unretouched flakes increased with the continued selection of raw materials like silcrete and chert particularly prior to 360 cm. Interestingly, this raw material preference and subsequent shift occurred at approximately the beginning of the wet period noted by Ivester beginning at 352.5 cm (Ivester 1995). Backed microliths were extremely rare but large backed forms morphologically similar to the microlith's in overall form were being produced. Scrapers were relatively large but recovered in low frequency. The scrapers were both end scrapers with convex working edges and steeply retouched side scrapers in approximately equal numbers. It appeared that the scrapers were shaped by secondary retouch, while the blades were produced by careful preparation of the core to produce artifacts requiring minimal retouch. Throughout the period represented by the production of large blades, there was a parallel between changes in mean length of tools and unretouched flakes, which indicates that the flaking method was geared to a greater extent to the production of blanks for larger tools. In addition, there was some correspondence between the incidence of particular tool forms and the raw materials selected. This was particularly notable with regard to chert and silcrete and the production of blades and large backed tools utilizing large single platform blade cores.

Compared to the early LSA "Lower Fish" assemblage discussed below, the flake dimensions, core types and raw material preferences, as well as the range of formal tool designs were reduced in the "Large Blade" assemblage, as were the frequency of formal tools. The tools also show less standardization in their metric attributes which consistently separated the two assemblages.

The "Lower Fish" assemblage (300-200 cm) which dated to the Late Pleistocene between 38-30,000 B.P., was characterized by standardized bladelet cores, as well as the small flat forms which were used to produce relatively high numbers of small bladelets, a small proportion of which were retouched or backed. Of interest, larger blades continued to be produced during this time showing some continuity with the "Large Blade" assemblages which preceeded them.

Preferred raw materials were quartz(ite), chert, jasper and chalcedony. These finer grained raw materials were associated with increased numbers of certain tool categories and a decrease in the size range of tools emphasizing small scrapers and backed microliths. Bladelet cores and unretouched bladelets were common and it appeared that these artifacts were made by careful preparation of the core to produce tools that required minimal retouch. Quartz(ite) dominated the assemblage as a whole, but mostly in the debitage and angular waste categories. Most of the formal tool designs which continued into the Holocene assemblages were in use in the Late Pleistocene, however, there was a wider variance in the metric attributes, particularly in the range of size in scrapers and blades/bladelets and the presence of some relatively large backed forms.

The analysis of the raw material from the "Lower Fish" assemblage seemed to confirm the observations of Clark (1974) and Gould (1980) that if a site is located close to a source of raw material, this material will be far more common than any other when it fulfills the technological requirements for the tool manufacturer. Thus, quartz(ite) dominated the "Lower Fish" assemblage, although it was certainly present in the earlier the "Large Blade" assemblages, but mostly in the scraper, debitage and angular waste categories.

The fact that raw material preferences shifted from more non-local raw materials in the upper MSA and the "Large Blade" assemblages at WPS is even more interesting if we can assume that these changes were motivated by changing preferences and not simply what was most readily available. It is the timing of these changes in raw material preferences that is significant. This was correlated with the incidence of certain raw materials (chert and silcrete) which could produce larger flakes and were thus selected over those that occur in smaller nodules (jasper, chalcedony and quartz(ite)) as we move forward in time.

The shifting metrical dimensions of the lithic artifacts through time seem to be the clearest examples of change manifested by the WPS assemblages examined. The correspondence between formal tool and unretouched flake length indicated that changes in size may be largely dependent on raw material selection. However, based upon the results of my analysis the lithic reduction techniques also appeared to play a major role. There is no evidence for the assumption that particular raw materials need more retouch than others, however certain raw materials were deliberately selected for particular formal tools classes, presumably due to their superior qualities for the production of these tools. In addition, it appears that for the microlithic tools, the finer grained raw materials like chert, jasper and chalcedony were the preferred raw materials, however silcrete was also occasionally used. Therefore, I feel it appropriate to conclude that the selection and availability of raw materials had a lot to do with the design and intended uses for which lithic tools were produced.

The most common raw material (quartzite) in the assemblages had a clear influence in the relative frequency of debitage and angular waste due to the way in which the material breaks up in the reduction process, but had little influence on the range and frequency of the formal tools produced at WPS.

The lithic data from WPS clearly illustrate that the raw materials were deliberately selected and often sought out from distant sources for their particular properties. This indicates that the tool manufacturers were quite aware of the properties of these specific raw materials. There is a parallel between the use of chert and silcrete and the production of larger tools and between the use of finer-grained raw materials like jasper and chalcedony, which

occur in smaller packages, and the production of smaller backed tools and small scrapers. This seems to indicate that these raw materials were selected because the tool manufacturers consciously selected these raw materials to make larger or smaller tools respectively.

The changing density and distribution of formal tools and debitage through time in the excavated units has been discussed and it seems clear that there were differences in site use through time at WPS and this will be the topic of Chapter VII.

ADDRESSING THE FIRST TWO HYPOTHESES

I now return to the hypotheses presented in the beginning of this chapter and how the results relate to them. The first hypothesis was that procedures of lithic reduction would demonstrate a shift from prepared core direct percussion techniques producing points, large flakes and blades during the late MSA and transitional MSA/early LSA, to indirect percussion techniques producing smaller flakes and blades in the early LSA. This hypothesis was generally supported by the WPS lithic analysis. Direct percussion techniques were the primary reduction method used in the production of prepared (tortoise) cores and MSA points, as well as for a number of the flakes tools. However, it appears that the punch technique was utilized during the late MSA and transitional period in the production of large blades, and a similar technique was more

than likely also employed in the production of early LSA microlithic tools. Continuity in reduction techniques was also indicated in quartz(ite) reduction throughout the three assemblages, in the form of bipolar reduction techniques. The largest non-quartz flakes were produced during the transitional MSA/early LSA period when large blades were the focus of lithic manufacture and there was a clear trend toward the reduction in size of flakes, cores and tools between the transitional MSA/early LSA and the early LSA assemblages.

The second hypothesis posited that raw material acquisition patterns would demonstrate a preference for imported raw materials during the MSA and the transitional period, then shift to more locally available sources during the LSA. This hypothesis was strongly supported by the WPS lithic assemblages. However, there was still a tendency for retouched tools, blades, and bladelets to be produced on exotic raw materials during the early LSA although the types of raw material utilized appears to shift somewhat to those available in smaller initial packages, like chalcedony and jasper. Conversely, during the MSA and transitional MSA/early LSA periods, the stone workers at WPS were selecting imported raw materials that were generally available in larger initial packages, like chert and silcrete.

The final three hypotheses deal with raw material acquisition patterns and climatic variables and shifting

mobility patterns through time and will be addressed in Chapter VII.

COMPARISONS WITH WPS: POSSIBLE TRENDS

In this section, I compare the three principle lithic assemblages examined at WPS with other regional sites. The reader is referred to Figure 2.1 for the location of key sites mentioned in the text and Table 2 for the sequences and references. I examined sites which has comparable lithic assemblages and/or dated sequences, particularly sites with transitional late MSA/early LSA assemblages and the presence of blades, as well as technological and raw material shifts similar to the WPS assemblages. With the exception of Tsodilo Rhino Cave and the Depression sites, these comparisons should be considered as general observations based on literature reviews. I examined published illustrations and typological descriptions rather than conducting a first-hand study of the actual artifacts.

The reader will notice that for the most part, I examined sites quite far removed from WPS for comparative data. The primary reason for this is, with the exception of Depression, Rhino Cave and Gi, all sites with comparable assemblages are located quite a distance from the western Kalahari. It is always difficult to conduct comparisons when so little is known, however, for this very reason it makes the work more rewarding and hopefully the results all the more important.

With this in mind, the upper MSA, transitional MSA/early LSA and early LSA assemblages at WPS appear to have affinities with assemblages to the northeast, east, and south of the Kalahari. To the east in Zimbabwe, the sites of Pomongwe, Redcliff, Tshangula, as well as the sites in the Matopos Hills (Figure 2.1) have assemblages which date to between 12,000-32,000 B.P and contain a microlithic component, as well as MSA prepared cores, triangular flakes, and unifacial and bifacial points (Cook 1979, Walker 1995) which appear similar to the upper MSA assemblages at WPS. The presence of blades and burins in the Bambata assemblages (Armstrong 1931; Jones 1940; Walker 1995) also seem comparable to the "Large Blade" assemblages at WPS. The presence of backed tools near the top of the MSA at Nswatugi (Walker 1995), also appear similar to the backed tools from the "Large Blade" assemblages from WPS. The more recent assemblages termed Tshangula (Cook 1969, 1979; Walker 1978, 1995) were described as being "nondescript with few formal tools" (Walker 1978:6) and "with no clear division between macroliths and microliths" (Cooke 1969:7). It is hard to associate these assemblages with the early LSA "Lower Fish" levels at WPS. It is also difficult to resolve the dating of the assemblages from Zimbabwe, particularly when MSA assemblages appear to persist until 12,000 B.P. north of the Limpopo River, while they end at a much earlier date south of the Limpopo (Volman 1981).

In seeking comparative data from Zambia, the only

association that was noted by this analyst was the presence of backed points in the early LSA "Lower Fish" assemblages at WPS and the dominance of similar artifacts in the Nachikufan I (Figure 2.1) assemblages (Musonda 1985; Miller 1969). The problem in the comparison of the WPS early LSA assemblages with those from Zambia is related to the dating of the Nachikufan I assemblages to between 18,000-9,000 B.P. and the "Lower Fish" assemblages at WPS dating to between 30,000-38,000 B.P..

Similarities between the WPS assemblages were also noted with several sites from South Africa. Particularly, the Transvaal sites of Cave of Hearths and Bushman Rock Shelter (Figure 2.1). At Cave of Hearths (Mason 1971; Sampson 1974) the presence of large flake blades in the Pietersburg Industry were mentioned which were associated with disc cores and triangular points, however, the latter were both described as being rare (Sampson 1974). A decrease was noted in the proportions of blades from earlier to later Pietersburg assemblages (Sampson 1974). I believe that these assemblages are comparable to the transitional MSA/early LSA "Large Blade" assemblages at WPS. Also of interest were the percentages of raw materials at Cave of Hearths being dominated by quartz in Bed 4 with increasing proportions of chert in Bed 5 and then a roughly equal percentage of quartz and non-quartz raw material in Beds 6-9 (Sampson (1974). This is very similar to the situation at WPS, with quartz dominating the early LSA "Lower Fish"

assemblage, and then non-quartz raw material increasing throughout the transitional MSA/early LSA "Large Blade" assemblages and reaching roughly equal proportions in the upper MSA assemblages.

A similar situation was encountered at Bushman Rock Shelter (Figure 2.1) (Plug 1978, 1979 Brain 1969a; Butzer and Vogel 1979) with quartzite predominating (75%) in the early LSA and non-quartz raw material accounting for 63% of the raw materials in the MSA assemblages (Plug 1978). The MSA tools found at Bushman Rock Shelter were also similar to those recovered from WPS, with retouched unifacial and bifacial points and a similar dominance of side scrapers (Plug 1978, 1979).

The other Transvaal site examined was Cave James (Figure 2.1) (Wadley 1989). Wadley (1989) described the early LSA assemblages as "unstandardized with few formal retouched tools" (Wadley 1989:51), so comparison rests on her discussion of large percentages of quartz in the early LSA assemblages which is certainly comparable to the dominance of quartz(ite) in the early LSA "Lower Fish" assemblage at WPS. However, the early LSA at WPS contains a number of standardized tools.

One of the closest comparisons came from two of the more distant sites. These were Highlands Rock Shelter (H.J. Deacon 1976) and Boomplaas (J. Deacon 1979a) in the Cape Province of South Africa (Figure 2.1). At Highlands Rock Shelter, the late MSA dates to between 30,840-38,900 B.P.

and was dominated by a "strong blade element" with rare unifacial points and large crescents (H.J. Deacon 1976). This is very similar to the transitional MSA/early LSA "Large Blade" assemblage at WPS and the dates are roughly comparable. At Boomplaas the LP member was termed early LSA and dated to 22,000 B.P. (J. Deacon 1979a). As with Cave James, this assemblage was dominated by quartz with no formal retouched tools. However, the B.P. member was termed late MSA and dates to between 32,400 B.P. and 34, 620 B.P. and was characterized by long flake blades (J. Deacon 1979a:123). With regard to the dominance of quartz in the raw material, the early LSA at Boomplaas appear comparable to the early LSA assemblages at WPS and the late MSA is comparable to the transitional MSA/early LSA "Large Blade" assemblages in the dominance of flake blades, although the dates from Boomplaas are more recent than those of similar assemblages encountered at WPS.

Recent work by Wadley (1991, 1996) and Clark (1997) at Rose Cottage Cave in the Orange Free State (Figure 2.1) is also very important in comparison to the WPS assemblages. Clark (1997) noted a "dominance of naturally backed knives" (Clark 1997:113) (blades) and large side scrapers in her transitional MSA/LSA assemblages, along with a dominance of MSA retouched tools. These were found with "an increasing frequency of bladelets and bladelet cores and dated to 20,600 B.P." (Clark 1997:118). Although the Rose Cottage dates are more recent, the WPS and Rose Cottage assemblages

were very comparable. In the transitional MSA/early LSA "Large Blade" assemblage at WPS, bladelets occurred in roughly equal proportions to large blades, until the lower levels of the assemblage at WPS. As with Rose Cottage, flat bladelet cores and single and double platform bladelet cores were also present in the assemblages. Finally, the dominance of non-quartz raw materials in both assemblages is noteworthy.

Border Cave in Kwazulu in South Africa (Figure 2.1) (Cooke et al. 1945; Beaumont 1980) has an early LSA assemblage dated to 37,000 B.P. and which is assigned to the Epi-Pietersburg Industry. Notable tools mentioned by Cooke et al. (1945) were long narrow thin blades, backed pieces and small triangular points. The presence of large blades and the dating of these assemblages appear to be comparable to the transitional MSA/early MSA "Large Blade" assemblages from WPS.

Again, quite far removed from WPS, the Lesotho Rock Shelters of Sehonghong (Mitchell 1994) and Moshebi's Shelter (Carter 1977) assemblages appear very comparable to the WPS assemblages (Figure 2.1). This was particularly true for Sehonghong. At this site, Mitchell's (1994) OS/MOS/RFS layers date to between 26,000-20,000 B.P. and were dominated by chalcedony, flat bladelet cores and small bladelet cores. He noted a bladelet component, but that they were recovered in lower frequencies than in the more recent Robberg levels. According to Mitchell (1994), Layer 5 was capped by a rock

fall dated to 32,000 B.P. and blades accounted for 80% of the formal tools. Although more recent in age, it appears that the OS/MOS and RFS layers are comparable to the early LSA "Lower Fish" assemblages at WPS and Mitchell's (1994) Layer 5 is certainly comparable to the transitional MSA/early LSA "Large Blade" assemblage at WPS. At Moshebi's Shelter, Carter (1977) reported a number of blades, some with unifacial retouch and unifacial points and burins in a late MSA context. Although these assemblages were not dated, they appear quite similar to the "Large Blade" assemblages from WPS.

In Natal at the site Umhlatuzana (Figure 2.1), Kaplan (1989) reported a transitional MSA/LSA assemblage dated to between 35,000-25,000 B.P.. Again, the site is rather far removed from the western Kalahari, however the assemblages reported are quite comparable to those recovered from WPS. According to Kaplan (1989) the most common raw materials were hornsfeld in the late MSA/transitional LSA. The LSA assemblages were dominated by quartz, however non-quartz raw material were most frequently used to produce the retouched tools. Kaplan (1989) noted an increase in bladelet production in the late MSA which continued into the transitional MSA/LSA assemblages and that the MSA assemblage's unifacial and bifacial points dominated the assemblage. In addition, Kaplan (1989) reported (36) blades from these levels and in the transitional levels, he reported (179) blades, as well as MSA retouched tools. It

appears that Kaplan's (1989) transitional levels in which blades predominate are quite comparable to the transitional "Large Blade" assemblage from WPS. The presence of MSA points, as well as blades in his late MSA levels also appears similar to the upper MSA levels at WPS.

Finally, the only Botswana sites with corresponding assemblages are the Tsodilo Sites of Depression (Robbins 1990) and Rhino Cave (Robbins et al. 1996a) and the site of Gi (Figure 2.1) (Brooks et al. 1990; Brooks and Yellen 1977, 1987; Kuman 1989). At Depression, in square 5, Robbins (1990) reported that the assemblages from the lower levels (below 4 m) contained burins, retouched blades, backed artifacts, points, blades and bladelets (Robbins 1990:336). I believe this assemblage is similar to early LSA "Lower Fish" assemblages and perhaps in the lowest levels the Depression site's assemblages may overlap with the transitional MSA/early LSA "Large Blade" assemblages at WPS.

At Rhino Cave (Robbins et al. 1996) transitional MSA/early LSA and early LSA assemblages were not recovered. However, the Rhino cave MSA assemblage included 21 MSA points and other MSA retouched tools, the most notable being numerous medium and large end and side scrapers, awls, denticulates and notches. In addition, the Rhino Cave MSA assemblages contained "several large unretouched blades ... the largest measures 49 mm in length" (Robbins et al. 1996:32). I believe that the Rhino Cave MSA assemblage,

which included blades, MSA points and other comparable tools, is roughly equivalent to the upper MSA assemblages at WPS, although the Rhino Cave assemblage may be more recent. This suggestion is based on the size range of some of the MSA points in the MSA levels at Rhino Cave compared to MSA points recovered at WPS. The Rhino Cave specimens were significantly smaller than any of the MSA points recovered from WPS. In fact it was suggested that some of these points may have been "arrow" points (Robbins et al. 1996:31).

At the pan margin site of Gi, which is geographically close to WPS (Figure 2.1), Kuman (1989), Brooks and Yellen (1977, 1987) and Brooks et al. (1990) reported a large MSA component that they equate to Zimbabwean Stillbay Industries and Bambata material from Redcliff in Zimbabwe. As mentioned above, the MSA assemblage from Gi was dominated by bifacial and unifacial points, side scraper, notches, denticulates, perforators, and becs (Brooks and Yellen 1977, 1978; Kuman 1989; Brooks et al. 1990). Based on the published drawings in Kuman's (1989) manuscript the tools were very similar to the MSA assemblages at WPS, and the published TL date for the MSA levels at Gi of 77,000 +/- 11,000 (Brooks et al. 1990:62) is well within the suggested range of dates bracketing the MSA assemblages at WPS. In addition, the "Intermediate Industry" in level 2C at Gi which is dated to 34,000 B.P. and described "as containing blades but few formal tools" (Brooks et al. 190:62) appears

to be directly comparable to the "Large Blade" assemblage at WPS, although the dates for this assemblage at Gi are somewhat more recent than those suggested for the "Large Blade" assemblage at WPS.

In review, I have summarized the artifact sequences from a number of inland cave and rock shelter sites, as well as one open-air site within or in regions adjacent to the Kalahari in southern Africa with deposits that have been described as Late MSA, transitional MSA/early LSA or early LSA. A number of these assemblages provide good evidence for technological and typological continuity during the MSA and across the MSA/early LSA boundary. However, certain trends appear to be present in a number of these assemblages and were clearly evident at WPS. These include: (1) a decrease in average artifact size; (2) standardization of tool forms; (3) an allied increased preference for fine-grained raw material for the production of formal microlithic retouched tools and unretouched bladelets; and (4) a decrease in the variety and an increase in the numbers retouched tools.

Beaumont (1979a) suggested that similar trends reflected increased knapping or flaking efficiency which was evident in the reduction of the relative thickness of tools and flakes through time (Beaumont 1979a:23). He also proposed a similar trend in the selection of and use of cryptocrystalline raw materials, which he believed aided in the production of thinner flakes (1979a:23). Beaumont also

interpreted the LSA microlithic technology coupled with the production of composite tools as a continuation of this strategy. It is also implied in Beaumont's (1979a) model and supported by the WPS data, that increased standardization in the size of early LSA microlithic artifacts was directly tied to the increased incidence of hafting and the production of composite tools. Conversely, the larger size and less standardized tool forms in the MSA and transitional MSA/early LSA assemblages were due to them being predominantly hand held. Finally, while agreeing with Beaumont's (1979a) scenario, I noted above the possibility the well-documented increased use of microlithic tool technology in the LSA and the use of fine-grained raw materials may have been functionally related.

Overall, the regional site review seems to confirm the differences noted by Volman (1991) and J. Deacon (1984) between assemblages to the north of the Kalahari or the Limpopo River, that were once termed "Magosian" and now are called Tshangula or Nachukufian, and the assemblages to the south. These assemblages from Zimbabwe and Zambia seem to be intermediate, both technologically and typologically, between what have been defined as MSA and LSA to the south. In addition, it appears that certain MSA technological features continued to have been used in the regions north and northeast of the Kalahari until the end of the Pleistocene.

In the next chapter I present the current understanding

of the fluctuating southern African paleoenvironmental situation during the late MSA and early LSA and what is known about regional MSA and early LSA adaptations. This will set the stage for a consideration of changing hunter-gatherer mobility patterns and shifting raw material acquisition and exchange networks during this time period as evidenced at WPS in Chapter VII.

CHAPTER VI

SOUTHERN AFRICAN PALEOENVIRONMENTAL RECONSTRUCTION AND MSA-EARLY LSA ADAPTATIONS

An understanding of the environmental fluctuations is critical to the interpretation of human behavior during the time period this dissertation addresses. Thus, I will focus on the time periods covering the upper MSA and early LSA (ca. 30,000-70,000 B.P.) and consider the influences the changing environmental conditions had on the human inhabitants of the region.

Brook et al. (1996), Butzer (1984), Cooke (1975), Klein (1984), and Thomas and Shaw (1991) are excellent sources for the long term environmental conditions of the interior of southern Africa. These authors utilized a number of studies of cave deposits and ancient land forms to propose a paleoenvironmental reconstruction for the region. Their combined data suggest a number of environmental fluctuations during the Pleistocene.

Butzer (1984) stated that "the most striking aspect of the climatic history of the interior is the rapidity of change, primarily in terms of phenomena that reflect effective moisture. It is the rapidity of such change, and the complexity of the evidence and the responsible variables, that makes synthesis so difficult" (1984:63-64).

Cook (1975), Klein (1984), and Thomas and Shaw (1991) all document specifics regarding the dating of these climatic fluctuations, but overall each relates that the climate in southern Africa has changed drastically and cyclically over the course of human occupation of the region. These authors document that during the Pleistocene certain areas of tropical Africa received 50% more rainfall than modern averages, and at times the area was significantly cooler on the average. These changes in the environment of the region would have had a major influence on the amounts and kinds of animals and plant foods present at any one time in the past. Seasonal variation during the Pleistocene glaciations certainly also had an effect on the Stone Age inhabitants of the region. During the interglacial periods it has been documented that sea levels rose and forest areas expanded. In the tropical and subtropical regions the changes were less dramatic than in the northern environments, however, in all cases, humans would have been a part of the overall landscape and would have had to adjust their social, subsistence, and settlement patterns accordingly.

I will attempt to correlate these regional paleoenvironmental studies with George Brook's (1990, 1992) and Andrew Ivester's (1995) site specific data on WPS and the Depression Shelter. Brook sampled the entire 7 m depth of White Paintings Shelter taking sediment samples every 7.5 cm (Figure 6.1). Ivester (1995) then examined the sediments for climatic indicators including angularity, texture, and size sorting, as well as other variables, to derive a detailed paloenvironmental reconstruction for the site.

Figure 6.1 Dr. George Brook of the University of Georgia collecting WPS sediment samples.

Finally, Richard Klein and Richard Milo's (personal communication) faunal analysis will be utilized to aid in the environmental reconstruction. Klein and Milo identified thirty-five types of mammals from WPS, some of which are wetland species, while others are extinct forms (Table 3).

The evidence for changing environments, combined with the related technological innovation and changing subsistence practices, indicate that sub-Saharan Africa's cultural developments were as dynamic as those which occurred in Europe at similar times. In fact, recent research indicates that these developments may have occurred earlier in Africa than in Europe (Brooks and McBrearty 1998). According to Volman (1981), during the later Middle Pleistocene to the Mid-Upper Pleistocene (130,000 to 40,000 B.P.) "interregional variability in subsistence practices and stone artifact assemblages was as least as great in southern Africa as for Europe and the circum-Mediterranean area." (Volman 1981:2).

Most authors agree that the Kalahari presents problems in the interpretation of a paleoenvironmental sequence that have not entirely been resolved, although significant progress has been made in the two decades. "The paleoenvironmental framework (of the Kalahari) that is now beginning to emerge is far from complete, but it offers a fascinating insight into the development of the science" (Thomas and Shaw 1991:168).

Current problems in interpretation of paleoclimatic events in the Kalahari were summarized by Thomas and Shaw (1991) as follows:

(1) the presence of deep deposits of Kalahari sands which "are much altered, are difficult to differentiate, contain few fossils and have low levels of preservation of organic matter" (Thomas and Shaw 1991:170).
(2) "Few sites have long geomorphological records and therefore most work is on a large scale and geomorphological and deductive in nature, rather than small-scale, multi-disciplinary, and inductive" (Thomas and Shaw 1991:171).
(3) "The dating of paleoenvironmental events. Generally, organic materials are not well preserved in most regions of the Kalahari, so chronologies are necessarily based on radiocarbon dates of inorganic materials, most commonly calcretes." (Thomas and Shaw 1991:170-171)
(4) "Sites of paleoenvironmental significance are unevenly located and large gaps exist in the central Kalahari, and "closed sites with potential for long chronologies, exist only at Drotsky's Cave and Wonderwerk Cave in the west and southeast respectively" (Thomas and Shaw 1995:174-175).

Unfortunately, the dating of the sequences are particularly problematic, as much of it rests on the dating of calcretes which generally yield the "youngest possible date as calcrete formation is not necessarily monogenetic" (Netterberg 1980 in Thomas and Shaw 1991:170). Thus, according to Thomas and Shaw "calcrete dates must be treated with caution, and used as indicators rather than stratigraphic markers" (1991:171).

Drotsky's Cave (Gcwihaba) is one of the rare cave sites within the Kalahari and thus is of major importance in paleoenvironmental studies (Figure 6.2). The first studies were undertaken at Drotsky's Cave by Cooke (1975a). His initial interpretations were then revised (Cooke and Verhagen 1977; Cooke 1984). Cooke's studies were based on radiocarbon dates on stalagmites and associated dates for

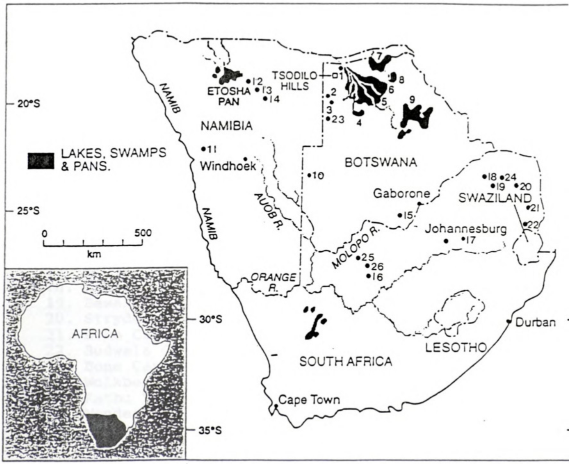


Figure 6.2 Approximate location of sites of paleoenvironmental significance in southern Africa mentioned in the text. (After Ivester 1995, Brook et al. 1996, and Burney et al. 1994)

Key:

1. Shakawe
2. Gi in Dobe Valley
3. Drotsky's Cave
4. Ngami Basin
5. Maun
6. Okavango Delta
7. Caprivi Basin
8. Mababe Basin
9. Makgadikagadi Pans
10. Urwi Pan
11. Rossing Cave
12. Aikab and Aigamas Cenotes
13. Guinas Meer Cenote
14. Harasib and Dragonsbreath Caves
15. Lobatse I and II Caves
16. Gaap Escarpment tufas
17. Sterkfontein Cave
18. Makapan Cave
19. Bewaarkloof tufas
20. Strydom Tunnel tufas
21. Echo Cave
22. Sudwala Cave
23. Bone Cave
24. Wolkberg Cave
25. Kathu Vlei
26. Wonderwerk Cave

Figure 6.2 cont. Key to approximate location of sites of paleoenvironmental significance in southern Africa mentioned in the text. (After Ivester 1995, Brook et al. 1996, and Burney et al. 1994) calcretes in the nearby Gcwihaba Valley. With these data, Cooke interpreted several cycles of cave development. According to Cooke (1984), these cycles were related to increased rainfall in the area which accelerated "sinter" deposition. The major periods of increased rainfall identified by Cooke and Verhagen (1977) and Cooke (1984) were between 45,000-37,000 B.P and between 34,000-29,000 B.P..

Another set of important paleoclimatological sites are located in the Dobe Valley which lies approximately 70 km northwest of Drotsky's Cave (Figure 6.2). In this area, archaeological work at the sites of Gci (Gi) and Quangwa by Brooks and Helgren (Brooks 1978; Helgren and Brooks 1983), discovered evidence of a paleo lake in the valley that existed on at least two occasions. In addition, Helgren and Brooks were able to correlate these lake stages with two different archaeological assemblages. The paleo lake was logically interpreted as representing humid periods. The first lake period was associated with Middle Stone Age artifacts and beyond the range of radiocarbon dating (Brooks et al. 1990). The second lake Phase was believed to exist between 23,000-22,000 B.P. prior to an arid phase at the last glacial maximum around 19,000 B.P.. The single calcrete date of 31,000 B.P. from the paleo lake was interpreted by Helgren and Brooks as being too old due to problems created by tectonic activity in the region and that it likely related to the more recent humid period and was not associated with the MSA artifacts (Helgren and Brooks 1983).

Additional paleoenvironmental data in the region was provided by the Okavango-Makgadikgadi Pan complex (Figure 6.2). According to Thomas and Shaw (1991) "the Okavango-Makgadikgadi complex forms one of the most extensive paleoenvironmental sites in Africa" (Thomas and Shaw 1991:175). Initial investigations were conducted by Grove (1976) and Heine (1978b). More recent work on the Okavango-Makgadikgadi complex includes: Cooke 1984; Cooke and Verstappen 1984; Shaw 1985a, 1986; Shaw and Cooke 1986; Shaw and Thomas 1988; Shaw et al. 1988, and Shaw et al. 1997). In summarizing the results of these researchers Thomas and Shaw (1991) interpreted the data as follows:

> "Arid conditions in the Makgadikgadi Basin at around 46,000 B.P. were succeeded by the 945 m Lake Paleo-Makgadikgadi level between 40,000-35,000 B.P. ... low lake levels were attained from 35,000-26,000 B.P. ... then between 26,000-10,000 B.P. a succession of lakes at the 920 m level interspersed with lower lake levels at 21,000 and 19,000 B.P. ..." (Thomas and Shaw 1991:176).

In a recent article on high lake levels in the Makagadikgadi Basin Shaw et al. (1997) reinterpreted the existing radiocarbon dating sequence of the regional lake phases which were primarily based on the dating of calcretes. On the basis of this reinterpretation of the calcrete dating techniques, Shaw et al. documented two high lake levels phases between 32,000 and 27,000 B.P. "which are older than, and comparable to, existing C14 dates on terrace calcretes in the Boteti" (Shaw et al. 1997:273).

In summarizing evidence for the southwest Kalahari, Lancaster (1979, 1984, 1987, 1989) and Deacon and Lancaster (1988) interpreted lacustrine (wet) phases between 33,000-30,000 B.P and again between 17,000-11,000 B.P., the former of which would be comparable to the high lake phase for the Makgadikgadi Basin by Shaw et. al (1997). Documenting of this lake phase is critical to my interpretation of the "Lower Fish" levels at WPS discussed below.

On the margins of the Kalahari, there are a number of sites of paleoenvironmental significance. In the Northern Cape of South Africa is the site of Wonderwerk Cave (Figure 6.2) (Beaumont et al. 1984; Butzer 1984a). According to the summary of these data provided by Thomas and Shaw (1991) "moist and cold climate was experienced at 30,00-26,000 B.P. accompanied by frost-spalling in the cave" (1991:179).

Another northern Cape paleoenvironmental site yielding important data is the Gaap Escarpment (Figure 6.2) (Butzer et al. 1978, Butzer 1984b). Butzer et al. (1978) and Butzer's (1984b) geomorphological studies of the escarpment indicated depositional phases of breccia and tufa accumulation 94,000-30,000 B.P, separated by an erosional hiatus dated to between 30,000-14,000 B.P. (Butzer et al. and Butzer 1984b in Thomas and Shaw 1991:180). According to Thomas and Shaw "tufa deposition currently takes place only during years of above-average rainfall, an annual mean of 600-1000 mm (unadjusted for any accompanying temperature changes) is indicated for these episodes" (1991:180).

What becomes apparent in examining the current literature of the Kalahari paleoenvironmental record is the fact that it is fragmentary and there appears to be some significant conflict between different locations and data sets. Also, it is clear that most studies seem to stress precipitation changes, noting episodes of greater rather than less precipitation than at present.

In reference to this current situation Thomas and Shaw comment "that there should be such conflict is not surprising, for it is inherent in the Kalahari environment itself, which occupies a transitional position between the tropical summer rainfall and temperate winter rainfall belts, both of which play a part in the present-day distribution of rainfall. Thus, there need not be regional correlation in palaeoclimatic events..." (1991:183).

Recognizing that problems exist, it appears that some general trends can be discerned. Humid conditions are indicated at most sites between 35,000 and 22,000 B.P.. This humid condition is indicated between 35,000 and 28,000 B.P. at Drotsky's Cave, Gci Pan, the Western Pans and the Gaap Escarpment (Figure 6.2). According to Thomas and Shaw, "within this broad belt are suggestions of drier episodes, certainly the Okavango-linked lakes appeared to dry out around 25,000 B.P., representing conditions at least as dry as at present" (1991:184).

The paleoenvironmental record for the period beyond

50,000 years ago is more difficult to obtain reliable data. However, a recent article by Brook et al. (1996) attempted to plot the wet and dry periods in the southern African summer rainfall zone during the last 300,000 years based on dated speleothems from fifteen caves in Namibia, Botswana and the Transvaal of South Africa as well as tufa deposits from the Gaap Escarpment and the eastern Transvaal of South Africa along with sand dune data from Etosha Pan within the Kalahari in Namibia (Figure 6.2). Of importance to this present study was that Brook et al. (1996) determined that the changing rainfall patterns were the same across the entire region. In addition, ages on cave speleothems from Aikab, Aigamas and Guinas Meer in the Otavi Mountain Land Cave of Namibia (Figure 6.2), southeast of Etosha Pan, that are currently submerged under up to 40 m of water have given these researchers a unique opportunity to examine evidence of past drier conditions in this part of the subcontinent.

According to Brook et al. (1996) these submerged spelothems in the Otavi Mountain Land Cave were the result of current annual precipitation averaging between 600-700 mm/year which they interpreted as clearly higher than in the past. They noted that "only at Sudwala Cave in South Africa and Drotsky's Cave in Botswana is there even modest speleothem growth under the present climatic conditions" (Brook et.al. 1996:148). They interpreted extensive speleothem growth in these Namibian caves as suggesting substantially wetter conditions than exist today.

These submerged cave deposits "are therefore taken to be evidence of past drier periods of climate when ground water levels were lower than now. This allowed deposition of speleothems in the deeper recesses of the caves that are now under water" (Brook et al. 1996:148). The dryness in the region could have resulted from reduced rainfall or from higher temperatures or a combination of these two factors. In the other caves used in this study, the extant spelothems are believed to represent evidence of past wetter conditions when water surpluses were higher than now thus allowing more water to make its way into the caves (Brook et al. 1996). "Wetter conditions may have resulted from an increased precipitation or lower temperatures of a combination of these" (Brook et al. 1996:148).

Brook et al. (1996) noted that "there was agreement between the U-series, TL, and corrected C14 ages on the timing of wet and dry periods over the range of the radiocarbon method" (1996:149). As mentioned above, the authors interpreted the submerged speloethems from the Otavi Mountains of Namibia and ages of the Etosha and Kalahari sand dunes as evidence of drier conditions in the past. The age ranges for the submerged speleothems were from 129,000-7,500 B.P. and there were two distinct groupings at 30,800-28,300 B.P. (4 dates) and 8,800-7,500 B.P. (3 dates). "If dryness of climate can be interpreted from the minimum amount of groundwater lowering necessary for speleothem deposition, then deep-sea isotope stage 5 (ca. 128-75,000

B.P.) was at times the driest period of the last 130kyr of so" (Brook et al. 1996:150). This was based on the Aigamas hemi-cenote water levels were 40 m lower than today at 112,000 +/-5,300 B.P. (Ag 92-3 outside) and 129,900 +/-6,900 B.P. (Ag 92-3 inside) and at Harasib they were 16 m lower than present at 107,600 +/-6,600 B.P.(H 92-6). From data presented in their Table 2 (Brook et al. 1996), there was a positive association between the submerged speleothem and sand dune ages as they both suggested dry conditions in the early Holocene and in the period from 34-28,000 B.P. (Brook et al. 1996:151).

Details for the time period between 300-50,000 B.P were summarized by Brook et al. (1996) as follows:

> Speleothem growth in the Transvaal, South Africa and in Botswana points strongly to wet phases of climate in both areas from 200-186, 133-131, 111-103, 93-83, and 77-69,000 B.P.. A carbonate raft deposit in Rossing Cave, Namibia indicates wetter conditions here at 260,000 B.P.. Ages of speleothems in Otavi Mountain Land caves in Namibia, presently under 9-40 meters of water, and times of dune activity in the Etosha-Kalahari region, suggest that the periods 130-111, 103-93, 83-77, and 69-50,000 B.P. were much drier than today. The period 130-111,000 B.P may have been particularly dry given that speleothems at the Aigamas hemi-cenote, now submerged by 40 meters of water, date to 130 and 112,000 B.P. (1996:151)

The time period from 50-13,000 B.P. in the region was summarized Brook et al. (1996) as follows:

> This period was characterized by five wet intervals at 50-43, 38-35, 31-29, 26-21 and 19-14,000 B.P.. Based on the number of speleothem and tufa ages, peak wetness was reached at 48-46, 37-36, 31-30, 27-26, 24-23, and 16-15,000 B.P.. The age of submerged speleothems in Namibia and dune activity at Etosha and in the Kalahari, as well as apparent hiatuses in speleothem and tufa deposition, suggest significant dry intervals

> at 35-31 and 30-27,000 B.P.. Speleothems deposited in Otavi Mountain Land caves during these intervals are now 5-13.5 meters underwater. Lower speleothem and tufa age frequencies suggest a third major dry interval at 43-38,000 B.P. and a short-lived dry intervals at 20-19 and 14-13,000 B.P.." (1996:151)

In summary then, Brook et al. (1996) presented evidence that during the last 300,000 years the summer rainfall zone in southern Africa had a number of wet and dry periods. According to Brook et al (1996) these periods seemed to be tied into the glacial to interglacial and interglacial to glacial transitions in the northern latitudes and that these transitions appeared to bring more moisture to the summer rainfall zone of southern Africa. "It also appears that glacial and interglacial maxima bring modest and severe dry intervals to the area respectively" (Brook et al. 1996:151). Finally, these authors noted that warmer intervals during oxygen isotope stage 3 (ca. 64-32,000 B.P.) brought wetter conditions to southern Africa, most notably the wet intervals at 50-43,000 and 38-35,000 B.P. and that cooler periods during oxygen isotope stage 3 brought slightly dryer conditions (Brook et al. 1996:151-152).

Fortunately a detailed site specific paleoenvironmental study has also been completed on the paleoenvironmental record for the sediments at the WPS by Andrew H. Ivester (1995) of the University of Georgia. It is not my intention to give a complete account of this research but some of the significant findings shall be mentioned in order to refer to them in the interpretation phase of this lithic analysis. I will also summarize evidence given by Brook et al. (1990, 1992) for the existence of a late Pleistocene lake at Tsodilo (Figure 4.5). This lake was located to the west of the Tsodilo Hills and its existence was indicated by a sheet of lacustrine carbonates which contain gastropods and freshwater diatoms. According to Brook et al. (1992) this former lake reached a maximum size of 8 x 5 km. So far, radiocarbon dates on calcrete deposits recovered from several fossil shorelines indicated standing water in the lake from 22,500-19,200, 17,500-11,700, and again at approximately 7,500 B.P. (Brook et al. 1990, 1992).

Prior to a discussion of the results of the sediment analysis for WPS, I will briefly describe the sediment sampling procedure undertaken by Dr. George Brook in 1991 and 1992 and subsequently analyzed by Andrew Ivester for a portion of his M.A. thesis in the Geography Department at the University of Georgia. During the summer of 1991 a 5.5 m excavation was undertaken at WPS. This excavation was extended to 7 m in 1992. Dr. Brook collected soil samples for the entire 7 m depth at 7.5 cm intervals along the south wall of Squares 12 and 23. Note that the sediment sampling ended at 705 cm, although the base of the archaeological excavation was actually 700 cm. These samples were then analyzed in the Geomorphology Laboratory at the University of Georgia for grain size distribution, organic and carbonate content, and Munsell color. The samples were also subjected to magnetic susceptibility and acid extractable element analyses (Ivester 1995:29).

According to Ivester (1995), the sediments from WPS were from two sources in varying proportions. These two sources of sediments were from sand dunes located adjacent to the Hills and the bedrock of the Tsodilo Hills themselves. "The relative proportion of dune to hill sediment can be identified based on differences in the source materials, and is a function of climate at the time of deposition" (Ivester 1995:47). Thus the source of sediment was the key to identifying the paleoenvironmental conditions prevailing at the time of deposition.

It was hypothesized by Ivester (1995) that during wetter periods the dunes would have been stabilized by increased vegetation and this vegetation would have prevented large amounts of dune sand from being deposited in the rock shelter. The increased moisture would also have caused increased chemical weathering of the parent bedrock of the hills and increase the local sediment input from the hill to the shelter. Thus, sediments with a higher proportion of material weathered from the hill would represent periods of wetter climates. "These sediments would be similar to the present-day hill sediments and bedrock; they would have higher gravel and course sand amounts, higher concentrations of certain elements, higher magnetic susceptibility, and would be less well sorted" (Ivester 1995:47).

Conversely, in drier periods it was hypothesized by

Ivester (1995) that local dunes would have reactivated and increased the sand deposition and decreased the weathering and input from the hills to the shelter. Thus, in his interpretation of the WPS sediment column Ivester used an estimate of the relative distribution of each of these sources to determine paleoclimatic conditions at the site (1995:47-48).

In his interpretation of the sediment characteristics at WPS Ivester (1995) utilized the percent of gravel throughout the stratigraphic column as evidence for past wetter and perhaps colder conditions. He assumed that during drier periods the coarser materials would be covered by aeolian sand. Thus, the gravel percentages would indicate "wetter periods characterized by vegetated and stabilized landscape and increased weathering of the bedrock at the Male Hill into gravel-sized clasts" (Ivester 1995:49). The gravel percentages of the sediments from the WPS rock shelter varied from 1-31% of the total clastic weight. Ivester (1995) noted that "certain levels have particularly high gravel concentrations, most noticeably at around 4 meters depth and again just below 5 meters" (Ivester 1995:49).

It should be noted that Ivester used the dates available at the time of his study, rather than depths; therefore, I have extrapolated depths from his Figure 5.4 p. 50. The reason for this modification was because Ivester did not have access to the more recent OES racimization and

AMS dates, or the University of Botswana TL ages. Thus, while I include Ivester's age estimates, they are not necessarily in agreement with my own estimates as will be shown below. Ivester (1995) suggested dry conditions at 49,000 B.P. (6.8 m), 46,000 B.P. (5.4-6 m), 42-41,000 B.P. (4-4.4 m), 38-37,000 B.P. (3.4-4 m) and again at 31,000 B.P. (1.2 m). The prominent gravel peaks which were interpreted as wetter and possibly colder conditions were suggested between 48-47,000 B.P. (6-6.2 m), at 43,000 B.P. (5.1-5.4 m), 40,000 B.P. (4 m) and between 37,000-32,000 B.P. (3.4-1.8 m) (Ivester 1995:49).

According to Ivester (1995), the rest of the sediment data supported the interpretation of the gravel percentages and "additional data of sorting of the sediment samples also proved valuable in determining the provenience of the sediments from the Rock shelter" (Ivester 1995:51).

> "As would be expected, the hill sediments are less well sorted and the dune samples are much better sorted. The sediments from WPS are of intermediate values, as would be expected since the shelter sediment is a mixture of the two source materials. Sorting is then a good indicator of provenance, with better sorting resulting from drier conditions and increased aeolian input from the dunes and poor sorting a result of the increased input of the coarse sands and clays from the hill during wetter periods" (Ivester 1995:51).

According to Ivester (1995), the sorting of the sand, silt and clay fraction correlated well with the gravel data presented above. The best-sorted samples come from above 120 cm in Holocene sediments and "poorly sorted sediments indicate drier (wetter?) and/or colder conditions at ca. 32

to 40,000 B.P.(1.3-4 meters) and at ca. 48,000 B.P (6.8 meters)" (Ivester 1995:51). He also noted a dramatic increase in coarse sands at around 41,000 B.P. (3.8-4.2 m). This increase in coarse sands "corresponds to the uppermost MSA artifacts and the appearance of fish remains in the profile, and indicates a rapid change to a wetter climate" (Ivester 1995:52). He also noted that coarse sand amounts remained fairly high from 40,000-30,000 B.P (4-1.3 m) which indicated a wetter environment (Ivester 1995:52).

Ivester (1995) also calculated carbonate percentages for the WPS sediments. These varied from 2-11% with the higher concentrations occurring at 160-360 cm, 420-440 cm, and 560-660 cm. According to Ivester, "the distribution of carbonate in the profile correlates well with the proposed wet periods, with increased carbonate precipitated approximately one meter below levels with high amounts of coarse material" (Ivester 1995:53).

Ivester (1995) assumed that during drier periods, very little gravel would be deposited and little or no carbonate would accumulate below the surface. Conversely, during wetter periods coarse material would be deposited, "the carbonate would be leached from the surface and reprecipitated at a depth of about 1 meter" (Ivester 1995:53). Finally, Ivester (1995) interpreted the climate at Tsodilo as "repeatedly oscillating from drier to wetter conditions since the Last Interglacial with a periodicity of approximately 3-4,000 years" (1995:67).

In summary, Ivester suggests dry conditions at 50,000-48,000 B.P. (705-645 cm) and again at 45,000 B.P. (562.5-540 cm), which was separated by a wet period from 48,00-45,000 B.P. (645-562.5 cm). At 45,000-42,000 B.P (540-457.5 cm) a "better substantiated wet and possible colder period occurred, forming the prominent lower schist cobble horizon" (1995:67). This schist layer was a distinct boundary separating the MSA from the LSA at WPS. The evidence presented by Ivester indicated the period of 42,000-41,000 B.P. represented by the 457.5-420 cm levels as somewhat drier.

Of all the sediment data on WPS paleo environmental conditions, one of the more significant was identified by Ivester (1995) as beginning around 41,000 B.P. and between 420-352.5 cm, which he interpreted as possessing good indicators of wetter and perhaps colder conditions. In these levels he identified "well sorted sands covered by large amounts of gravel and coarse, poorly sorted sands ... and an increase of heavy metals, such as chromium" (1995:67). These were interpreted as a dramatic change in climate occurring at this time suggesting wetter conditions. This wet period was followed by drier conditions between 352.5-300 cm and dated to between 38-37,000 B.P. (Ivester 1995:67).

According to Ivester, "one of the best evidenced climatic periods in the profile is the wet period H, from 37,000-32,000 B.P. (300-157.5 cm)" (1995:69). The end of this period was not clear-cut and Ivester interpreted this as indicating a gradual change to drier conditions. However, he determined that a drier climate was "certainly established by 33,000 B.P." (157.5-127.5 cm) (1995:69).

Ivester defines a break in sedimentation at 120 cm which he says "is seen in both sedimentary and archaeological data. The archaeology seems to suggest that the break is a result of cultural disturbance, although this cannot be shown conclusively" (1995:69). Ivester's sediment analysis in relation to the sudden break in the dates indicates a substantial gap in the WPS archaeological record. However, archaeological findings (viewed through lithic analysis) is another powerful line of evidence that can indicate whether or not there is a substantial break in occupation (mirroring the sediment evidence) or continuity (no evidence for a cultural hiatus) in occupation. Based on the lithic evidence already presented, I would argue that this break defined by Ivester has no real archaeological basis, at least based on the lithic data.

As previously mentioned, Brook et al. (1992) had identified a paleo lake at Tsodilo on the western side of the hills (Figure 4.5). Evidence of this lake was in the form of lacustrine carbonates that were deposited on several fossil shorelines. These carbonates were dated to 22,500-19,200 B.P., 17,500-11,700 B.P. and 7,500 B.P.. According to Brook et al. (1992), the lake was seasonal at 15,000 B.P. which was determined based on diatom assemblages with the inclusion of windblown sand. He interpreted a more permanent and deeper lake at 17,500 B.P.. Brook et al. (1992) believed that the lake was the result of increased summer precipitation combined with lower temperatures thus leading to lower evapotranspiration rates. At its height, the lake at Tsodilo reached a maximum area of 8 x 5 km with a depth of several m (Figure 4.5).

It is impossible to reconcile Ivester's WPS data with the paleo lake at Tsodilo as he interprets the period represented by Lake Tsodilo as missing from the WPS record. As already discussed in Chapters IV and V, there were two distinct occupation horizons (Robbins et al. 1994) which contained extensive evidence of a fishing economy at WPS. These deposits contained abundant fish bones and associated barbed bone points, and I believe that the fish were obtained locally. I will attempt to resolve this problem below.

I have already referred to the Depression Shelter located on the east side of the Female Hill at Tsodilo (Robbins 1990). The Depression Shelter provided a well dated archaeological sequence spanning the last 21,000+ years. Brook conducted a paleoenvironmental sediment analysis of Depression and identified coarser sediments which he interpreted as indicating wetter conditions (indicated by * below) in deposits dated to *21,500-20,500 B.P., *18,000-16,000 B.P., *14,500-13,500 B.P., 11,500-10,500 B.P., *7,500-6,500 B.P., 5,000-3,000 B.P., and 2000-

1000 B.P. (Brook, unpublished). Clearly, the wetter periods of Lake Tsodilo (Brook et. al 1992) were represented at The Depression Shelter.

In the following discussion I will attempt to reconcile the WPS paleoenvironmental reconstruction by Ivester (1995) with other regional studies which have already been discussed. This is very important, although difficult as discussed in the dating section of Chapter IV, due to the fact that much of the proposed reconstruction rests on dating of the various levels. As is apparent in Table 5 the various dating techniques did not always agree with one another on the ages of the various levels. This was particularly true for samples below 130 cm. In the discussion that follows, I shall attempt to interpret the dating evidence that appears to be the most logical and consistent to me and which is in agreement with the dated regional archaeological sequence and fits the paleoclimatic data as well.

Several paleoenvironmental studies in southern Africa are in accord with the revised results presented below (Table 27) for WPS. In the interval between 700-420 cm, roughly 103-50,000 B.P., the three dry phases at 103-93,000 B.P., 83-77,000 B.P., and 69-50,000 B.P. are correlated with dated speleothems in Otavi Mountain Land caves in Namibia, presently under 9-40 m of water and the timing of renewed dune activity in the Etosha-Kalahari region. The two wet phases between 93-83,000 B.P. and again between 77-69,000

Table 27 WPS proposed wet and dry periods and the dates for them. Adapted from Brook et al. (1996) which provided a well dated sequence for the region and provides a standard to place the WPS sediment sequence in the context of the dates that I believe are most reasonable. The depths and climatic interpretation are from Ivester (1995) and the dating is my current interpretation. As has been indicated above, my interpretation of the dates are different than Ivester's (1995).

Depth (cm) below surface	Age B.P.	Proposed Climate	Supporting Evidence (+) = high values (-) = low values
0-7.5	present-350	Dry	gravel, sorting, carbonate, carbon, Al (-)
7.5-15	350-700	Wet	gravel, organics, coarse sand, mag.susc., Fe, Cr, Cu, K, Ni, Pb, Zn (+)
15-37.5	700-1,000	Dry	gravel, sorting, coarse sand, carbonate, carbon, mag.susc. Ni, Pb, bone points, wetland mammals (-)
37.5-45	1,000-1,600 Sheep Jaw AMS 1,080+/-100 C14 1,225+/-60	Wet	sorting, coarse sand, organics, Al, Fe, Cr, Cu, K, Ni, Si, Zn, bone points (+)
45-112.5	1,600-2,600	Dry	gravel, coarse sand, carbonate, mag.susc., Al, bone points, wetland mammals (-)
112.5-127.5	2,600-6,900 C14 3,700+/-100 4,330+/-160 OES AMS 3,860+/-50 3,900+/-50 6,840+/-40	Wet	gravel, carbonate, organics, mag.susc., Al, Cu, K, P, Zn, Fe, Pb, Si, fish bones, bone points, wetland animals (+)
127.5-157.5	27-30,000	Dry	gravel, coarse sand, carbonate, mag.susc. (-)
157.5-300	30-38,000 OES AMS 31,220+/-320 33,470+/-250 33,020+/-270	Wet	gravel, sorting, coarse sand, carbonate, mag. susc., Al, Fe, Cr, K, Ni, P, Pb fish bones, wetland mammals, bone points (+)

Table 27 cont. WPS proposed wet and dry periods and dates for them.

Depth (cm) below surface	Age B.P.	Proposed Climate	Supporting Evidence (+) = high values (-) = low values
300-352.5	38-43,000	Dry	gravel,sorting,carbonate mag.susc.,Al,Fe,Cr,Ni(+)
352.5-420	43-50,000	Wet	gravel,sorting,coarse sand,carbonate,mag.susc Al,Fe,Cr,K,P,Pb,Si (+)
420-457.5	50-69,000 Fea. T.L. 55,430+/-4,700	Dry	gravel,sorting,coarse sand,carbonate,mag.susc., Fe,Cr,K,Pb,Si (-)
457.5-540	69-77,000 U.B. T.L. 66,393+/-9,411	Wet	gravel,sorting,coarse sand,carbonate,mag.susc., Al,Fe,Ni,Pb,Si (+)
540-562.5	77-83,000	Dry	gravel,sorting,coarse sand,carbonate mag.susc. Fe,Ni,Pb (-)
562.5-645	83-93,000 U.B. T.L 94,262+/-9,411	Wet	gravel,sorting, coarse sand, mag.susc., Cr,Cu,Ni,Pb,Zn (+)
645-705	93-103,000	Dry	gravel,sorting,coarse sand,Fe,Cu,Ni,Pb (-)

B.P are correlated with dated speleothem growth phases in the Transvaal, South Africa and in Botswana (Brook et al. 1996).

The wet and dry phases between 50-38,000 B.P. and represented by the levels between 420 cm and 300 cm at WPS are also supported by corresponding data elsewhere in the region. There also exists a very apparent double layer of schist fall fragments from the roof of the shelter at approximately 420 cm at WPS which marked the MSA/LSA boundary (Figure 4.11). Based on a number of speleothem and tufa ages cited by Brook et al. (1996), a wet interval was indicated between 50-43,000 B.P. with peak wetness reached at 48-46,000 B.P. Speleothem deposition at Drotsky's Cave (Figure 6.2) was reported between 45-37,000 B.P.. The dry period between 43-38,000 B.P. was represented by submerged speleothem in the Otavi Mountain Land caves (Figure 6.2) which are now under 5-13.5 m of water. Tufa age frequencies "also suggest a major dry interval at 43-38,000 B.P" (Brook et al. 1996:151). Evidence of low lake levels at Makgadikgadi (Figure 6.2) were also indicated between 47,000-45,00 B.P. (Thomas and Shaw 1991).

The wetter conditions represented by the period between 38-30,000 B.P and the levels between 300-157.5 cm at WPS are widely established in southern Africa. In Namibia evidence comes from the work of Brook et al. (1996), Diester-Haas et al. (1988), Heine (1987), Heine and Geyh (1984), Teller et al. (1990) and Vogel (1984). In addition

Makagdikgadi lake levels are reported as high between 40-35,000 B.P.(Shaw et al. 1991). At Drotsky's Cave, speleothem deposition occurred from 43-37,000 B.P. and 34-29,000 B.P.(Cooke 1984). Deacon and Lancaster (1988) reported a cooling trend began around 45-40,000 B.P in the oxygen isotope record of Wolkberg and Cango Caves (Figure 7.2), and frost spalling was reported at Border Cave between 38-33,000 B.P. (Figure 6.2). Deacon and Lancaster (1988) noted that this period was one of the wettest periods during the last 130,000 years in the region. According to Ivester, the sediments between 300-157.5 cm document that this was "certainly the most consistently wet period in the White Paintings record" (1995:82).

The dry period between 30-27,000 B.P. represented by the 157.5-127.5 cm levels at WPS could be related to submerged speleothems in Namibia and dune activity at Etosha and the Kalahari, as well as the apparent hiatuses in speleothem deposition in the Otavi Mountain Land caves which suggested significant dry intervals between 30-27,000 B.P. (Figure 6.2)(Brook et al. 1996:150).

As mentioned above, I am not completely satisfied with the 25,000 year gap in the WPS record between 30,000 and 5,600 B.P. proposed by Ivester (1995) and I have attempted to resolve this hiatus. However, I cannot fully support or refute the hiatus based on the archaeological, dating or the sediment data. Instead, I was left with a number of unanswered questions and several possible explanations.

Perhaps the dry period proposed by Brook et al. (1996:150) between 30-27,000 B.P. could have extended through the Last Glacial Maximum at 19,000-18,000 B.P. when according to Thomas and Shaw (1991), "cold and dry conditions prevailed, possibly accompanied by aeolian activity, with dry lakes and some peat formation" (Thomas and Shaw 1991:184). In this situation there is a good chance that the site would not have been inhabited during this time and perhaps a significant aeolian fill occurred in a relatively short time which could help explain Ivester's (1995) hiatus in the WPS sediment record. A second possibility considering that the levels below 130 cm were cemented, perhaps little deposition occurred and the dune sediments simply blew over the site without accumulating or settling. A third possibility which I have considered is related to the extent of Paleo Lake Tsodilo and the possibility of periodic flooding of the site. According to Thomas and Shaw "this (wet) episode was of probably of greater extent and humidity than envisaged by Deacon and Lancaster (1988), and extended from the Zambezi as far as the Orange-Vaal drainage, as shown by the remarkable lake level changes at Alexandersfontein (Butzer et al. 1973) and Swartkolkvloer Pan (Kent and Gribnitz 1985) in the northwest Cape" (1991:184). The wet phases may have stabilized the local vegetation during the documented phase of greater moisture availability throughout the Kalahari from 17,000-12,000 B.P., with a well established core at 16-13,000 B.P. (Thomas and Shaw 1991:184) to reduce accumulation of shelter deposits.

These various conditions could explain at least a portion of the gap proposed by Ivester (1995). In addition, Ivester (1995) interpreted the levels between 112.5 and 45 cm as dry, however, the levels between 80-110 cm have numerous fish bones and bone harpoons which seem to indicate a moist environment based on the archaeological remains. Although these levels are not critical to the main focus of this dissertation, I feel that it is important to mention this for future discussion.

With my concerns noted above, I have basically adopted Ivester's interpretation of the Holocene record at WPS which appear to date to roughly the last 7,000 years.

A CONSIDERATION OF PALEOENVIRONMENTS AND RELATED MSA/early LSA ADAPTATIONS DURING THE PERIOD ca. 70,000-30,000 B.P.

As is apparent from the foregoing discussion, the environmental conditions in southern Africa during the roughly 40,000 years under consideration (ca.70,000-30,000 B.P.) often differed from those of the present. For portions of this time period climates were cooler and wetter or drier and warmer than today. Geological, paleoenvironmental, paleontological, palynological and archaeological evidence indicate that during Oxygen Isotope Stage 4 (ca. 75-64,000 B.P.), Stage 3 (ca. 64-32,000 B.P.), and Stages 2 (ca. 32-12,000 B.P.), habitats were more open and grassy, and the mammal populations were dominated by medium to large grazing species including equids and alcelaphines (eg. hartebeest) (Butzer and Helgren 1972; Butzer 1984; J. Deacon 1989; Stuckenrath et al. 1978; Klein 1974a, 1974b, 1977a, 1980a, 1989, 1995). As I discuss MSA/early LSA adaptations, I need to mention that most of data are from the Cape area of South Africa and there was probably some variability in the habitats across the southern African region as a whole.

Below, I will discuss the current state of understanding of the relationship of Later Pleistocene paleoenvironments and MSA/LSA adaptations. As I previously mentioned, a great deal of progress has been made in recent years in the available paleoenvironmental data for the region, as well as in the archaeological data base. However, at this time these data still only allow general reconstructions and, as will be apparent, interpretations of the current data are still being debated (Klein 1995, Brooks et al. 1990; Brooks and McBrearty 1998; Wadley 1998).

Since there are well documented environmental changes within the late Pleistocene in the region, it is clear that we can not assume any long term environmental stability. Furthermore, it is clear that these changing environmental condition would certainly have played a major role in human adaptations in the region (Butzer 1984; Butzer and Helgren 1972; H.J. Deacon 1979, 1989; Klein 1980a, 1989; Martin, 1968; Thomas and Shaw 1991).

According to Klein (1989, 1995), most MSA/early LSA sites in southern Africa do not possess well-preserved animal bones. In addition, the end of the MSA/beginning of the LSA "may prove particularly difficult to study in Southern Africa, because many sites were abandoned in the 60-30,000 B.P. interval when it occurred, probably because of widespread hyperaridity in the middle of the Last Glaciation" (1989:534). However, animal remains do occur at some sites. Therefore, these sites are particularly important in conjunction with paleoenvironmental and archaeological data to interpret the habitats and subsistence of MSA/LSA populations inhabiting southern Africa.

Klein's analysis of well-dated terminal Pleistocene and Holocene faunas from both archaeological and non-archaeological sites (1977a, 1980a, 1989, 1995) indicated that the paleoenvironmental situation during various times was at least as important as cultural selection in the proportional representation of large mammal species in LSA archaeological contexts. According to Klein (1989), in LSA assemblages small, non-gregarious browsers and mixed feeders were the most common fauna throughout the Holocene, when closed, non-grassy vegetation dominated the region. However, in examining terminal Pleistocene faunal assemblages, Klein (1989) noted a much higher proportion of gregarious alcelaphines and equids which he equated with colder and drier climates and the widespread occurrence of open grasslands during this time period. Again as mentioned above, some variability is expected across Southern Africa based on the paleoclimatological data discussed previously.

According to Klein (1976b, 1989), the MSA faunas are dominated by open country forms. In his analysis of the Klasies River Mouth site (Figure 2.1) in the southern Cape of South Africa, faunal samples from the last interglacial-early last glacial period he observed a correlation between intervals of colder climate and a comparatively high incidence of alcelaphines and equids. At Klasies River Mouth, in the levels indicating warmer periods, Klein (1976b) noted a distinctive increase in smaller bovids which are currently found in closed habitats.

Other sites with a fairly large MSA/LSA faunal assemblages used by Klein in his assessment of MSA/LSA adaptations were Die Kelders 1 (Klein 1975a) and Boomplaas (Klein 1978c) (Figure 2.1). According to Klein (1975a), at Die Kelders the early Last Glacial levels were dominated by evidence of gregarious grazers and at Boomplaas, Klein (1978c) noted that alcelaphines and equids were hunted with less frequency during the documented cool phases of oxygen isotope Stage 3 (ca. 64-32,000 B.P.) than by later LSA inhabitants occupying the site during the cold interval which occurred during the terminal Pleistocene.

Klein (1979, 1989, 1995) argued that the terrestrial faunal remains suggested that MSA populations were less effective hunters, than their LSA successors. He outlined the southern African data for modern human origins with an emphasis on whether the biological modernity inferred from the fossils was accompanied by behavioral modernity as inferred from associated artifacts and animal bones.

Based on the human fossils Klein (1979, 1989, 1995) argued that early Upper Pleistocene people in southern Africa were clearly more modern than their Neanderthal contemporaries in Europe. The artifacts associated with the human remains have consistently been assigned to the MSA and dominated by flakes or flake-blades from prepared cores, and the principal retouched pieces were scrapers, points, and denticulates.

The subsistence of the MSA peoples were inferred by Klein (1979, 1989, 1995) by the animal remains from the MSA levels at the various sites discussed above. He argued that these remains do not suggest fully modern subsistence behavior. The evidence for this noted by Klein (1979, 1989, 1995) were the lack of fish and flying sea birds and the percentages of ungulate species in MSA verses LSA faunal assemblages. Klein (1989) noted that at LSA sites the "ungulate species are roughly proportional to their historical abundance near the sites, while last interglacial MSA sites tend to contain ungulate species in rough proportion to the danger involved in hunting them" (Klein 1989:536). He concluded that MSA people lacked the ability to hunt truly dangerous animals on a regular basis.

According to Klein (1979, 1989), at both Klasies River Mouth and Die Kelders 1 (Figure 2.1) MSA fauna assemblages contrast with LSA ones in that eland were relatively more common and suids (warthog or bushpig) were rare. Klein suggested "that the relative abundance of eland in the MSA faunal assemblages reflects the docility of this species when confronted by hunters, while the rarity of pigs may reflect their ferocity, at least when attacked" (1979:156).

Klein (1978d, 1989) also studied age distributions of several species of large bovids from the Klasies River Mouth MSA levels and the Nelson Bay Cave (Figure 2.1) LSA faunal samples to examine shifting hunting efficiency and/or strategies. He discovered no real differences between the sites in the age distributions of the species that they share in common, "but there are significant differences in the age distributions among species" (1978d:195). From these age distributions Klein recognized these two basic patterns:

> Pattern 1: Among the blue antelope (_Hippotragus leucophaeus_), roan antelope (_Hippotragus equinus_), Cape buffalo (_Syncerus caffer_), and giant buffalo (_pelorovis antiquus_), the archaeological samples contain numerous very young animals and relatively few prime-age adults. In the buffalo samples, there is also a fair representation of old adults.

> Pattern 2: Characterized by the bastard hartebeest (_Damaliscus dorcas_) and the eland (_Taurotragus oryx_), the prime adults are far more prominent relative to younger and older age groups.

According to Klein (1978d), the first pattern would be similar to the natural pattern of death that would characterize all healthy stable populations of these animals. The second pattern was "reminiscent of the age structure of live herds" (Klein 1978d:195). Klein interpreted the first pattern as reflecting hunting focused on individual animals, emphasizing the animals in the age range in which they were most vulnerable. The second pattern Klein interpreted as reflecting the "susceptibility of certain species to driving, so that whole groups could be killed in traps in which differences in age had no meaning" (1978d:195).

Klein (1979) interpreted Pattern 1 or the "natural mortality pattern" as essentially identical to that of modern buffalo killed by lions. This, according to Klein, represented a predation strategy that would have posed no long-term threat to the vitality of these species. The second pattern, however, in which many of the reproductively active prime adults were killed would have the potential to drive the prey species to local extinction. Of interest, Klein noted that this would not be the case for the eland. "Eland groups tend to be widely dispersed, to wander widely, and to be generally difficult to locate" (Klein 1979:159). Therefore, even if isolated groups were eliminated during drives, this would only be a fraction of the numbers available.

Klein interpreted the prominence of the eland in the Klasies River Mouth MSA assemblages as indicating the MSA peoples' inefficiency in dealing with other large bovids, combined with the ability to hunt eland by driving. He also concluded that the higher proportion of non-eland bovids and the presence of greater numbers of suids (pigs) as indicating a greater effectiveness of the LSA peoples in utilizing the local faunal resources (1979:159).

In summarizing his position in 1989 Klein states that:

> Present interglacial LSA sites contain ungulate species in rough proportion to their historical abundance near the sites, while last interglacial MSA sites tend to contain ungulate species in rough proportion to the danger involved in hunting them. In particular, compared to LSA faunas, MSA ones are much richer in the relatively docile eland and much poorer in the more dangerous Cape buffalo and bushpig. The significantly greater abundance of buffalo and bushpig versus eland in LSA faunas is reminiscent of their relative abundance in the historic environment (1989:537-539).

Klein interpreted these contrasts as being supported in differences between MSA and LSA artifact assemblages. Klein maintains that only in LSA assemblages were there artifacts that suggest the presence of the bow and arrow. "With the bow and arrow, LSA people could have attacked dangerous species from a distance at reduced personal risk" (1989:539).

Overall, Klein contended that if the early Upper Pleistocene peoples were anatomically modern, that the artifacts and faunal remains suggested less than fully modern behavior. Therefore, "the evolution of modern physical form preceded the evolution of fully modern behavior" (1989:543).

H.J. Deacon (1989) interpreted the southern African data on MSA/LSA subsistence quite differently from Klein using some of the same data, particularly from Boomplaas and

Klasies River Mouth (Figure 2.1). Based on the archaeological and faunal evidence, he argued that Middle Stone Age peoples did not differ from the Later Stone Age peoples in their basic subsistence ecology, and that their subsistence behavior was essentially modern.

As evidence for this similarity, H.J. Deacon pointed to the distribution of MSA sites in the southern Cape as the same as that for the LSA and "markedly different from that of the Acheulian distribution" (H.J. Deacon 1989:557). He suggested that MSA and LSA peoples were moving away from water sources near the coast to sites high up in the Cape mountains and that both MSA and LSA peoples made frequent use of rock shelters. H.J. Deacon viewed this shift in site locations as "a change in the perception of the potentials of the environment" (H.J. Deacon 1989:557). These environmental potentials were, according to H.J. Deacon (1989), the beginning of the exploitation of "fynbos" and a diverse "geophyte flora" associated with it, some of which have a large part of their biomass concentrated below ground. He noted that "natural fields of geophytes grow along the mountains and in acid soils along the coastal margin. It is the distribution of these resources that explains the wide range of Middle and Later Stone Age locations" (H.J. Deacon 1989:557). Based on this data H.J. Deacon concluded that MSA people did not differ from LSA people in their basic subsistence ecology, and that the MSA peoples subsistence behavior was essentially modern.

As evidence for this type of economy in both the MSA and LSA, H.J. Deacon (1989) discussed the Howieson Poort levels at the Klasies River Mouth main site. In these levels were a number of "conspicuous lenses of carbonized materials (which) represent the same kind of accumulations of the inedible residues of geophytic plant food as have been documented from Melkhoutboom Cave in the Holocene" (H.J. Deacon 1989:557). H.J. Deacon also argued that in order to be exploited on a long term basis, the geophytes would have to be periodically burned. As evidence for MSA control of fire he pointed to the abundant hearths in the MSA levels at the Klasies River Mouth main site, and at Boomplaas "the hearth features are identical to those in the LSA. This provides evidence for the ability to make fire at will and to manage geophyte patches in the Middle and Later Stone Ages in a way that was not available to the Acheulian populations" (H.J. Deacon 1989:557).

H.J. Deacon (1989) maintained that a subsistence base that emphasizes carbohydrate-rich and low protein food sources like geophytes would require the "episodic ingestion of higher quality food- which is how hunting and scavenging for meat relates to gathering in this system" (H.J. Deacon 1989:558). This he saw as being fulfilled by collecting shell fish. H.J. Deacon (1989) also argued that the lack of fish in the MSA levels mentioned by Klein (1989) had to do with the investment of time and energy in fishing and the availability of other higher-ranked protein sources to the

MSA inhabitants, rather than their ability to catch fish.

H.J. Deacon responded to Klein's (1980, 1989) noted absence of flying birds in the MSA as opposed to LSA sites by arguing that in the LSA it was "the value of bird bone as a raw material (for tools), rather than their carcasses as food" (H.J. Deacon 1989:558). He also responded to Binford's (1984) suggestion that MSA subsistence at Klasies River was based on scavenging versus hunting; that the MSA inhabitants lacked the food-sharing ethic; and a "base camp" due to the small size of the food sources. Deacon's response to Binford's interpretation was that the MSA people practiced "an opportunistic approach to obtaining protein in a basic plant food diet" and that "distinctions between hunted and scavenged foods becomes blurred and the size of individual meat packages provides no reliable criterion for the identification of sharing" (H.J. Deacon 1989:558).

H.J. Deacon (1989) also noted that Holocene hunter gatherers residing in the same habitats used small nocturnal and territorial bovids, and even game like hyrax and tortoise as protein sources; "these are foodstuffs which occur in small packages, but there is no question that such groups practiced food sharing" (H.J. Deacon 1989:558).

In reference to the Florisbad (Figure 2.1) MSA fauna analyzed by Brink (1987), H.J. Deacon noted that they indicated that the MSA inhabitants were selectively hunting small to medium sized bovids and were scavenging hippopotamus. Based upon these data H.J. Deacon (1989), concluded that the MSA peoples were not less effective in hunting selected prey species than LSA peoples. Furthermore, he felt that MSA peoples' ability to solve problems relating to resources was "modern". H.J. Deacon pointed out that based on MSA peoples' use of their habitat that their perception of their environment was "the same as their Holocene successors and in their subsistence behavior they show the same reliance on carbohydrate-rich plants, supplemented by animal protein and the use of shell fish as a source of nutrients, as found in the Later Stone Age" (H.J Deacon 1989:558-559).

H.J. Deacon (1989) also considered technological evidence of the transition between the MSA and LSA and whether it in fact represented a major change in behavior and concluded that it did not. Using data from the Klasies River lithic assemblages by Singer and Wymer (1982), H.J. Deacon (1989) pointed to significant changes in artifact typology through time in the sequences labelled MSA I, MSA II, Howieson's Poort, MSA III and MSA IV substages by Singer and Wymer (1982). However, according to H.J. Deacon (1989), even though he accepted these substages as having a sound technological basis that these divisions "tend to obscure the basic technological continuity throughout the sequence" (H.J. Deacon (1989:559). Therefore, H.J. Deacon (1989) stressed the technological continuity throughout the MSA based on "the production of standardized flake-blade blanks from prepared cores, with shaping through secondary retouch and in the case of Howieson's Poort levels, of the use of blunting or backing" (H.J Deacon 1989:559).

Based on the technological studies of the LSA by Janette Deacon (1972, 1984), and by comparing these data to the MSA sequences recognized by Singer and Wymer (1982), H. J. Deacon (1989) interpreted the MSA as demonstrating subtle changes in stylistic attributes over time. He also suggested that the horizon marker proposed by Singer and Wymer (1982) for MSA II as a short "stubby" point was one stylistic element which was replaced by segments and "trapezes" in the overlying Howieson's Poort levels. According to H.J. Deacon (1989), at Boomplaas and Klasies River, the Howieson's Poort horizon was associated with "a period of regressing sea level that equates with a glacial event, and cooler and drier climates are indicated in the associated biological and isotopic data" (H.J Deacon 1989:559). He noted that the end of the Howieson's Poort horizon and the transition to the MSA III "approximates to the maximum of the regression and the rapid amelioration of climates which followed the full glacial conditions" (H.J. Deacon 1989:559-560).

The fact the Howieson's Poort horizon coincided with a period of variable and deteriorating environmental conditions led H.J. Deacon (1989) to suggest that the Howieson Poort Industry was linked to the problems of coping with increasing environmental stress. "Such stress may have more to do with the maintenance of populations and their social structures under conditions of lowered habitual productivity, than simply coping with colder and drier conditions" (H.J. Deacon 1989:560). He viewed the Howieson's Poort industry with its standardized backed tools and the preferential use of high-cost raw material, for example silcrete over quartzite, "as a solution to environmental stress which with the release of this stress with the amelioration of environmental conditions the subsequent MSA III reverts to type" (1989:560).

H.J. Deacon (1989) made a stylistic and structuralist argument to support these conclusions. However, I think they are less convincing than his functionalist interpretation of the Howieson's Poort Industry.

In discussing the Boomplaas (Figure 2.1) sequence in relationship to the MSA-LSA transition, H.J. Deacon (1989:561) noted that "it corresponds to the initiation of a glacial event which seems similar to the one documented for the MSA II-Howieson's Poort transition although the latter happened 50,000 years earlier" (H.J. Deacon 1989:561). At Boomplaas, he noted that the final phase of the MSA in the BP member was dated to ca. 32,000. In these levels the tools were characterized as long flake-blades and the use of prepared cores. "In the succeeding YOL member there is a very low density of artifact finds, but they include novelties like bone points" (H.J. Deacon 1989:561). According to H.J. Deacon, at that point in time the use of the prepared core technique for the production of flake-blades "falls away and the miniaturization of at least the blade component becomes pronounced from 21,000-18,000 years ago" (H.J. Deacon 1989:561). H.J. Deacon (1989) also discussed the climatic amelioration which occurred after the last Glacial Maximum (ca. 18,000 B.P.) as corresponding to the development of the "classic" LSA sequence of the southern Cape documented by J. Deacon (1984).

Overall, H.J. Deacon (1989) argued that the MSA/LSA transition did not represent a major change in the "quality of human behavior". He based this on the fact that "the level of technology practised is not correlated with behavioral potentials" (1989:561). Using a similar argument he suggested that the use of bone tools, shell ornaments, leather clothing and the practice of rock painting, as seen in the LSA, "are not markers of a different quality of human behavior and are in a sense epi-phenomena. The absence of these attributes does not preclude the Middle Stone Age populations from being behaviorally modern" (H.J. Deacon 1989:561). Finally, H.J. Deacon concluded that "people in the southern Cape 100,000 years ago were anatomically modern as well as behaviorally modern" (H.J. Deacon 1989:561).

Interestingly, new evidence from Blombos Cave (Henshilwood and Sealy 1997) shows that bone artifacts, as well as fishing were known in MSA times. In addition, data in support of H.J. Deacon position also occur at the site of Gi, an open-air site in the northwest Kalahari on the Botswana-Namibia Border which was already discussed in

Chapter V (Brooks et al. 1990). According to Brooks et al. (1990) "the MSA materials at Gi document several behaviors normally associated with anatomically modern humans in Howieson's Poort levels of disputed age or in LSA or Upper Paleolithic contexts younger than 30 ka." (Brooks et al. 1990:62). According to Brook et al., the archaeological materials recovered from MSA contexts at Gi and representing behaviors normally associated with fully "modern" behavior were:

> 1. "over 400 projectile points of standardized shape and size apparently modified for hafting".
> 2. " association (of MSA material) with the remains of large, dangerous, or elusive prey species (<u>Phacoerus</u>, <u>Pelorovis</u>, <u>Equus</u> cf. <u>capensis</u>, <u>Megalotragus</u>)".
> 3. (The)"use of grindstones". (Brooks et al. 1990:62)

The LSA assemblage at Gi is also of interest as it represents a long time span and appears to represent a great deal of continuity through time. According to Brooks et al. (1990), "... these (the LSA assemblage) do not appear to change throughout the (LSA) sequence and can be linked at the top to the modern San or Bushman inhabitants of the area" (1990:62).

The debate surrounding "modern" human behavior continues in earnest (Brooks et al. 1995; Brooks and McBrearty 1998; Klein 1995; Wadley 1998). Once I have presented the data for changes in mobility, trade and exchange at WPS during the upper MSA and early LSA in Chapter VII, I will return to this issue of "modern" human behavior, in my interpretation and conclusions section of Chapter VIII.

CHAPTER VII

CHANGING HUNTER-GATHERER MOBILITY PATTERNS AND RAW MATERIAL ACQUISITION/EXCHANGE PATTERNS THROUGH TIME AT THE WHITE PAINTINGS SHELTER

This chapter addresses the applicability of current models of hunter-gatherer mobility to the lithic analysis of WPS. In this analysis of changing hunter-gatherer mobility as evidenced at WPS, I intend to examine three important issues: 1) since there is a vast ethnographic data base on the Kalahari San, I will examine how these data can be used to interpret the archaeological record at WPS; 2) as there have been documented changes in the paleoclimate of the region, and a lake in the Tsodilo area at various times during the Late Pleistocene and Holocene (Figure 4.5), I will assess the possible impact that the presence or absence of this fresh water source had on mobility during these times; 3) I shall examine how mobility relates to changing raw material preferences over time. Again utilizing the paleoclimatological data, it is anticipated that during wetter periods, mobility would be restricted and more local sources of raw material would be used, and conversely during the drier periods of the past, that raw material acquisition patterns would reflect increased mobility and higher percentages of exotic raw materials would be in evidence at WPS. These shifting raw material acquisition patterns will assist in identifying how and when the exchange relationships changed over time for the inhabitants of Tsodilo.

As mentioned at the end of Chapter VI, LSA assemblages in southern Africa are usually attributed to San or ancestors of modern San (Brooks et. al 1990; Yellen 1977; Brooks and Yellen 1977, 1987; Wadley 1989) and although further removed in time, I believe that the early LSA occupations of WPS were produced by ancestral San groups in a very remote sense. Therefore, the archaeological mobility models discussed below may be combined with the ethnographic (ie. Lee 1979) and ethnoarchaeological (ie. Yellen 1977) data to develop a number of testable hypotheses regarding the use of WPS through time. Before I continue with this discussion, I wish to state that I am well-aware of the fact that ethnographic band size among the San has probably been influenced by contact with agropastoralists as well as colonialism, but these factors cannot be fully controlled in the reconstruction of archaeological models of the kind utilized below.

The practice of group aggregation and dispersal is universal among hunter-gatherers (Kelly 1995). According to Wadley (1989) modern San aggregation camps are characterized by "socialization, ritual, formal behavior and active manufacture of tools and gifts for hxaro exchange" (Wadley 1989:42). In contrast, according to Yellen (1977) dispersal phase encampments contain expediently produced assemblages. It is assumed that like their modern counterparts, Stone Age aggregation sites should contain evidence of similar assemblages. That is, at aggregation sites it is expected that higher frequencies of standardized, curated artifacts and increased evidence of tool manufacture will be present in the artifact assemblages, while on the other hand, an "expediently" produced artifact assemblage, with few standardized or curated artifacts is expected in dispersal camp assemblages. Finally, it is expected that shifting aggregation centers and/or difficulty in aggregating in harsh environments could have affected both the distribution and character of Stone Age assemblages.

Clark (1959) was the first researcher to suggest that different environmental conditions in southern Africa could effect the character of stone tool assemblages. This led to the subsequent interest in reconstructing environments, diets, settlement patterns, seasonality and scheduling (Carter 1970; Deacon 1976; Parkington 1977; Yellen 1977; Klein 1980, 1981; Cable 1984; Mazel 1983; Wadley 1984, 1989).

Before reviewing some of the ethnographic models I will utilize for this discussion, I wish to state that I do realize that late Pleistocene and early Holocene hunter-gatherers certainly differed from their modern counterparts. However, there is some convincing evidence that there are significant technological continuities between modern hunter-gatherers and certain aspects of Stone Age assemblages (Brooks et al. 1990; Yellen 1977; Brooks and Yellen 1986). Thus, I believe that models which are derived from San ethnography are preferable in most cases to models derived from other regions.

According to Silberbauer (1981), among the Central Kalahari Gwi, during the dispersal phase of the year, life is generally informal and small groups separate from the larger band. During this phase husbands and wives work closely together at subsistence activities. This is an energy conserving period when ritual, traveling and even subsistence work are minimized (Silberbauer 1981:202-247). According to Lee (1979), during the dispersal phase, the making or even mending of tools is infrequent (Lee 1979:265) and Wadley (1989) noted that manufacturing is not very important during the dispersal phase because it "is not practical to store or transport gifts or tools for later use and, apart from this, stock-piling of possessions is not part of the traditional San value system" (Wadley 1989:43).

According to Lee (1979) and Marshall (1969), during the dispersal phase, many of the social rules relating to the sexual division of labor are relaxed and men often do things like help gather plant foods or firewood which are tasks that are traditionally in the female domain during the aggregation phase (Marshall 1969:97).

The aggregation phase is quite different. Kin-related households congregate at this time and there is a great deal of socializing, the making and exchanging of gifts, marriage arrangements, and major rituals such as initiations and trance dancing (Lee 1979; Tanaka 1980; Silberbauer 1981).

Even though the aggregation phase may only last for a few weeks, the San view it as central to the maintenance of the social order. It is through aggregation that they gain access to social, religious and economic resources. During this period a delayed gift exchange called hxaro takes place and there is a consistent flow of valued artifacts, particularly beads and arrows (Wiessner 1977, 1882, 1983, 1984).

Archaeologists are well aware of the classification of sites into "home bases" and "special purpose" sites (Wadley 1989). Several models can be derived from the San ethnography briefly discussed above. First, that open-air aggregation sites will contain numerous widely distributed tool scatters (Yellen 1977; Brooks 1984; Sampson and Bousman 1985). It needs to be stressed that rock shelter or cave sites are not discussed for the current San because such sites were no longer being used at the time of the ethnographic study of the San. Thus, the distinction between dispersal and aggregation sites must be extrapolated by the range and number of tools and other artifacts present. This type of research has already been attempted by Parkington (1980, 1981, 1984), Walker (1995) and Wadley (1989) for southern Africa, as well as in Europe at the famous cave art site of Altamira in Spain. At Altamira, Conkey (1980) interpreted the site as an aggregation site due to the presence of large quantities of decorated antler artifacts.

The aggregation phase sites should contain "curated" artifacts of standardized morphology. The "curated" artifacts could include items that have been carefully made which were carried from camp to camp and were mended when necessary (Binford 1983). In addition, aggregation sites should contain evidence of manufacturing in the form of lithic debris from stone tool or bead manufacture and perhaps evidence of intensified ritual in the form of decorated objects or paintings (Lewis-Williams 1984). In contrast to the aggregation sites, the dispersal phase camps should have low densities of "curated" artifacts like beads or decorated objects. The majority of the tools present should be informally worked (expedient) and made from predominantly local raw materials which were discarded shortly after use (Binford 1983:145-146).

From the LSA of southern Africa, the crescent (segment) is one of the most standardized retouched tools based on quantitative morphological studies (Deacon 1984). These crescents (segments) are believed to have been parts of composite tools or arrow barbs. This deduction is based on some pre-1920 San arrows that have microliths made of glass as arrow barbs (Goodwin 1945; Deacon 1984:316). Also, some southern African crescents (segments) have mastic on them which indicates that they were part of composite tools (Deacon 1976:59). Although not necessarily contradictory to the idea that crescents (segments) were part of composite tools, recent microwear studies of this tool type from

Jubilee Shelter in South Africa (Figure 2.1) have shown polishes associated with working plant materials such as wood (Wadley and Binneman 1995:153-155).

In southern African MSA assemblages, the MSA unifacial or bifacial points are also fairly standardized (Volman 1981, 1984; Brooks et al. 1990) although not to the same degree as crescents (segments). The microwear studies by Dr. Randolph Donahue of a sample of WPS MSA points indicates that they too may have served as projectile points (Dr. Randolph Donahue personal communication and ms. in prep.) and the thinning of the bases of some of the MSA points from a number of regional sites may indicate that they were hafted (Brooks et al. 1990; Volman 1981, 1984)

In comparing the upper MSA, "Large Blade" and "Lower Fish" assemblages from WPS with the models presented above, it became apparent that applying these inferences to the upper MSA occupations is difficult. When using models developed from modern ethnographic studies to remote time periods like the upper MSA, the ethnographic models applied to transitional and early LSA assemblages below become more suspect. Certainly aggregation sites should contain evidence of the widest range of activities and thus they would seem to be the best for detecting changes through time. However, much depends on the amount of tool manufacture, the intensity and frequency of aggregation and the types of social and ritual activities carried out by the site's inhabitants. Of course, these variables could be influenced by factors such as changing group composition and environmental conditions.

Changing environmental circumstances can result in an almost infinite range of responses all directed toward continuing survival of the individuals and groups. Addressing some of the possible responses, Wadley (1989) noted that "environmental stress may result in two different and opposing needs: first the need to gain access to a neighboring territory; and second, the need to keep neighbors out of your territory" (1989:48). According to Wadley (1989) when it is possible to transfer membership from one group to another, this is a means to cope with local environmental stress. Other researchers note that when regional environmental conditions shift dramatically, this may encourage territoriality (Cashdan 1983:54). As a case in point, Cashdan (1983) discussed the relative abundance of resources as decreasing from the !Kung area in the north to the !Ko area in southern Botswana. Significantly tighter social units were observed among the !Ko and the units become looser in membership as one moves north into !Kung territory (Cashdan 1983). According to Cashdan (1983), the !Ko display great territoriality and rarely travel outside their home territory. Thus, the !Ko respond to scarcity by avoiding ties with outsiders.

The presence of regional shortages or environmental stress may also influence the content and distribution of aggregation sites. The aggregation site must be able to support a large population for at least a few weeks. According to Wadley (1989), low biomass areas may have the potential to feed small bands and such areas might not be occupied unless they are contiguous with territories that are able to sustain periodic aggregations. Thus, aggregation centers may develop. "These centers may have shifted many times during the Stone Age to accommodate regional deteriorations or ameliorations in the environment" (Wadley 1989:48).

Group size also may have fluctuated over time. It appears that during the Holocene bands were fairly small (Brooks and Yellen 1986). However, a different scenario has been suggested by H.J. Deacon (1976) for the later Pleistocene. H.J. Deacon believes the hunting of large migratory herd animals in the late Pleistocene was correlated with large group organization, lower population density, larger territorial ranges, and an absence of fixed territorial boundaries during this time (H.J. Deacon 1976:163). This type of social organization is quite different from those of ethnographically documented small band societies.

Although not always mutually exclusive, cooperative large group hunting of large gregarious bovids with spears, which has been suggested for the later Pleistocene by H. J. Deacon (1976), is quite different from individual or small group hunting with bows and arrows. The former type of hunting did not depend on surprise and the animals may be driven and dispatched with spears (Klein 1989). According to Lee (1979), this type of hunting can involve men, women and children (Lee 1979:234). The latter form of hunting a few men hunt with bows and arrows and use stealth to approach game. According to Biesele (1975) and Marshall (1976), when only a few men hunt with bows and arrows, strict rules exist for the division of the products of the hunt. However, when large animals were hunted by groups with spears, no such rules for distribution applied.

I do not advocate a complete cause and effect relationship between spear and group hunting and bow and arrow and individual hunting. However, based on the archaeological evidence further discussed below, I do suggest a possible scenario similar to H.J. Deacon's (1976) for Late Pleistocene populations, for the upper MSA populations who occasionally inhabited WPS. It appears that these people did have the technological means to produce spears, but based on current evidence, probably lacked bows and arrows.

For the reasons outlined above, I have difficulty in applying the aggregation and dispersal models to the upper MSA assemblage at WPS. Furthermore, based on paleoenvironmental evidence, the increased number of regional sites, and overall artifact density at sites during this period, I view the upper MSA period as being associated with demographic expansion, when peoples moved into new territories where land and resources were plentiful.

From current evidence it appears that the MSA was the time of the initial occupation of Tsodilo. Elsewhere in Botswana, for example surrounding the Makgadikgadi Basin, the first really widespread and noticeable occupations occurred during the MSA (Robbins and Murphy 1996). In this model, rules for group membership would emphasize inclusion rather than exclusion. This may assist in explaining the dramatic increase in non-local lithic debris and MSA points in the upper MSA levels at WPS (Tables 25 and 26). From the magnitude of the change and the differences noted above, it appears that the MSA inhabitants of WPS may not have practiced the same aggregation-dispersal pattern observed in the transitional MSA/early LSA and the early LSA discussed below. I suggest that the MSA peoples did not aggregate or disperse. The pattern of large, local group organization, low population density, large territorial range and weak territoriality suggested by H.J. Deacon (1976) may explain the lack of aggregation and dispersal. I will return to this issue below.

The "Large Blade" transitional MSA/early LSA assemblage (300-420 cm) was quite different from that encountered in the upper MSA assemblage. These levels contained significantly reduced numbers and range of formal stone tools but, they also contained a limited number of bone tools. With the exception of the large blades, this assemblage had the appearance of being "expediently" manufactured, as it was dominated by burins, awls (see comment on these tools above) and crudely retouched scrapers (Table 26) and utilized pieces. Two quartzite grindstone fragments were recovered from these levels, one from Square 11 300-310 cm and another from Square 21 370-380 cm. Overall, there were reduced quantities of stone debris and most of the debitage in these levels was local quartz(ite). I acknowledge that some of the differences in the artifacts represented in the upper MSA versus the "Large Blade" assemblages could be due to cultural or chronological changes or perhaps sampling error, but this is my current interpretation.

In addition, there were also differences between the upper MSA and the "Large Blade" non-lithic assemblages. Compared to the upper MSA levels, there was comparatively more ostrich egg shell fragments (Table 12) in the "Large Blade" levels, although neither had the density of the more recent "Lower Fish" assemblage discussed below. Although less than perfect preservation occurred at this depth at WPS, the fauna recovered from the "Large Blade" assemblage generally lacked large quantities of fish and the range of mammals were somewhat restricted, especially compared to the more recent "Lower Fish" assemblages.

Klein and Milo (personal communication) identified an extinct "giant" hartebeest, as well as a hartebeest/ tsessebe and one unidentifiable large bovid from the "Large Blade" levels (Table 3). The remainder of the fauna were from small to medium bovids and rodents like springhare.

Although it is not known for sure, it is possible that the rodents and perhaps some of the small bovids may have been snared. I suggest this based on ethnographic data from Lee (1979) and Silberbauer (1981), which indicated that modern San concentrate on smaller animals and snares rather than on the active hunting of large game in the dispersal phase (Silberbauer 1981:202,205,209).

In the early LSA "Lower Fish" levels (300-200 cm) the retouched tools included crescents, backed bladelets, backed points, finely worked side and end scrapers, burins, awls, drills, and numerous unretouched bladelets (Table 26 and Figures 5.14-5.16). Burins and awls were found throughout the entire sequence at WPS. In the case of burins and awls, these tools are thought of as tools to make other tools. For the retouched tools and bladelets, the early LSA inhabitants of WPS selected fine-grained siliceous rocks like chert, jasper and chalcedony (Tables 13, 14 and 25). There was also a great number and variety of cores and debitage in these levels which is dominated by locally available quartz(ite) in the debitage categories (Tables 15 and 20). Also present were a variety of grindstones, and possible nutting stone/anvils (Figure 7.1 and Appendix D). In addition, there were quantities of unworked ostrich eggshell (Table 12) and several drills (Figure 5.14, S) which were assumed to have been used to perforate ostrich egg shell to produce beads among other possible functions. There were also a number of bone points and worked bone

Figure 7.1 WPS Non-Chipped Lithics. A-B, Quartzite Hammerstones from the "Lower Fish" and Upper MSA Assemblage; C, Combination Grindstone/Hammerstone from the "Lower Fish" Assemblage.

fragments (Figure 4.4).

The fauna of the "Lower Fish" levels contained large quantities of fish (Table 11), as well as numerous tortoise shell fragments (Table 12). The mammals represented included a fairly wide range of large, medium and small bovids that were likely hunted (Table 3) (Klein and Milo personal communication).

Based on the ethnographic band aggregation and dispersal models from the San presented above and the archaeological evidence from the "Large Blade" and "Lower Fish" assemblages from WPS reviewed above, I suggest that the "Large Blade" occupations were dispersal phase camps, while the "Lower Fish" occupations were aggregation camps. Before I continue, I need to mention that my interpretation of aggregation and dispersal contrasts somewhat with Wadley's (1989, 1993) interpretation of the onset of these activities. My interpretation suggests this pattern of aggregation and dispersal beginning at the MSA/LSA transition, while Wadley suggests "aggregation and dispersal were not practiced before the Holocene" (1993:287). Also, as will be discussed below, particularly with reference to the "Lower Fish" levels, it is not certain whether these were wet or dry season aggregation camps.

ARCHAEOLOGICAL HUNTER-GATHERER MOBILITY MODELS

The archaeological mobility models considered below are those presented by Bettinger (1991), Binford (1980), Bamforth (1991), Bielawski (1988), Kelly (1992), and Stevenson (1985).

Bettinger (1991) applied Binford's (1980) forager-collector model discussed below, to the Great Basin of western North America. Specifically, he found that the "collector" mode of subsistence could operate in the absence of any accompanying variation in technology or any real differences in climate. This seems to contradict several of the important assumptions anticipated by Binford's (1980) model. Bettinger (1991) concluded that the Binford's (1980) model should be regarded as a source of hypotheses that can be tested, rather than accepted as a fixed framework into which archaeological and ethnographic hunter-gatherers are compartmentalized as either strictly "collectors" or "foragers".

Of special interest was Bettinger's (1991) demonstration that "middle-range" theory must not be solely dedicated to linking dynamic living systems to static archaeological systems. This, according to Bettinger (1991), would limit us to studying only those extant dynamic processes and not those, that for whatever reason, might not be operating today. This would be true, for example, for the absence of ethnographic examples of recent San fishing on the scale indicated by the archaeological examples from WPS. Thus, observation of contemporary systems are important for developing models, but these models must be able to go beyond individual cases to be of value to the archaeologist and "middle-range" theory must have the potential to be explanatory in a broad range of applications.

Binford's (1980) model is considered a pioneering work in the study of hunter-gatherer mobility. He viewed the availability of natural resources as dictating differing combinations of social, economic, and settlement organization. These factors combined in a continuum of subsistence-settlement systems with highly mobile "foragers" at one end and highly sedentary "collectors" on the other. The differences between "foragers" and "collectors" are, according to Binford (1980), related to variability in the quantity and seasonal distribution of resources available to the people.

A "foraging" model views the population as moving their residential base to ensure easy access to resources for the group. Binford (1980) defined two settlement types generated by foragers: "residential bases" and "locations". The "base camp" is where task groups departed from in order to obtain food and raw material and to which they subsequently returned to process, manufacture, or maintain their tools. "Locations" on the other hand, were places where extractive activities occurred (ie. kill and butchering sites). The residential mobility and low differentiation of activities of foragers have implications for interpreting the archaeological record at WPS. It is assumed by Binford (1980) that groups which were frequently

on the move would be more likely to deposit refuse reflecting functionally associated tasks and tasks specific to particular locations, than groups that were more sedentary in orientation.

"Collectors", on the other hand, faced fluctuating resource availability. Thus, it is argued by Binford (1980) that in this situation resources must be stored to extend their availability and must be obtained in bulk when they are available (Binford 1980). This would directly affect the flexibility of people with regard to settlement systems because places where resources were obtained and stored anchored populations to those areas. Binford (1980) argued that this led to increasingly sophisticated equipment that was used for a limited time period and at specific places and specific tasks, and that this equipment was then often "curated" for later use. It is this discrete phasing that generally distinguished "collector" systems from "forager" systems. Archaeologically, the collector system would have greater variability both within and between sites of different kinds due to this seasonal variation. Therefore, according to Binford (1980) "collectors" generate different types of sites. Binford (1980) saw all of these differences as having direct consequences for interpreting the archaeological record.

Thus, I suspect that open-air sites like Gi or Florisbad (Figure 2.1)(Kuman 1989) versus rock shelters like WPS, would have distinct assemblages, and furthermore, as discussed above, wet-season dispersal camps and dry-season aggregation camps would contain different assemblages.

The environmental changes through time documented for WPS (Ivester 1995) and the region by Brooks et al. (1996) also have implications for considering Binford's (1980) model. While there is good evidence for wet/dry climates at WPS, seasonality is another issue. It could be argued (but not conclusively) that:

1. Levels with numerous tortoise shells are more than likely wet/warm season occupations (Table 12).
2. Levels with numerous fish bones correlate with spawning runs tied in with the seasonal flooding of the Okavango and its tributaries related to rainfall in Angola. Today this occurs during the dry season in Botswana, however, we can not assume similar conditions in the past and the levels which contain evidence of a fishing economy could be either dry season or wet season occupations (Table 11).
3. Possibly levels with high frequencies of ostrich eggshell could indicate wet season occupations, unless the eggshells were curated, as would be the case if the ostrich egg shells were utilized as water containers which has been documented ethnographically (Lee 1979) (Table 12).
4. The presence of all three of the conditions above could be indicative of year-round use of the site, although not necessarily a continuous occupation.
5. I would also speculate that artifact concentrations under or near the "drip line" would fit in with wet season use as the inhabitants would have utilized the shelter for protection from the elements.

Considering these data, it appears that use of WPS fits with a "collector" strategy during wetter phases and a "forager" strategy during the dryer phases of the past. Thus, the wetter phases of the past indicated by Ivester (1995) and Brooks et al. (1996) for the lower levels of the "Large Blade" assemblage dated to ca. 43,000-50,00 B.P. and the "Lower Fish" occupations (200-300 cm) dated to ca.

30,000-38,000 B.P., less mobility was indicated at WPS, and a collector system seemed to have been in operation. As has already been presented in Chapter V and will be elaborated upon below, in these levels the artifacts appear to reflect discrete seasonal phasing, as distinguished from the levels where a "forager" system was operating.

Binford's (1980) residential mobility model represented by low differentiation of activities at certain sites also has implications for the interpretation of the other WPS lithic assemblages. I hypothesize that there was a high degree of residential mobility for the inhabitants of WPS during the upper MSA levels (450-420 cm) dating to ca. 69-50,000 B.P., and the upper levels of the "Large Blade" occupations of the site (360-300 cm) dating to ca. 38,000-43,000 B.P.. The sediments from these levels were interpreted as indicating a drier phase of the past by Ivester (1995). As pointed out above in the distribution section of Chapter V, the contextual relationship between activities and the residues resulting from those activities appear to have rather fine resolution.

The more recent inhabitants of WPS during the "Lower Fish" occupations (300-200 cm) ca. 38,000-30,000 B.P. may have faced fluctuating resource availability, particularly during the seasonal flooding of the Okavango and its tributaries and the annual spawning of the riverine fish populations. In addition, this may have been a period when a paleo-lake exited at Tsodilo (Figure 4.5), if the Shaw et al. (1997) data for the Makgadikgadi Basin having a high lake phase between 32,000 and 27,000 B.P. can be extended to the Tsodilo area. This must remain tentative because the Brook et al. (1992) dates for the Tsodilo Lake indicate a more recent age.

Archaeologically, the "collector" system should have greater variability both within and between different types of sites due to this seasonal variation and this appears to be the case for the "Lower Fish" occupations at WPS. "Collectors", it is argued, must obtain resources in bulk to extend their availability. This directly affects the flexibility of the people with regards to settlement systems, as mentioned above the places where resources are obtained in bulk and stored anchors populations to those area. The "collector" strategy could also help explain the presence of numerous grindstones and specialized bone artifacts as well as the large quantities of local raw material in these levels at WPS.

In overview, utilizing Binford's (1980) model to interpret the three assemblages examined at WPS, it appears that a combination or fluctuation between "forager" and "collector" subsistence-settlement systems is in evidence related to the climatic changes which occurred in the region. Although not entirely clear, a "forager" mode of subsistence is suggested for the upper MSA levels. In the lower levels (420-360 cm) of the "Large Blade" occupations a "collector" mode of subsistence may be indicated. This was followed in the upper levels of the "Large Blade" assemblage (300-360 cm) by a "forager" mode of subsistence. The "Lower Fish" levels that have been documented for WPS, appear related to a return to a "collector" mode of subsistence at the site.

Bamforth (1991) offered a model that provided detailed attention to the local conditions with which stone tool users had to cope, and as such, is applicable to my study of WPS. Bamforth (1991) utilized lithic data of tool production and use from a number of California (USA) sites spanning a considerable time period. Bamforth (1991) argued that no one factor controls human behavior in isolation. By utilizing California data, he was able to illustrate the operation of several key factors in regard to lithic technology. Bamforth discovered that specific factors, such as access to replacement stone sources, transport capabilities, and task requirements in the sub-region, did not change substantially over time. He maintained that these environmental and cultural variables were important conditioners of technological patterns among the prehistoric inhabitants of this region. The results of his study suggested that local environmental conditions often influenced technological behaviors. Bamforth (1991) demonstrated that all prehistoric human groups in the area needed tools under similar conditions and thus his model can help explain continuity in strategies of tool production and use through time.

Bamforth (1991) argued that archaeologists have often linked specific kinds of technological patterns with general causal processes, particularly in attempts to study prehistoric mobility patterns (ie. Binford 1980). He maintained that the data supporting such links are important and have the potential to provide insights into prehistoric behavior. However, Bamforth (1991) noted that translating the overall "global" level of relationships that are proposed in some "middle-range" arguments can be a very complex problem. Furthermore, he argued that no single factor controls human behavior in isolation. Bamforth (1991) documented that his analysis was sensitive to these factors and to the interpretive problems that may be created. He also emphasized the importance of patterned variation in technological behavior.

Bamforth's (1991) model was able to deal with the unusual case of technological uniformity over time. The elements of stability existed despite the fact that outside the region the same peoples' general organization of settlement and land use was documented to have changed. This lack of change visible in the project area, according to Bamforth (1991), reflected the fact that the sites investigated represented only a small portion of the settlement pattern existing in the overall region at any given time. Since WPS is a single site and not likely to have been occupied on a continuous year-round basis, this situation likely existed at WPS during various times in the past.

Thus, in the California case, the conditions under which stone tools were made and used in the area studied by Bamforth (1991) remained essentially constant over time and all prehistoric human groups residing in the subregion needed tools under similar conditions. Therefore, Bamforth argues that archaeologists need models that can deal with continuity in strategies of tool production and use through time.

I will utilize this model to examine raw material preference and lithic reduction techniques during the upper MSA, the MSA/early LSA transition and the early LSA periods at WPS. Bamforth's (1991) model can be expanded to anticipate several possible cases that could be observed. First, (Case 1) local raw material sources were used and technological uniformity is observed through time. Second, (Case 2) trade and exchange of raw material occurred which may or may not be accompanied by technological shifts. Or third, (Case 3) some combination of the two cases might be observed.

As discussed in Chapter V, there was a great deal of technological continuity in local (quartz(ite)) lithic reduction observed in the three assemblages considered. This was reflected in the metrical attributes of quartzite flakes, platform conditions, dorsal surface characteristics and flake plan forms (Tables 16-19). With regard to retouched tools, continuity was indicated in the production of awls and burins and, to a lesser extent, end and side scrapers, on quartz(ite) (Tables 14,25 and 26). In addition, there was a constant presence of quartz(ite) bipolar, flat bladelet, and multi-platform cores (Table 15). Clearly, the quartz(ite) element of the three assemblages examined at WPS support Bamforth's (1991) model and fit case 1 presented above.

The non-quartz elements of the three assemblages examined at WPS however, do not indicate the same level of technological continuity. As discussed in Chapter V, this lack of continuity was reflected in the metrical attributes of non-quartz flakes, platform conditions, dorsal surface characteristics and flake plan forms (Tables 17, 22, 23, and 24). In reference to tools, less continuity was indicated in the emphasis on the production of MSA points and to a lesser extent blades in the upper MSA assemblages (Table 26) combined with an emphasis on chert and silcrete raw materials (Table 14); an emphasis on blade production and large backed forms in the MSA/early LSA transitional "Large Blade" assemblage (Table 26) with a continued emphasis on silcrete and chert (Table 14); and then a shift to microlithic artifacts in the early LSA "Lower Fish" assemblage and an emphasis chalcedony and jasper (Tables 14 and 26). Non-quartz cores also indicated a lack of continuity in the dominance of prepared (tortoise) cores in the upper MSA assemblage, blade cores in the "Large Blade" assemblage and microlithic bladelet cores in the "Lower

Fish" assemblage (Table 9 and 21). Thus, it appears that in regard to the non-quartz element of the three assemblages examined at WPS, they do not support Bamforth's (1991) model and fit case 2 presented above.

Overall, the three assemblages examined differ with respect to local versus non-local raw materials and in raw material preference and lithic reduction techniques during the upper MSA, the MSA/early LSA transition and the early LSA periods at WPS. Continuity was indicated in the local quartz(ite) assemblages and a lack of continuity was indicated in the non-local raw material assemblages, thus the combined assemblages would fit case 3 presented above.

The overall contribution of Bamforth's (1991) model was its ability to be able to deal with the unusual case of technological uniformity through time. This model viewed technological uniformity as a product of a more or less constant pattern of interaction among a number of factors. These include the kinds of resources available in the study area, the regional availability of stone suitable for flaking, and the size of human groups that occupied the project area.

I also considered a model designed to isolate the effects of seasonal mobility (Bielawski 1988). However, as I mentioned above, determining seasonality for the three assemblages on which this analysis concentrates was not as conclusive as the overall wet/dry periods of site occupation. Bielawski (1988) suggested that seasonal mobility may explain a substantial amount of the variability in artifacts and associated features within regions and sites. Bielawski (1988) was concerned with how seasonally nomadic behavior would be reflected in the archaeological record and how to isolate the effects of seasonal mobility. He stressed that research design must consider the likelihood of this mobility, as this might bias our interpretation. I am very impressed with Bielawski's (1988) approach and will use his model below to examine the three principal assemblages addressed, as it appears that the inhabitants of the site were highly mobile during certain periods of the past and possibly more sedentary during others. Furthermore, considering the long time span covered by the archaeological deposits at WPS and the documented changing environmental circumstances, I have interpreted the site as serving as both a wet and dry season camp during periods of the MSA and early LSA.

Beginning with the upper MSA occupations, Bielawski's (1988) model can be applied. As previously discussed, I utilized Deacon's (1976) model to interpret the upper MSA occupations as representing the hunting of large migratory herd animals. This model was correlated with large group organization, lower population density, larger territorial ranges, and an absence of fixed territorial boundaries (Deacon 1976:163). Group hunting of large gregarious bovids, which was suggested for the later Pleistocene upper MSA assemblages, is quite a different form of mobility than suggested for the "Large Blade" and "Lower Fish" occupations discussed below, but can be accommodated by Bielawski's (1988) model.

The "Large Blade" transitional MSA/early LSA assemblage (300-420 cm) was quite different from that encountered in the upper MSA assemblage. As mentioned previously these levels contained significantly reduced numbers and range of formal stone tools (Table 26) and they also contained a few bone tools. With the possible exception of the large blades, this assemblage had the appearance of being "expediently" manufactured. The assemblage was dominated by burins, awls and minimally retouched scrapers (Tables 14 and 26) and utilized pieces (Appendix C). Although burins and awls are interpreted as tools used for the manufacture and the repair of other tools, these tools are quickly and easily produced using a simple "burin blow" in the former and the bipolar technique for the latter. Based on tool morphology, frequency, and raw materials, my interpretation of these tool types is that they were manufactured and used immediately for one task and then discarded rather than being "curated". There were reduced quantities of stone debris in these levels and most was local quartz(ite).

I utilized Bielawski's (1988) models in conjunction with the climatic reconstruction by Ivester (1995), which indicated that the levels between 350-300 cm were deposited during a dry phase which I interpreted as dating to ca. 38,000-43,000 B.P., to offer the following interpretation of the "Large Blade" assemblage. In this assemblage, a low density and range of artifacts was recovered and combined with the paleoenvironmental data, led me to interpret the "Large Blade" assemblage from WPS as resembling a dry season dispersal phase camp, such as have been documented ethnographically for the San and presented above.

The fauna recovered in the "Large Blade" level were somewhat limited and this may be due to less than perfect preservation at this depth (Table 3), however the faunal assemblage lacked the large quantities of fish and tortoise bones (Tables 11 and 12) present in the "Lower Fish" levels discussed below and the range of mammals was somewhat restricted to rodents like springhare and small to medium bovids, although several large species were in evidence (Table 3).

As I mentioned in Chapters I and IV, oral tradition indicated that WPS was a wet season aggregation site within the last 50/60 years. Of interest, this is the opposite of ethnographic accounts of the Dobe San dispersing during the wet season and aggregating around permanent water sources during the dry season (Lee 1979). It appears that this type of wet season site use may have a substantial history. If my interpretation of the data are correct, wet season aggregation may be indicated for the "Lower Fish" levels of the site. In these levels, substantial amounts of fish and tortoise shell fragments (Tables 11 and 12), as well as the overall artifact density, indicated that these levels may represent a wet season aggregation phase (Tables 15, 20, and 26). In addition, the environmental reconstruction of WPS by Ivester (1995) indicated wetter conditions between 300-160 cm dated to between ca. 38,000-30,000 B.P. (Table 27) and Brook et al. (1996) suggested wet intervals between 38,000-35,000 B.P. and 31,000-29,000 B.P.. Also, the high lake phases documented by Shaw et al. (1997) for the Boteti and Makgadikgadi basins between 32,000-27,000 B.P. could have changed the periodic flooding of the Okavango and its tributaries. If environmental conditions were less seasonal with respect to moisture availability, perhaps the inhabitants based on WPS were more sedentary than current models of the San would indicate.

CHANGING HUNTER-GATHERER MOBILITY, RAW MATERIAL ACQUISITION, AND EXCHANGE DURING THE UPPER MSA, TRANSITIONAL MSA/ EARLY LSA AND EARLY LSA AT WPS

Expanding upon the question of changing hunter-gatherer mobility, raw material acquisition, exchange or trade patterns were examined in the three assemblages analyzed in detail at WPS. For this part of the analysis I utilized models developed by McBryde (1984), Stevenson (1985), and Kelly (1992).

McBryde (1984) did a very thorough study of the ethnographic, linguistic, and archaeological evidence of the social context of production and distribution of the Kulin greenstone from Mt. William in southwestern Australia. According to McBryde (1984), this raw material was extremely important in the production of stone axes throughout a wide region. However, the distribution was not uniform in occurrence as would be expected if the raw material was distributed simply as an adaptive mechanism for ensuring acquisition of raw materials not available in the local environment (McBryde 1984).

McBryde (1984) utilized several anthropological studies of aboriginal exchange (ie. Berndt 1951; Elkin 1934; Stanner 1933), all of which stressed the complexity of the exchange and the difficulty of separating the social and economic aspects of the system. Therefore, McBryde (1984) considered the distribution of the greenstone and the social role of exchange by comparing the observed archaeological patterning and the distribution of other aspects of aboriginal culture in the study area. Of special interest was the fact that the quarry was still being actively mined in the early nineteenth century. Thus, the historical and linguistic evidence from the contact period were available to McBryde (1984) to frame hypotheses about the distribution of the Mt. William raw materials.

Several interesting points were raised by McBryde (1984). First, the movement of the greenstone was not necessarily toward the areas in which raw material was scarce. She believed that the social functions of the trade were at least as important as the need for raw materials. Since the distribution arrays of the raw materials were extensive and nonrandom, McBryde (1984) concluded that the extent and diversity of the patterns could be correlated with ecological, resource, and economic factors, and with certain aspects of group relationships. Second, McBryde (1984) suggested that anomalies in the distribution of the artifacts indicated the existence of redistribution centers which were far removed from the quarry site.

Based on these results, McBryde (1984) hypothesized the operation of social factors determining the direction and flow of goods, as well as providing for redistribution which influenced the observed fall off curves. Since the site was used in historic times, McBryde (1984) tested these hypotheses by examining the correlations with the ethnohistorical evidence concerning the spatial distribution of social and political units, the organization of ceremonial activities, and the exchange system operating in the nineteenth century.

Overall, McBryde's (1984) analysis makes a strong case for social determinants operating on the production, as well as the distribution of the raw materials from the Mt. William site. McBryde (1984) documented distinct and positive spatial correlates between the artifact distribution and other aspects of culture documented in the anthropological and linguistic records. Her strong spatial correlation between these differing aspects of culture suggested that the archaeological distribution arrays in this case were reflective of other social factors, as well as group relationships. This type of multidimensional analysis has important implications for other archaeological investigations of exchange, not only in Australia but for other regions and time periods where the historical and linguistic evidence used to develop this model are not available. The primary contribution of the work is McBryde's (1984) insights into the complexities of ownership and management of resources and the production and distribution of those resources. By utilizing linguistic and ethnohistorical data she provided new hypotheses that can be tested against the archaeological record not only of the Australian quarry sites, but also those of Africa like WPS or other regions of the world.

Unfortunately, the detailed knowledge of raw material sources available to McBryde (1984) for aboriginal Australia are not available for Botswana, although efforts are underway to acquire it, as indicated by the recent research by Weedman (1993). The ethnographic data base on exchange is comparable (Weissner 1982, 1983; Lee 1979; Silberbauer 1981). In addition, source areas are known for certain regions of South Africa (Wadley 1989) which do indicate that raw materials often traveled over great distances from their quarry sites. Ethnographic studies of San exchange systems by Weissner (1982, 1983) also indicated that rather sophisticated forms of hxaro exchange form an important part of San social and economic systems.

Accepting that many of the source areas for the non-local raw materials observed in the WPS lithic assemblages are unknown, Robbins (1990) suggested that the source of some of the chert recovered in the Depression shelter may have come from dry river valleys to the west of Tsodilo. Furthermore, that "some of the chert is similar to that found in the Qangwa Valley, 100 km from Tsodilo" (Robbins 1990:334) (Figure 2.1). Weedman (1993), with reference to the Divuyu and Nqoma sites at Tsodilo, suggested that "all the chert present in the Tsodilo Hills must have been obtained through exchange networks" (Weedman 1993:68). According to Weedman (1993), "the closest known sources of chert are the Shakawe cherts 70 km to the east, and the Aha Hills 125 km to the southwest" (Van Wyk 1980 in Weedman 1993:68) (Figure 6.2). Weedman performed a petrographic analysis of chert samples from Nqoma which "indicated that some of the cherts were obtained from Shakawe" (Weedman 1993:72). However, other cherts from the Nqoma site were interpreted by Weedman (1993) as perhaps coming from sources as far away as the hardveld "or in sources not yet discovered in the northwestern Kalahari" (Weedman 1993:72).

As to the sources of the silcrete recovered from the WPS lithic assemblages, I have observed brown silcrete quarry sites along the Boteti river valley and where the Dikgatlhong River and the Boteti River join, that appear to have been utilized since the ESA (Figures 2.1 and 6.2). I have also seen green and black silcrete quarries on the margins of the Makgadikgadi Pans south of Gweta (Figures 2.1 and 6.2) which appear to have been in use since the MSA. In addition, I have observed brown silcrete outcrops on the west side of the Okavango north of Shakawe just south of the Caprivi Strip (Figure 6.2), and I have seen quantities of silcrete in an unnamed large pan about 100 km northwest of Molepolole in the Central Kalahari associated with MSA artifacts. Finally, I noted chalcedony in bore hole tailings at WPS in 1996, although it did not appear that these materials were being quarried.

Certainly this does not give enough detail to plot distributions on the fine resolution that McBryde (1984) obtained. However, several observations seem warranted with regards to the sources documented by Weedman (1993) and Robbins (1990) and the ones I have observed. The sources are located in currently flowing and dry river valleys and pans which are seasonally or periodically flooded and may have been inundated on a perennial basis during the wetter phases of the past. I will return to this issue below.

Beginning with the upper MSA assemblages, I have interpreted this time period as representing a period of demographic expansion when peoples moved into new territories where land and resources were plentiful. In this model, rules for group membership would emphasize inclusion rather than exclusion. This could assist in explaining the dramatic increase in non-local lithic debris and MSA points in the upper MSA levels at WPS (Tables 14, 15, 20 and 26). From the magnitude of the change, and the differences noted above, it appears that the MSA inhabitants of WPS may not have practiced the same aggregation-dispersal pattern suggested for the transitional MSA/early LSA and early LSA levels at WPS. The pattern of large local group organization, low population density, large territorial range and weak territoriality suggested by Deacon (1976), I believe, helps account for the quantity and range of lithic artifacts encountered in the upper MSA levels of the site. That is, the periodic presence of large groups which did not aggregate or disperse in the same fashion as more recent populations. I suggest that the MSA inhabitants continued to utilize traditional sources of raw materials which they encountered while following the large migrating herd animals. In this scenario, WPS served as a convenient stop-over point where tools were produced and repaired using raw materials that the people brought with them.

The MSA/early LSA transitional "Large Blade" assemblage, which is interpreted as dispersal phase occupations, occurred both during a wetter phase between (420-360 cm) ca. 50,000-43,000 B.P. and a drier phase (360-300 cm) ca. 43,000-38,000 B.P. of the past (Ivester 1995; Brook et al. 1996) (Table 27). The lower levels of the "Large Blade" assemblage (420-360 cm) interpreted as a wetter phase (Ivester 1995; Brooks et al. 1996) had continued high percentages of non-local raw materials in the debitage categories (Table 20, 25), although these percentages decrease with decreased depth. The retouched tools and blades continued to be predominantly produced on non-local chert and silcrete (Tables 13, 14 and 26). Not a great deal of lithic debris were recovered in these levels (average density per unit volume of 20 pieces per 10 cm level per 1 m square) which indicated limited tool manufacture was undertaken at the site. The debitage that was present could be the result of tool maintenance rather than manufacture (Table 20). The dominance of non-local chert, indicates that raw materials were obtained elsewhere and I believe that the chert and silcrete were coming from the Okavango/Boteti river valleys. Since these levels were interpreted as indicating wetter conditions in the regions, it may be that the inhabitants of WPS obtained the raw materials during the dry season when these sources were exposed or they may have traded or exchanged with peoples who had access to these sources when they were periodically exposed. Again, these levels were interpreted as representing dispersal phase occupations due to the density, type, and range of tools. Therefore, the aggregation phase of the inhabitants at WPS is believed to lie elsewhere and at this point I would suggest the Okavango/Boteti region to the east and southeast of the site as likely locations.

The upper levels (360-300 cm) were characterized by a dominance of local quartz(ite) in the waste categories (Table 20 and 25) and "expedient" tools like burins, awls and scrapers (Table 13, 14 and 26). However, the blades and retouched tools continued to be dominated by non-local raw materials, particularly chert and silcrete (Tables 14 and

26). During this drier phase (Table 27), the Boteti and Makgadikgadi sources of silcrete and the Okavango sources of chert would have been exposed and it appears that mobility and exchange was directed toward the east and southeast of WPS. Although I cannot prove this since aggregation sites have not been located in the Okavango/Boteti region, perhaps the inhabitants of WPS periodically returned to or aggregated in this region during this transitional period and obtained the raw materials themselves or traded and exchanged raw materials with individuals inhabiting the Okavango/Boteti regions (Figures 2.1 and 6.2).

Returning to the possibility of periodic flooding of raw material source areas, this appears to have been the case during the "Lower Fish" levels (300-200 cm) and dated to between 38,000-30,000 B.P. where Ivester (1995) suggested wetter conditions prevailing at WPS (Table 27) and Brook et al. (1996) indicated wet intervals between 38,000-35,000 B.P. and again between 31,000-29,000 B.P.. In addition, as mentioned previously, Shaw et al. (1997) have recently reported two high lake phases in the Makgadikgadi basin dating to between 32,000-27,000 B.P. which would have flooded the Makgadikgadi pan sources, the Boteti river sources and perhaps the Okavango river valley sources as well. Of interest, this period of site occupation is characterized by an emphasis on local sources of raw materials and the non-local sources included a dominance of jasper and chalcedony (Tables 20 and 25), which in the latter case may have been available locally or in unknown sources which remained exposed during this wet phase. Raw material acquisition or exchange may have been less far-ranging during this wet phase and combined with restricted mobility as discussed above.

Finally, I accept that other sources of the raw materials found at WPS may be discovered in the future which may change the interpretation offered above. However, the interpretation offered is the most logical to me based on the current state of knowledge on the raw materials sources.

I also considered a model presented by Stevenson (1985) which proposed a means to interpret hunter-gatherers workshop/habitation sites. This model posed three successive stages of activities carried out at this type of site which effected the distribution and composition of lithic artifact assemblages. The three stages proposed by Stevenson (1985) were: 1) an initial settling in phase; 2) an occupation or exploitation phase; and 3) a final or abandonment phase. Stevenson (1985) maintained that these stages would produce varying lithic assemblages. He posited that during the initial settling in phase, significant accumulations of lithic artifacts, consisting of mostly primary debitage but also of exhausted tools produced of non-local materials, would be in evidence due to tool replacement, as well as manufacture (Stevenson 1985). During the second (exploitational) phase, stone working would continue, however, the debitage would be related to refined flaking, maintenance, and repair of the tools (Stevenson 1985). Lithic remains would tend to be secondary and tertiary debitage rather than composed of predominantly primary waste. Finally, during the abandonment phase, campsites located to exploit lithic resources would be expected to have tool replacement and manufacturing again, in anticipation of projected needs at future locations (Stevenson 1985). Thus, like the initial phase, this last phase would contain lithic assemblages composed of primarily early reduction debitage. Discarded tools would be expected, and would be produced of mostly local raw materials (Stevenson 1985).

As I believe that the WPS site may have served as a workshop/habitation site during the upper MSA and early LSA periods, and the fact that quartz(ite) veins in the hills were available to be exploited, Stevenson's (1985) model seemed appropriate. In addition, the presence of exotic raw materials and discarded formal tools made of these raw materials warranted testing this model in successive levels at WPS in order to determine if the debitage and tools reflected this form of site development.

As the analysis progressed, I became aware that the 10 cm levels used in the excavation did not have the fine resolution to separate Stevenson's 3 phases of site development. In addition, I became concerned about whether the refuse produced during Stevenson's (1985) Stage 1 and Stage 3 of site occupation could be consistently differentiated in the archaeological assemblages at WPS. Particularly, if these stages were encountered in repeated and successive stratigraphic levels, which seemed to be the case in the assemblages analyzed. Furthermore, I was concerned that I could not consistently determine if the assemblages were the result of multiple use by the same group or different groups of people using the site. Even though I could not use Stevenson's (1985) model to the extent it was intended, and I probably would have reached the same conclusions without Stevenson's (1985) model, the lithic data from WPS did indicate that the upper MSA and "Lower Fish" assemblages contained repeated evidence of workshop/habitation occupation, while the intervening "Large Blade" assemblage appeared to be a series of temporary encampments.

The final model in this section that I evaluated for its applicability to lithic analysis at WPS was Kelly's (1992) which presented archaeological models to measure the degree of mobility/sedentism. Kelly's (1992) model aided in tying together a number of issues discussed so far. This was particularly true with regard to the changing environmental conditions at WPS, the changing raw material acquisition and exchange patterns and the differences in the three lithic assemblages through time which have been discussed above. Kelly (1992) documented cases where hunters-gatherers move infrequently, and in some cases, less than so-called "sedentary" societies.

Kelly (1992) argued that many past assumptions about hunter-gatherers were not entirely accurate and maintained that these assumptions misled early analysts. According to Kelly (1992) mobility is in fact universal, variable, and multidimensional. This, I believe, is critical and I think that archaeologists certainly need models that recognize the various forms of mobility, as these factors have strong influences on the types of data encountered in the archaeological record.

Kelly (1992) focused on models of mobility/sedentism and the archaeological measures of reduced mobility on foraging and horticultural societies. By deconstructing the concepts of mobility and sedentism, Kelly (1992) demonstrated that the current models based on the polarization of mobile versus sedentary societies were inadequate in a number of archaeological cases. Furthermore, Kelly (1992) argued that no society is truly sedentary, they just move in different ways. Kelly (1992) argued that the dimensions of mobility need to be studied independently to discover how factors altering one component of the system may affect other components. In order to do this, Kelly (1992) noted that we need detailed models that can link group mobility with daily activities. In addition, according to Kelly (1992), the models should be able to deal with critical economic structures like labor requirements, child care, marriage, trade and exchange. A major contribution of the work was that Kelly casts doubts on the long-held belief that mobility was the defining characteristic of hunter-gatherers (see Lee and DeVore 1968, 1976) and that this concept led to an inaccurate view of a continuum between mobile hunter-gatherers and sedentary horticulturalist's (Kelly (1992).

I was particularly interested in Kelly's (1992) use of modern San groups from Botswana to model several different mobility patterns. Thus, his models were directly applicable to my analysis of the WPS lithic assemblages. Kelly's (1992) model related the differences between the genders and ages in regards to differences in each, and their type and amount of mobility. Basically, young men were the most mobile, followed by women and small children who ranged less from the base camp, to the elderly who may remain in the base camp for the majority of the time (Kelly 1992).

The archaeological data from WPS, as well as at most archaeological sites, did not allow a consideration of changing mobility patterns at the individual level. However, I believe that addressed the criticisms raised by Kelly (1992) in my interpretation of the data on mobility/sedentism at WPS. My interpretation was based on ethnoarchaeological, ethnohistorical and ethnographic evidence of the San, which indicated that some groups oscillated between greater and lesser residential mobility (Hitchcock 1987), as well as the data presented above for the lithic and other archaeological materials from WPS indicating that shifting patterns of mobility have considerable antiquity. The documentation of these varying pattern of sedentism and mobility was a major goal of this analysis.

EVALUATION OF HYPOTHESES 3-6

Returning to the hypotheses presented in Chapter V, H3-posited that raw material sources/preferences would be correlated with availability of raw material related to periodic flooding of source areas through time. This hypothesis was confirmed by the data presented, however the lack of knowledge of source areas outside the river drainage and pan sites limits me to commenting only on these sources.

With these reservations, in the upper MSA levels (450-420 cm) dated to between ca. 69,000-50,000 B.P. a drier period was indicated for the site by Ivester (1995) and Brook et al. (1996) for the region. High densities and percentages of imported raw materials were recovered in these levels at the site. If the environmental reconstruction is correct, the raw material sources in the river drainages and pans would have been exposed. I have suggested a different type of group organization with large groups following migrating herds of large mammals for this period. If this is the case, then these groups could have collected raw materials when encountered and carried cores or preforms with them in anticipation of future needs. Perhaps these groups periodically returned to known raw material source areas to obtain new supplies of raw material.

In the lower levels of the "Large Blade" assemblage (420-360 cm) dated to ca. 50,000-43,000 B.P. a wet phase was indicated for WPS by Ivester (1995) and for the region by Brook et al. (1996). This period of site use had continued high percentages of imported raw materials in the debitage and a continuing preference for these raw materials in the retouched tool and blade categories. If the raw material sources were only seasonally or periodically flooded, they could have been obtained during the dry season. However, if the sources were perennially flooded during this wet phase, perhaps individuals or groups sought raw materials from other unknown sources, although the types of raw material in the WPS assemblages remain similar during this period. Another possibility is that certain groups stockpiled these raw materials as the flooding progressed and these rare raw materials served as an important commodity which could have been traded or exchanged with other groups, however, these hypothetical redistribution sites have not been located.

In the more recent "Large Blade" levels (360-300 cm) dated to between ca 43,000-38,000 B.P. was interpreted as a drier phase (Ivester 1995; Brooks et al. 1996) during which the site was only periodically occupied and the raw materials were dominated by local quartz(ite) in the debitage and "expedient" tool categories. However, the formal retouched tools and large blades continued to be predominantly produced on non-local raw materials (chert and silcrete) which could have been obtained directly, traded or exchanged with peoples with access to the dry or periodically dry river drainages and pans or other unknown sources.

In the "Lower Fish" levels (300-200 cm) dated to ca. 38,000-30,000 B.P. even more local sources of raw materials were utilized. I believe that it is possible that the increased use of local raw material is related to longer term aggregation due to the presence of large quantities of fish. That is, that people stayed longer in the area and as a result used more of the raw material that was locally available. In this case perhaps people settled for the local raw material in order to stay longer even if the non-local raw materials were preferred. I would also suggest that the bone artifacts may have been used for certain activities (ie. fishing) as an addition to the stone artifacts. These levels at WPS were interpreted as a wetter phase by Ivester (1995) and if the Shaw et al. (1997) reported high lake phases in the Makgadikgadi Basin and the Boteti river dated to between 32,000 and 27,000 B.P. are correct, this could have flooded important chert and silcrete sources and perhaps have filled Paleo Lake Tsodilo.

The fourth hypothesis, H-4, anticipated shifts from high degrees of residential mobility evident in the artifact assemblages during the drier phases, to more intensive long term occupations during the wetter phases of the past.

The upper MSA levels (450-420 cm) do not appear to support the hypothesis. These levels were interpreted as being deposited during a drier phase of the past (Ivester 1995; Brook et al. 1996), however, the lithic evidence indicated by both the range and quantity of tools and debitage indicated intensive site use by a rather large number of individuals. This, I believe, is explained by different mobility patterns practiced by the MSA peoples outlined above. That is, that peoples traveled in large groups following migratory herd animals and may have used WPS repeatedly over a long period of time on a short term basis.

The lower levels of the "Large Blade" assemblage (420-360 cm) were interpreted as occurring during a wetter phase of the past (Ivester 1995; Brooks et al. 1996) and also do not appear to support the hypothesis. Although slight increases in debitage and tools were noted for these levels and fairly high percentages of imported raw materials were in evidence, the site appears to have functioned as a temporary camp.

The upper levels of the "Large Blade" assemblage (360-300 cm) appear to support the hypothesis. In these levels drier conditions were indicated for the site (Ivester 1995) and the region (Brooks et al. 1996). The quantity of tools and debitage recovered from these levels indicated that the site served as a temporary camp for a limited number of individuals. Similar conditions at other sites utilized by the inhabitants of WPS have not been demonstrated. However, based upon the WPS results a rather high degree of residential mobility is indicated.

The hypothesis is also generally supported by the data from the early LSA "Lower Fish" assemblage at WPS. In the "Lower Fish" levels (300-200 cm), interpreted as a wet interval (Ivester 1995; Brook et al. 1996), a more intensive long term occupation was suggested based on the quantities and range of artifacts recovered combined with the fauna and ostrich egg shell data. In addition, a local focus on quartz(ite) raw materials was indicated in the debitage and in several tool categories.

The final two hypotheses posited that H-5 WPS would conform to the dry season concentration/wet season dispersion patterns observed ethnographically for the !Kung and the alternate H-6 that based on oral traditions of site use, that WPS served as a wet season aggregation site. In regard to the three assemblages examined in detail, it appears that neither hypothesis can be fully supported or disproved by the data discussed previously, that is, that wet/dry seasonal indicators were not entirely clear. However, based my interpretation of the data, it appears that site use fluctuated between the two scenarios depending on environmental and cultural factors.

First, the upper MSA assemblages do not support either hypothesis. I have interpreted these assemblages as produced by peoples that did not aggregate or disperse in the same fashion as modern San hunter-gatherers either in the forms based on oral tradition or ethnography.

The MSA/transitional early LSA "Large Blade" assemblage on the other hand, seems to support the dry season aggregation/wet season dispersal patterns documented ethnographically for the !Kung. This period of site use appears to represent temporary camps by a relatively small numbers of individuals for the reasons discussed above.

Finally, in the early LSA "Lower Fish" levels it appears that the site may have functioned as a wet season aggregation camp for the reasons discussed above and would support oral traditions of wet season aggregation, although environmental conditions were probably quite different from the period of ca. 60 years ago which were recalled by the San elder.

CHAPTER VIII

RESEARCH IMPLICATIONS AND CONCLUSIONS

The data described in the preceding chapters have been analyzed to highlight changes through time in the upper MSA, MSA/early LSA transitional period and the early LSA in the interior regions of southern Africa using WPS as a case study. This study examined a critical time period during which relatively little is known. This transitional period witnessed the development of microlithic stone tool technology, elaborate bone tools, items of personal adornment, and other features that when taken together, I believe, indicate fully "modern" behavior. These archaeological features appear as early or perhaps earlier in Africa than comparable regions in Europe. In this analysis I have applied novel approaches to examine raw material shifts and lithic reduction sequences through time. Based on these approaches, both change and continuity were noted in the frequency, size and shape of stone artifacts and the by-products of stone tool manufacture, as well as in the relative proportions of raw materials used in tool manufacture.

The changing environmental circumstances in the region have been documented to assess if changes in stone artifact manufacture were independent or dependent on regional changes in the environment or if they may reflect social and demographic adjustments. I believe that innovations in stone tool manufacturing techniques mark general stages in the evolution of technological systems and that when these changes coincide at particular points in time that we can consider a major technological shift to have taken place.

While accepting that the mechanisms and underlying reasons for biological evolution are not directly applicable to changes in artifact systems, the debate about the nature and timing of the beginnings of "modern" human behavior and that of hominids assuming "modern" form are certainly relevant questions that can be addressed by archaeology, as we have the extended time frame to examine questions of long-term change through time.

This dissertation has focused on the late MSA/early LSA transition which is not well-known in southern Africa. In this regard WPS is a very important site as it has assemblages spanning this period of prehistory. In addition, WPS is located between well documented sites to the east and south of the Kalahari, which makes the WPS assemblages significant to aid in our understanding of the Middle and early Late Stone Age inhabitants of the interior regions of the African continent by helping to fill in the gaps present in these regions of southern Africa and tie them in with the better documented regions to the northeast and south.

In regard to the MSA, I have examined archaeological materials that may relate to the first populations of "modern" Homo sapiens. In the transitional MSA/early LSA and early LSA assemblages, the evidence presented documented the gradual development or assimilation of a range of behaviors which when taken together indicate fully "modern" behavior. My research directed toward this period has documented and added to our comprehension of the types of biocultural and technological adaptations in the areas of lithic reduction, hunter-gatherer mobility, and raw material acquisition or exchange and has moved the field forward regarding the nature of these "advances" in behavior.

The development of stone tipped spears and possibly projectiles, is clearly a major technological innovation of the MSA period, as was the ability to hunt larger and more dangerous animals (H. J. Deacon 1989; Brooks et al. 1990). Furthermore, although we have only a few fish bones in the MSA levels and accepting the fact that there are fish bones in older deposits at Olduvai in east Africa (Stewart 1991), the possible increased exploitation of aquatic resources during the MSA seems a clear adaptive advantage over what existed previously when aquatic resources were not apparently part of the subsistence strategy.

While accepting that Wonderwerk Cave in South Africa has evidence of Acheulian occupations, this is the exception rather than the rule. Thus, the MSA also witnessed increasing evidence for the use of rock shelters and caves for habitation in the Kalahari and elsewhere in southern Africa. WPS has extensive MSA deposits indicating long term reuse or reoccupation of rock shelters in this region during the MSA. This pattern of repeated use of the same site on presumably a seasonal basis by groups that did not aggregate and disperse as modern San groups do (H.J. Deacon 1976), provides significant insights into the subsistence and settlement patterns, as well as the mobility patterns of the first Homo sapiens.

The presence of large amounts of exotic raw material at WPS during the MSA occupations has added to our understanding of key elements of raw material acquisition by the early inhabitants of the region. An understanding of raw material acquisition systems during the MSA has helped elucidate possible exchange systems and shifting mobility patterns or both. The fact that exotic raw materials were used by MSA people at Tsodilo is not in question. However, the mechanisms of the acquisition of these raw materials is not fully determined. The MSA inhabitants of Tsodilo either obtained their raw material directly from the source areas, indicating to some degree the extent of their mobility, or there were exchange networks between the inhabitants of Tsodilo and people who lived near or had access to the various raw materials found in the MSA levels. My current research was able to determine the possible acquisition patterns or the types of exchange, but more research on the sources of the raw materials needs to be done to fully understand the mechanisms.

I have analyzed and presented details of the technological requirements and reduction techniques of the

MSA/early LSA stone workers and their relationship to the raw material attributes. These data will aid our understanding of the late MSA/early LSA of southern Africa, as there are very few systematic studies of the relationships between raw material and reduction in the MSA/early LSA.

The transition from the MSA to the early LSA in southern Africa was the primary focus of this research, since up to this point very little is known from this time period in the region. At WPS this transition witnessed a technological shift from the MSA tools produced from prepared cores (Volman 1984) to the microlithic technology of the LSA (J. Deacon 1984). The transition to the LSA also witnessed a shift to more locally available sources of raw materials, especially for the "expedient" flake tools. However, imported exotic raw materials were still favored for the production of formal tools. The long sequence, continuity and change in stone tool reduction techniques and technologies, and shifting raw material preferences at WPS, offered an excellent opportunity to examine these changes in lithic reduction and raw material acquisition or preference through time.

The further evidence from the early LSA is significant since there is much interest in the period when fully "modern" human behavior developed and the mechanisms inherent in this change. Moreover, there appear to be few clearly defined transitional MSA/LSA sites in the interior regions of southern Africa and virtually none within the Kalahari. Thus, WPS offered an important opportunity to study these important technological and behavioral shifts, as this transitional period was well represented at the site. In addition, I was able to relate the transition from MSA to the early LSA with paleoclimatological data. In correlating the behavioral and technological data with the paleoclimatological information, I have offered an interpretive model that ties together paleoclimatic change and changing cultural adaptations for an area of southern Africa similar to Jacobi's (1980) model for the Paleolithic of Britain.

Comparisons between the southern African MSA/early LSA sequences have shown that many of the trends identified at the site and regional level can be seen in assemblages elsewhere in the sub-continent, although there appear to be differences in the timing of these changes. It has not been fully established whether these technological changes are site specific, regionally specific, or universal to southern Africa. At this point it appears that assemblages north and south of the Limpopo River differ in several important respects. In Zimbabwe and to a lesser extent in Zambia, the transition from the MSA to the LSA seems to be more gradual than to the south. From recent excavations (Walker 1995) there is little evidence for progressive developments within the Bambata sequences. The Tshangula assemblages do appear to represent the latest phase of the MSA or the earliest phase in the LSA due to the addition of small backed pieces which are quite similar to those in the early LSA "Wilton" assemblages to the south. However, the documented Tshangula assemblages are consistently dated to more recent time periods and associated with non-lithic artifacts, for example OES beads, bone artifacts, and other items which are considered LSA features to the south. If the Tshangula assemblages are considered MSA, then the MSA persisted in Zimbabwe until ca. 12,000 B.P. which is ca. 20,000-30,000 years after the earliest LSA stone assemblages are indicated to the south.

Data from the upper MSA assemblages (450-420 cm), dated to 69,000-50,000 B.P., the "Large Blade" MSA/transitional early LSA (420-300 cm), dated to between 50,000-38,000 B.P., and the "Lower Fish" early LSA (300-200 cm), dated to ca 38,000-30,000 B.P., have shown that there were periods during this roughly 30,000 years when change was more rapid than at other times. However, these assemblages also show that change in some parts of the technological system was continuous, while other parts remained relatively stable. Accepting that changes in the relative frequencies of various tool types can be site-specific idiosyncratic change, which may be explained by activity variation, it appears that change is apparent in, for example, the trend toward miniaturization of certain artifacts. In addition, there appear to be some shorter term oscillations around means as is the case in the length of flakes and relative thickness ratios for non-quartz debitage, between the three assemblages. A similar pattern of oscillatory change can be seen in raw material frequencies, and at a different time scale, in the relative thickness of unmodified flakes.

Cumulative or "progressive" change is indicated by the appearance of innovations in the form of new tool-making techniques, new tool designs or a different use of previous designs in new ways to improve performance. What the MSA/early LSA lithic assemblages from WPS suggests is that the people who made the MSA assemblages during the late Pleistocene focused on the hunting of large migratory grazing and gregarious antelope. Although, fauna is poorly represented in the MSA levels at WPS, faunal evidence from the MSA levels at Gi (Brooks et al. 1990) support this interpretation. In addition, the microwear studies of the MSA points by Dr. Randolph Donahue from WPS identified impact damage on the point tips which is interpreted as indicating that at least some of them functioned as armatures (Dr. Randolph Donahue personal communication and ms in prep.) and the thinning of the bases of many of the MSA points from WPS as well as at Gi (Brooks et al. 1990) seems to be good evidence that at least some of these points were hafted.

I have suggested, based on a model proposed by H.J. Deacon (1976), that the seasonal movement of these large herds made it advantageous for the people to live in larger groups that did not aggregate or disperse as modern San do.

These groups occupied territories large enough to enable them to follow the game in its annual round. The use of spear hunting by large groups has been suggested and the use of prepared "tortoise" cores to produce MSA points is seen as a means to support this type of hunting strategy. I also interpret the increase in debitage and tools in these levels at WPS as the result of this demographic pattern and the use of the rock shelter as a temporary camp for a large number of individuals on a seasonal basis.

By contrast, the inception of what I have labeled as the "Large Blade" transitional MSA/early LSA assemblages at WPS seems to be linked to a shift in mobility more closely resembling the aggregation and dispersal patterns observed among modern San groups. If my interpretation is correct, this may be closely related to a shift in hunting patterns away from large gregarious herd animals toward more solitary browsers. This was correlated with the use of blade cores to make large numbers of unretouched blades and large backed elements. Coupled with this technological shift is the demographic change discussed above, as well as changes in the incidence of non-local raw materials and the size and shape of unretouched flakes which become more "blade-like". Continuity with the MSA is indicated as blades are also observed in the upper MSA assemblages at WPS indicating some continuity across the MSA/early LSA boundary, although typical MSA points were no longer produced. New formal tools were also introduced at this time including large backed forms anticipating microlithic forms which appear in the early LSA.

By the time that the early LSA assemblages "Lower Fish" were being deposited, the shift in hunting patterns appears complete, with the increasing presence of backed microliths which are interpreted as indicating essentially modern hunting techniques, possibly involving the use of bow and arrow, although I can not prove this definitively. The subsistence strategy shifted to include increased reliance on aquatic resources and to the game animals that were historically available in the region, with the exception of the wetland species discussed above and the extinct giant Cape equid. By shifting to a wider array of animals, the people no longer had to rely exclusively on the seasonal movements of game. In addition, the diet included considerable collecting of ostrich eggs and the regular use of aquatic resources in the forms of annually spawning fish populations discussed above.

During this period, ca. 38,000-30,000 B.P., there is a marked increase in microlithic formal tools and unretouched bladelets and bladelet cores which coincided with a reduction in the length and relative thickness of unretouched non-quartz flakes, as well as a shift in raw material preferences to locally available quartz(ite) and imported jasper and chalcedony and that these may have been functionally related due to the initial size of nodules of these raw material and the exceptional flaking characteristics of the fine grained raw materials which may have necessitated a new means to reduce them.

I have also suggested that the "Lower Fish" assemblages may represent a wet season aggregation site, which is the opposite of the dry season aggregation/dry season dispersal pattern observed for some modern San populations (Lee 1979; Yellen 1977). I cannot definitively confirm this, but it conforms to the oral tradition of site use as a rainy season aggregation site.

The details of this model for the MSA/early LSA transition in the interior regions of southern Africa may or may not be applicable to all regions of southern Africa, for it depends to a greater or lesser extent on the paleoenvironmental conditions which are documented to have varied considerably throughout the Kalahari and other regions of southern Africa during the late Pleistocene.

The conclusions which can be drawn from this analysis of change over the period of ca. 70,000-30,000 B.P. in the artifact assemblages from WPS are viewed at both the local and then in wider contexts. I accept that some of the changes noted are likely site-specific and relate primarily to the range of raw materials used and in the changes in frequencies of the relatively rare tool types. These include the non-lithic artifacts like ostrich egg shell and bone tools which likely have a different pattern of use and discard compared to stone tools.

In comparing the patterns of change in the three assemblages, the timing of changes is such that I can suggest that they indicate regional changes, rather than site-specific ones. These changes include the incidence of bladelets and bladelet cores, of certain categories of retouched tools and unretouched blades, and in the size and shape of unretouched flakes, platform preparation and relative thickness on local versus non-local raw materials.

In regard to some parameters, such as the relative thickness, platform condition and shape of unretouched flakes on quartz(ite) very little variability was apparent between the three assemblages. However, these same variables change dramatically in the non-quartz raw materials indicating that the subdivision of the sequence into the three assemblages designated has certain validity.

The changes in technology that took place between 69,000-50,000 B.P. was different from that which occurred 50,000 and 38,000 B.P. in that in the former (upper MSA/"Large Blade" transitional MSA/early LSA) it was related to a shift to an emphasis on the production of large blades and large backed forms, as well as an emphasis on blade cores which replaced prepared "tortoise" cores and MSA points. This change is not regionally specific and may be related to regional shifts in subsistence strategies tied into paleoenvironmental variables and applicable to large areas of southern Africa. In addition, it appears that the occurrence of new artifact designs can transcend environmental boundaries and subsistence strategies, although some lag in adoption is expected. In the latter, ("Lower Fish "early LSA) the shift was related to the production of highly standardized microlithic formal tool designs that are believed to have been associated with different reduction techniques and hafting methods, as well as a change in the size of the cores and the type of fine grained materials utilized.

Turning to the question of "modern" human behavior, I believe that human populations inhabiting southern Africa were anatomically modern by the Last Interglacial (ca. 128,000-75,000 B.P.). However, I also believe that the full range of cultural behaviors, which included the appearance in the archaeological record of numerous artifacts in materials other than stone, as well as the creation of "art" objects, items of personal adornment, mining of pigments, and ritual treatment of the dead, document the arrival of fully "modern" human behavior. This full range of cultural behaviors appears more recently than the evolution of "modern" anatomical form and really only appears in total in the archaeological record ca. 40,000 years ago in both Africa and elsewhere in the Old World.

If one accepts this scenario, it is suggested that tools and more complex features developed for specific tasks are more likely to have been made in materials other than stone, although I believe that stone artifacts (for example burins and awls) were used in the manufacture of some of these non-lithic artifacts. In the realm of stone, the introduction of composite tools is viewed as a major technological innovation, directly involving and reflected in stone artifacts. If it were not for the Howieson's Poort assemblages and related Last Interglacial assemblages in southern Africa, this could be seen as distinguishing the early LSA from MSA assemblages in the region. No Howieson's Poort type assemblages were in evidence in the WPS assemblages, however, their presence elsewhere can be interpreted as indicating that composite tools were developed in the MSA. Thus, these tool types are not necessarily a major improvement of LSA lithic technology. Volman (1981) interpreted the appearance and disappearance of distinctive Howieson's Poort assemblages within the MSA sequence as representing "a change in tool-kit fashion rather than a major improvement in tool making" (1981:283). Volman (1981) also suggested that the absence of these tool types in post-Howieson's Poort assemblages supports this conclusion. I accept Volmans (1981) interpretation. Thus, I interpret the appearance of backed microlithic elements in late Pleistocene and early Holocene assemblages as indicating a changing focus in stone tool technology, rather than a major improvement in tool making, as it appears that this type of the technology was available much earlier.

In addressing the question of "modern" human behavior, much depends on what each individual researcher uses to define what "modern" behavior consists of. If one insists on the full complement of items of personal adornment, art items, mining of non-utilitarian minerals (pigments), ritual treatment of the dead, blade technology, and sophisticated bone technology, then clearly these are not completely present until the early LSA. However, if you single out certain aspects of this list as dominant or more important, then you can push the definition to include a number of MSA assemblages with, for example, bone tools and blade technology or evidence of mining.

For example, although evidence of mining of raw materials during the MSA is rare, the presence of specularite in some of the MSA deposits at WPS and at Rhino Cave, also located in the Tsodilo Hills (Robbins et al. 1996; Robbins et al. 1998), seems to indicate that non-utilitarian minerals were valued by MSA peoples. In addition, a MSA specularite mine at Lion Hill Cavern in Swaziland in South Africa (Beaumont 1968, 1971, 1973b, 1979a) dated to ca. 43,000 B.P. seems to indicate rather sophisticated activities directed toward raw material acquisition during the MSA in southern Africa. This could be interpreted as an essentially "modern" behavior being exhibited by the MSA people in the region.

As discussed above, the MSA materials at Gi also contain certain artifacts and faunal elements that are according to Brook et al. (1990) "normally associated with anatomically modern humans" (Brooks et al. 1990:62). These artifacts included a number of projectile points "of standardized shape and size apparently modified for hafting;

association with the remains of large, dangerous, or elusive prey species... and the use of grindstones" (Brook et al. 1990:62).

At this point, I intend to keep an open mind on this debate, but view the early LSA as a time when a number of these variables come together in a suite at a number of sites and in different regions. Utilizing this definition, the early LSA includes the manufacture of standardized microlithic hafted formal tools, bladelets from bladelet cores, and a range of non-lithic items including those that have decorative purposes and/or could be regarded as art objects, such as the bone point with a series of incisions from the "Lower Fish" levels at WPS (Robbins and Murphy 1998) (Figure 4.10). This artifact indicates a sophisticated bone technology and this is further supported in the WPS early LSA "Lower Fish" assemblages' bone "harpoon" points (Robbins et al. 1994). Utilizing this definition, the early LSA of southern Africa can be viewed as part of a series of diverse and innovative cultural traditions found throughout Africa and into other regions of the Old World and beyond. The vast geographical distribution of these cultural traditions can be viewed as demonstrating the effectiveness of the technology and the reasons for which they were adopted.

With this working definition, I have to agree with researchers like Klein (1989, 1995), that humans assumed anatomical "modern" status in southern Africa well before they developed or acquired the full range of behaviors that, when viewed as a whole, indicate fully "modern" behavior.

In conclusion, the contribution of this dissertation reaches far beyond the interior regions of southern Africa. Changing lithic reduction strategies and tool form over time, shifting hunter-gatherer mobility models, and the documentation of raw material acquisition and exchange among egalitarian peoples could be applicable world-wide. However, I feel that the most significant contribution is to our increasing understanding of the origins of physically "modern" humans during the MSA and behaviorally "modern" humans during the LSA, as well as documenting the technological, behavioral, and cultural changes that accompanied these important transitions. It is contributing to our knowledge of how we became "modern" humans, that is the ultimate goal of this dissertation.

APPENDICES

APPENDIX A

BLADE(LETS) AND RETOUCHED TOOLS RAW MATERIAL AND METRICAL DATA

Table 28 WPS BLade/Bladelet Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
11	0-10	1	bladelet	0.2	1.2	0.5	0.3
12	0-10	1	bladelet	0.3	1.6	0.75	0.25
12	0-10	1	bladelet B.P.	0.2	1.65	0.6	0.2
13	0-10	1	bladelet	0.2	1.3	0.7	0.25
15	0-10	1	bladelet	0.2		0.8	0.25
19	0-10	1	bladelet	0.2	1	0.4	0.15
12	10-20	1	bladelet med.	0.1		0.45	0.2
20	10-20	1	bladelet	0.2	1.15	0.6	0.3
13	20-30	1	bladelet	0.2	1.3	0.65	0.2
13	20-30	1	bladelet med.	0.1		0.7	0.2
14	20-30	1	bladelet	0.1	1.1	0.4	0.15
17	20-30	1	bladelet	0.1	1.4	0.4	0.15
17	20-30	1	bladelet B.P.	0.2	1.3	0.5	0.25
18	20-30	1	bladelet B.P.	0.2	1.3	0.45	0.3
18	20-30	1	bladelet	0.1	1.25	0.5	0.2
20	20-30	1	bladelet B.P.	0.3	1.45	0.6	0.3
20	20-30	1	bladelet	0.3	1.55	0.7	0.3
22	20-30	1	bladelet	0.3	1.8	0.5	0.25
10	30-40	1	bladelet	0.3	1.8	0.8	0.25
10	30-40	1	bladelet	0.4	1.85	0.8	0.2
13	30-40	1	bladelet	0.1	1.05	0.6	0.15
14	30-40	1	bladelet	0.1	1.05	0.55	0.2
15	30-40	1	bladelet	0.1	1.3	0.5	0.2
10	40-50	1	bladelet	0.4	1.7	0.75	0.35
12	40-50	1	bladelet	1.1	2.2	1.05	0.45
12	40-50	1	bladelet prox.	0.2		0.7	0.3
14	40-50	1	bladelet B.P.	0.2	1.55	0.7	0.3
14	40-50	1	bladelet	0.1	1.15	0.55	0.15
10	50-60	1	bladelet	0.8	2.65	0.85	0.4
13	50-60	1	bladelet	0.3	1.8	0.65	0.25
13	50-60	1	bladelet prox.	0.2		0.65	0.25
14	50-60	1	bladelet	0.3	1.6	0.6	0.2
15	50-60	1	bladelet	0.3	2.1	0.75	0.2
20	50-60	1	bladelet	0.3	1.4	0.6	0.4
20	50-60	1	bladelet	0.1	1.25	0.5	0.25
22	50-60	1	bladelet	0.4	1.4	0.7	0.2
28	50-60	1	bladelet	0.1	0.6	0.25	0.1
11	60-70	1	bladelet	0.2	1.2	0.4	0.35
11	60-70	1	blade B.P.	1.9	2.8	1.2	0.7
12	60-70	1	bladelet B.P.	0.4	1.75	0.75	0.4
13	60-70	1	bladelet	0.4	1.9	0.75	0.4
13	60-70	1	bladelet	0.3	1.6	0.65	0.35
14	60-70	1	bladelet B.P.	0.4	1.75	0.8	0.25
14	60-70	1	bladelet	0.1	1.2	0.5	0.15
16	60-70	1	bladelet	0.1	1.3	0.45	0.15
16	60-70	1	bladelet B.P.	0.3	1.6	0.65	0.3
17	60-70	1	bladelet	0.2	1.7	0.55	0.2
17	60-70	1	bladelet	0.1	1.3	0.5	0.15
18	60-70	1	bladelet	0.9	2.2	0.95	0.45
19	60-70	1	bladelet	0.3	1.5	0.8	0.2
19	60-70	1	bladelet	0.2	1.2	0.6	0.2
10	70-80	1	blade	1.5	2.55	1.4	0.4

Table 28 cont. Blade(let) Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
10	70-80	1	bladelet	0.2	1.3	0.6	0.2
11	70-80	1	bladelet	0.4	1.6	0.75	0.35
12	70-80	1	bladelet B.P.	0.3	1.7	0.7	0.25
12	70-80	1	bladelet	0.1	1.2	0.6	0.15
12	70-80	1	blade	3.6	3.2	1.8	0.55
13	70-80	1	bladelet	0.5	1.9	1	0.35
13	70-80	1	bladelet	0.1	1.3	0.6	0.15
16	70-80	1	blade prox.	3		1.45	0.7
17	70-80	1	bladelet	0.1	1.1	0.45	0.1
18	70-80	1	bladelet	0.2	1.2	0.55	0.2
18	70-80	1	bladelet prox.	0.2		0.8	0.25
20	70-80	1	blade	2.8	3.1	1.45	0.6
20	70-80	1	bladelet	1	2.1	0.95	0.4
21	70-80	1	bladelet	0.2	1.3	0.6	0.3
21	70-80	1	bladelet	0.1	1.4	0.55	0.2
10	80-90	1	bladelet	0.2	1.6	0.7	0.25
10	80-90	1	bladelet	0.2	1.85	0.75	0.2
11	80-90	1	bladelet	0.9	2.45	1	0.35
12	80-90	1	bladelet	1.2	2.1	1.1	0.5
12	80-90	1	blade prox.	0.6		1.2	0.35
12	80-90	1	bladelet prox.	0.2		0.95	0.2
12	80-90	1	bladelet	0.5	2	0.95	0.3
12	80-90	1	bladelet B.P.	0.1	1.1	0.45	0.3
15	80-90	1	bladelet	0.4	2.2	0.95	0.3
15	80-90	1	bladelet	0.6	1.6	0.95	0.4
17	80-90	1	bladelet prox.	0.1		0.4	0.2
18	80-90	1	bladelet prox.	0.2		0.55	0.25
18	80-90	1	bladelet med.	0.1		0.5	0.2
19	80-90	1	bladelet	1	2.5	1.25	0.4
19	80-90	1	bladelet	0.5	1.8	0.85	0.25
22	80-90	1	bladelet	0.9	2.2	0.85	0.3
10	90-100	1	bladelet	0.1	1.2	0.45	0.25
10	90-100	1	bladelet	0.1	1.2	0.35	0.15
11	90-100	1	bladelet B.P.	0.6	1.95	0.9	0.35
11	90-100	1	bladelet	0.1	1.3	0.45	0.25
12	90-100	1	bladelet B.P.	0.4	1.55	0.7	0.3
15	90-100	1	bladelet	0.4	1.8	0.85	0.25
18	90-100	1	bladelet prox.	0.3		0.8	0.2
21	90-100	1	bladelet	0.2	1.45	0.6	0.15
11	100-110	1	bladelet B.P.	1	2	0.8	0.5
11	100-110	1	bladelet	0.3	1.5	0.65	0.35
11	100-110	1	bladelet	0.3	1.6	0.6	0.3
11	100-110	1	bladelet	0.2	1.45	0.55	0.2
12	100-110	1	blade	1.6	2.3	1.4	0.7
12	100-110	1	bladelet	1	2.1	1.1	0.5
12	100-110	1	bladelet	0.1	1.25	0.5	0.25
12	100-110	1	bladelet	0.1	1.2	0.4	0.25
12	100-110	1	bladelet	0.1	0.9	0.5	0.15
12	100-110	1	bladelet prox.	0.1		0.3	0.2
15	100-100	1	bladelet	0.5	2	0.95	0.3
15	100-110	1	bladelet B.P.	0.2	1.7	0.55	0.3
15	100-110	1	bladelet B.P.	0.2	1.65	0.45	0.3

Table 28 cont. Blade(let) Raw Material & Metric Data

Square	Depth	R.M.	Retouch	Location	Wt.gms	L	W	T
15	100-110	1	bladelet	B.P.	0.1	1.35	0.5	0.25
15	100-110	1	bladelet	B.P.	0.1	1.4	0.4	0.2
18	100-110	1	bladelet		1.2	2.4	1.1	0.5
18	100-110	1	bladelet		0.1	1	0.5	0.2
20	100-110	1	bladelet	B.P.	0.2	1.8	0.65	0.2
22	100-110	1	bladelet	prox.	0.5		0.9	0.3
24	100-110	1	bladelet		0.2	1.3	0.4	0.15
10	110-120	1	bladelet		0.1	1.3	0.6	0.2
11	110-120	1	bladelet		0.8	2	0.95	0.45
11	110-120	1	bladelet		0.2	1.55	0.75	0.1
12	110-120	1	bladelet		0.1	1.3	0.35	0.2
13	110-120	1	bladelet		0.1	1.4	0.6	0.2
13	110-120	1	bladelet	prox.	0.2		0.55	0.3
14	110-120	1	bladelet		0.4	1.85	0.6	0.3
14	110-120	1	bladelet		0.2	1.4	0.8	0.25
17	110-120	1	bladelet		0.4	1.75	0.9	0.35
21	110-120	1	bladelet		0.2	1.45	0.45	0.2
22	110-120	1	bladelet		1.1	3.1	1.05	0.3
22	110-120	1	bladelet		0.6	1.8	0.7	0.3
23	110-120	1	bladelet		0.5	1.4	0.7	0.2
23	110-120	1	bladelet		0.3	1.5	0.3	0.1
10	120-130	1	bladelet	B.P.	0.3	1.6	0.6	0.4
11	120-130	1	bladelet	prox.	0.2		0.75	0.2
15	120-130	1	bladelet	prox.	0.8		0.9	0.45
15	120-130	1	bladelet		0.2	1.4	0.7	0.2
15	120-130	1	bladelet		0.1	1.15	0.45	0.15
15	120-130	1	bladelet		0.1	1.1	0.4	0.25
18	120-130	1	bladelet	B.P.	0.5	1.6	0.8	0.45
18	120-130	1	bladelet		0.3	1.5	0.7	0.25
20	120-130	1	bladelet		0.5	2	0.7	0.35
21	120-130	1	blade		2.1	2.8	1.4	0.4
21	120-130	1	bladelet		0.2	1.4	0.65	0.2
10	130-140	1	bladelet	prox.	0.9		1.05	0.45
13	130-140	1	bladelet	B.P.	0.7	2.3	0.85	0.3
13	130-140	1	bladelet		0.4	1.55	0.75	0.3
13	130-140	1	bladelet		0.1	1.2	0.4	0.25
22	130-140	1	bladelet	prox.	0.7		1.15	0.3
22	130-140	1	bladelet	prox.	0.2		0.7	0.2
29	130-140	1	bladelet		0.1	1.1	0.3	0.1
11	140-150	1	bladelet		0.2	1.3	0.65	0.2
11	140-150	1	bladelet	prox.	0.3		0.8	0.25
21	140-150	1	bladelet		1.1	2.6	1.05	0.4
22	140-150	1	bladelet		0.6	1.5	0.7	0.35
11	150-160	1	bladelet	Uni/Unilat	0.3	1.4	0.65	0.3
20	150-160	1	bladelet		0.1	1.05	0.4	0.1
21	150-160	1	bladelet		0.7	1.8	1	0.4
21	150-160	1	bladelet		0.3	1.85	0.65	0.25
13	160-170	1	bladelet	B.P.	0.3	1.6	0.5	0.4
11	170-180	1	bladelet	prox.	0.4		0.95	0.2
13	170-180	1	bladelet		0.1	1.4	0.45	0.15
20	170-180	1	bladelet		0.2	1.8	0.7	0.15
20	170-180	1	bladelet		0.6	1.95	0.75	0.4
20	170-180	1	bladelet		0.2	1.55	0.5	0.25

Table 28 cont. Blade(let) Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
20	170-180	1	bladelet	0.1	1.55	0.4	0.1
10	180-190	1	bladelet	0.2	1.7	0.55	0.3
10	180-190	1	bladelet prox.	0.2		0.7	0.2
11	180-190	1	bladelet	0.6	2	1	0.35
11	180-190	1	bladelet prox.	0.5		0.85	0.35
12	180-190	1	bladelet	0.7	2	0.9	0.4
13	180-190	1	blade	1.7	2.6	1.4	0.45
19	180-190	1	blade prox.	2	2.4	1.4	0.6
19	180-190	1	bladelet prox.	0.8		0.9	0.6
20	180-190	1	bladelet	0.2	1.4	0.55	0.4
21	180-190	1	bladelet	0.1	1.35	0.45	0.2
21	180-190	1	bladelet	0.4	2.15	0.8	0.3
22	180-190	1	bladelet	0.5	2.3	0.65	0.45
22	180-190	1	bladelet prox.	0.4		0.7	0.2
12	190-200	1	bladelet B.P.	0.1	1.4	0.5	0.2
20	190-200	1	bladelet	0.5	1.7	0.7	0.4
21	190-200	1	bladelet	0.3	1.55	0.5	0.3
22	190-200	1	bladelet	0.5	1.4	0.9	0.25
12	200-210	1	blade B.P.	2	2.35	1.45	0.6
12	200-210	1	bladelet	0.3	1.35	0.6	0.3
20	200-210	1	bladelet	0.1	1.5	0.65	0.1
21	200-210	1	bladelet	1	2	1.1	0.3
21	200-210	1	bladelet	0.2	1.25	0.6	0.25
21	200-210	1	bladelet	0.1	1.1	0.5	0.2
22	200-210	1	bladelet	0.3	1.4	0.5	0.3
10	210-220	1	blade prox.Uni/Bila	5.5		1.95	0.65
10	210-220	1	bladelet prox.	0.2		0.65	0.2
11	210-220	1	bladelet B.P.	0.8	2.1	0.95	0.5
11	210-220	1	bladelet	0.1	1.3	0.5	0.2
19	210-220	1	bladelet	0.1	1.2	0.4	0.2
20	210-220	1	bladelet	0.2	1.65	0.4	0.2
21	210-220	1	bladelet prox.	0.6		0.85	0.35
22	210-220	1	blade	3.2	3.4	1.2	0.6
22	210-220	1	bladelet	0.7	1.9	0.6	0.4
23	210-220	1	bladelet	0.7	1.6	0.9	0.3
10	220-230	1	bladelet	0.1	1.3	0.6	0.15
11	220-230	1	bladelet B.P.	0.5	1.7	0.9	0.4
12	220-230	1	blade	1	2.2	1.2	0.4
21	220-230	1	bladelet	0.4	1.65	0.7	0.35
22	220-230	1	blade	0.8	1.9	1.25	0.3
22	220-230	1	bladelet	0.6	1.5	1	0.25
22	220-230	1	bladelet B.P.	0.4	1	0.65	0.3
10	230-240	1	bladelet prox.	0.2		0.6	0.2
11	230-240	1	bladelet B.P.	0.7	1.9	0.85	0.45
12	230-240	1	bladelet	0.2	1.7	0.8	0.2
12	230-240	1	bladelet	0.1	1.1	0.5	0.2
20	230-240	1	bladelet	0.2	1.65	0.8	0.2
21	230-240	1	blade prox.	1.3	2.55	1.2	0.5
21	230-240	1	bladelet prox.	0.4		1.1	0.3
21	230-240	1	bladelet	0.2	1.65	0.55	0.25
21	230-240	1	bladlet	0.2	1.2	0.6	0.2
22	230-240	1	bladelet	0.4	1.6	0.7	0.25
22	230-240	1	bladelet	0.4	1.4	0.7	0.25

Table 28 cont. Blade(let) Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
22	230-240	1	bladelet	0.6	1.45	0.9	0.3
22	230-240	1	bladlet	0.9	2.1	1	0.35
22	230-240	1	bladelet	0.8	1.9	1	0.35
22	230-240	1	bladelet	0.5	1.7	0.75	0.3
22	230-240	1	bladelet	0.8	1.7	0.9	0.45
22	230-240	1	bladelet	0.5	1.55	0.65	0.25
22	230-240	1	bladelet	0.9	1.9	1.1	0.3
22	230-240	1	bladelet prox.	0.9		1.15	0.3
10	240-250	1	bladelet prox.	0.2		0.7	0.25
11	240-250	1	bladelet prox.	0.6		0.9	0.35
12	240-250	1	bladelet prox.	0.3		0.75	0.25
12	240-250	1	bladelet prox.	0.3		0.7	0.35
12	240-250	1	bladelet	1	2.35	1.1	0.4
12	240-250	1	bladelet	1.2	2.35	1.05	0.45
12	240-250	1	bladelet	0.2	1.45	0.4	0.2
20	240-250	1	bladelet	0.5	1.9	0.65	0.35
20	240-250	1	bladelet	0.7	2.2	0.7	0.5
20	240-250	1	bladelet	0.4	1.75	0.9	0.3
20	240-250	1	bladelet	0.2	1.6	0.6	0.2
20	240-250	1	bladelet	0.2	1.6	0.6	0.2
20	240-250	1	bladelet	0.2	1.25	0.5	0.3
20	240-250	1	bladelet	0.1	1.25	0.35	0.35
20	240-250	1	blade	5.1	3.35	1.75	0.75
21	240-250	1	bladelet	0.7	2.25	1.15	0.25
21	240-250	1	bladelet	0.1	1.15	0.4	0.15
21	240-250	1	blade	0.8	2.4	1.2	0.3
21	240-250	1	bladelet	0.3	1.55	0.65	0.3
21	240-250	1	bladelet	0.4	1.6	0.7	0.3
21	240-250	1	bladelet	0.3	1.5	0.7	0.3
21	240-250	1	bladelet prox.	0.3		0.7	0.35
21	240-250	1	bladelet	0.2	1.2	0.5	0.25
21	240-250	1	bladelet	1.2	2.05	1.05	0.55
22	240-250	1	bladelet B.P.	1	1.6	0.55	0.35
22	240-250	1	bladelet	0.9	1.35	0.95	0.2
22	240-250	1	blade	1.4	2.3	1.2	0.55
22	240-250	1	bladelet B.P.	0.6	2.35	0.95	0.35
22	240-250	1	bladelet	0.9	1.9	1.1	0.45
22	240-250	1	blade prox.	0.9		1.3	0.35
22	240-250	1	bladelet	0.5	1.75	0.95	0.4
22	240-250	1	bladelet	0.4	1.95	1.05	0.45
23	240-250	1	bladelet	1.3	2.3	1.1	0.3
11	250-260	1	bladelet	0.5	1.85	0.85	0.3
11	250-260	1	bladelet B.P.	0.3	1.65	0.8	0.3
11	250-260	1	bladelet	0.3	1.6	0.7	0.25
11	250-260	1	bladelet	0.1	1.4	0.6	0.2
11	250-260	1	bladelet	0.2	1.2	0.6	0.2
11	250-260	1	bladelet	0.1	1.1	0.55	0.2
12	250-260	1	bladelet	0.6	2.05	0.7	0.4
12	250-260	1	bladelet	0.3	1.5	0.7	0.25
19	250-260	1	bladelet	0.7	2.05	0.9	0.3
19	250-260	1	bladelet	0.4	1.55	0.6	0.3
19	250-260	1	bladelet B.P.	0.5	2.05	0.7	0.35
19	250-260	1	bladelet	0.3	2	0.6	0.3

Table 28 cont. Blade(let) Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W
20	250-260	1	bladelet	0.3	1.8	0.65
21	250-260	1	bladelet	0.3	1.5	0.9
21	250-260	1	bladelet	0.2	1.4	0.7
21	250-260	1	bladelet prox.	0.3		0.7
21	250-260	1	blade	3	2.85	2.15
22	250-260	1	bladelet prox.	0.6		1.1
22	250-260	1	bladelet	0.4	1.7	0.7
22	250-260	1	bladelet	0.3	1.25	0.7
11	260-270	1	bladelet	0.2	1.4	0.65
12	260-270	1	bladelet	1	2.25	0.9
12	260-270	1	bladelet B.P.	0.4	1.75	0.75
12	260-270	1	bladelet	0.4	1.7	0.9
12	260-270	1	bladelet	0.1	1.1	0.55
12	260-270	1	bladelet prox.	0.3		0.85
12	260-270	1	bladelet med.	0.2		0.6
20	260-270	1	bladelet	0.4	1.6	0.7
20	260-270	1	bladelet	0.4	1.6	0.75
20	260-270	1	bladelet prox.	0.3		0.8
20	260-270	1	bladelet	0.1	1.3	0.4
21	260-270	1	bladelet	0.7	2.3	0.9
21	260-270	1	bladelet	0.5	2.1	0.65
21	260-270	1	bladelet	0.2	1.35	0.75
21	260-270	1	bladelet	0.2	1.15	0.5
21	260-270	1	bladelet	0.2	1.05	0.6
21	260-270	1	bladelet med.	0.1		0.6
12	270-280	1	bladelet	0.3	1.3	0.65
19	270-280	1	bladelet	0.4	1.35	0.6
20	270-280	1	blade	1	2.3	1.3
20	270-280	1	bladelet	0.1	1.15	0.45
20	270-280	1	bladelet	0.3	1.45	0.75
21	270-280	1	blade	1.1	2.5	1.15
21	270-280	1	blade	1.4	2.4	1.25
22	270-280	1	bladelet	0.7	1.65	0.8
22	270-280	1	bladelet	0.3	1.35	0.65
12	280-290	1	bladelet prox.	0.3		0.7
12	280-290	1	bladelet	0.2	1.15	0.6
21	280-290	1	bladelet	0.7	2	0.7
21	280-290	1	bladelet	0.9	2.45	0.85
21	280-290	1	bladelet prox.	0.2		0.8
11	290-300	1	bladelet prox.	0.2		0.75
12	290-300	1	bladelet prox.	0.2		0.65
21	290-300	1	blade	1.6	2.7	1.6
22	290-300	1	Uni/Unilat prox.	0.3		0.65
22	290-300	1	bladelet	0.7	1.7	0.75
23	300-310	1	blade	1.2	2.7	1.3
12	320-330	1	bladelet B.P.	0.1	1.4	0.5
22	320-330	1	bladelet	0.2	1.3	0.6
11	330-340	1	bladelet	1	2.05	1.1
12	330-340	1	balde Uni/Unilat	1.3		1.4
23	330-340	1	bladelet	0.8	1.8	0.9
12	340-350	1	bladelet B.P.	0.7	2.3	0.95
12	340-350	1	bladelet prox.	0.3		0.85
20	340-350	1	bladelet	0.1	1.2	0.4

Table 28 cont. Blade(let) Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W
21	340-350	1	bladelet prox.	0.7		1
11	350-360	1	bladelet	0.2	1.5	0.45
11	350-360	1	bladelet prox.	0.2		0.6
12	350-360	1	bladelet	0.1	0.9	0.4
21	350-360	1	bladelet prox.	0.2		0.65
22	350-360	1	blade prox.	0.7		1.5
12	360-370	1	bladelet dist.	0.1		0.6
20	360-370	1	bladelet	0.2	1.45	0.5
12	370-380	1	bladelet prox.	0.1		0.35
20	380-390	1	blade	10.6	4.6	1.9
23	380-390	1	bladelet	0.6	1.3	0.4
23	380-390	1	bladelet	0.2	1.5	0.5
11	390-400	1	bladelet	0.1	1.15	0.45
12	390-400	1	bladelet B.P.	0.2	1.55	0.5
12	390-400	1	bladelet prox.	0.2		0.7
22	390-400	1	blade	1.8	2.7	1.25
22	390-400	1	blade	3.8	3	2.05
22	390-400	1	bladelet	0.4	1.55	0.55
20	400-410	1	bladelet	0.1	1.5	0.4
20	400-410	1	bladelet prox.	0.2		0.55
20	410-420	1	bladelet	0.9	2.9	1
21	410-420	1	blade prox.	2		1.5
21	410-420	1	blade prox.	1.8		1.6
21	410-420	1	bladelet prox.	0.4		0.8
11/12	420-430	1	bladelet	0.2	1.3	0.6
21	420-430	1	blade	1.2	3	1.15
11/12	430-440	1	bladelet med.	0.2		0.7
21	430-440	1	bladelet	0.2	1.3	0.5
11/12	440-450	1	bladelet	0.2	1.35	0.5
21	440-450	1	blade prox.	1.3		1.4
21	440-450	1	bladelet	0.2	1.8	0.65
21	440-450	1	bladelet	0.3	1.85	0.65
11/12	450-460	1	blade prox.	1.7		1.55
11/12	450-460	1	bladelet prox.	1		1.05
11/12	450-460	1	bladelet	0.9	2	1.1
11/12	450-460	1	bladelet B.P.	0.4	1.8	0.65
21	450-460	1	bladelet	0.2	1.2	0.6
21	450-460	1	blade	9.4	3.95	2.35
11/12	460-470	1	blade	4.3	3.6	1.65
11/12	460-470	1	bladelet	0.8	2.5	1.1
11/12	460-470	1	bladelet	0.2	1.5	0.65
11/12	460-470	1	bladelet B.P.	0.2	1.6	0.55
11/12	460-470	1	bladelet B.P.	0.2	1.4	0.45
11/12	460-470	1	bladelet B.P.	0.1	1.1	0.5
11/12	470-480	1	blade	1.8	3.05	1.4
11/12	470-480	1	blade prox.	0.8		1.35
11/12	470-480	1	bladelet	0.8	2	1
11/12	470-480	1	bladelet B.P.	0.2	1.5	0.5
11/12	470-480	1	bladelet B.P.	0.3	1.75	0.5
11/12	470-480	1	bladelet prox.	0.2		0.7
23	470-480	1	bladelet	0.6	1.9	0.8
12	480-490	1	blade prox.	4.6		1.75
12	490-500	1	bladelet prox.	0.1		0.[illegible]

Table 28 cont. Blade(let) Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
21	510-520	1	blade	1.8	2.7	1.3	0.5
12	520-530	1	bladelet B.P.	0.4	1.8	0.75	0.25
12	520-530	1	blade B.P.	3.2	3.6	1.35	0.6
12	520-530	1	blade	2.7	2.75	1.6	0.6
21	530-540	1	blade	4.6	3.5	1.7	0.75
12	540-550	1	bladelet B.P.	0.3	1.6	0.65	0.3
21	540-550	1	blade	2.3	2.9	1.4	0.55
21	570-580	1	blade	2.1	3.1	1.45	0.5
21	580-590	1	bladelet	0.3	1.65	0.9	0.2
21	580-590	1	bladelet	0.9	2.2	0.85	0.5
12	590-600	1	bladelet prox.	0.7		1.1	0.35
12	590-600	1	bladelet B.P.	0.5	2	0.8	0.3
12	600-610	1	blade	2	2.8	1.4	0.5
21	600-610	1	blade	4.8	3.5	2	0.8
12	610-620	1	blade	0.9	2.5	1.3	0.25
12	640-650	1	bladelet	0.1	1.4	0.5	0.2
12	650-660	1	bladelet	0.2	1.6	0.9	0.1
19	20-30	2	bladelet	0.5	1.5	0.8	0.25
23	30-40	2	bladelet	0.6	1.6	1	0.2
12	40-50	2	bladelet	0.1	1	0.5	0.1
20	40-50	2	blade	1.5	2.5	1.35	0.45
23	40-50	2	bladelet/Unilat	0.9	2.7	1.1	0.4
23	40-50	2	bladelet	0.2	1.3	0.6	0.2
22	50-60	2	bladelet	0.4	1.65	0.8	0.25
10	70-80	2	bladelet prox.	0.2		0.55	0.2
11	70-80	2	bladelet	0.2	1.6	0.7	0.25
11	70-80	2	bladelet prox.	0.2		0.75	0.2
13	70-80	2	bladelet prox	0.1		0.75	0.2
19	70-80	2	bladelet	0.3	1.8	0.65	0.3
21	70-80	2	bladelet	0.1	1.3	0.6	0.2
22	70-80	2	blade	0.8	1.9	1.2	0.2
13	80-90	2	blade	5.4	4.35	1.5	0.9
15	90-100	2	bladelet prox.	0.1		0.7	0.2
19	90-100	2	bladelet	0.3	1.7	0.65	0.3
20	90-100	2	bladelet dist.	0.3		1	0.2
10	100-110	2	bladelet	0.4	2	0.45	0.45
10	100-110	2	bladelet	0.5	1.8	0.75	0.35
11	100-110	2	bladelet Uni/Unilat	0.6	2.55	0.85	0.35
11	100-110	2	bladelet	0.1	1.3	0.65	0.1
11	100-110	2	bladelet	0.2	1.5	0.8	0.2
11	100-110	2	bladelet prox.	0.1		0.5	0.2
12	100-110	2	bladelet	0.5	2.3	0.65	0.55
13	100-110	2	bladelat Uni/Unilat	0.5	1.7	0.75	0.35
14	100-110	2	bladelet	0.2	1.6	0.65	0.2
14	100-110	2	bladelet	0.1	1.2	0.45	0.2
15	100-110	2	bladelet	0.1	1.35	0.65	0.1
12	110-120	2	bladelet	0.1	1.1	0.6	0.15
14	110-120	2	bladelet	0.1	1.2	0.5	0.2
15	110-120	2	bladelet	0.1	1.4	0.55	0.2
18	110-120	2	bladelet	0.2	1.35	0.6	0.2
27	110-120	2	bladelet	0.3	1.7	0.5	0.15
10	120-130	2	bladelet	0.3	1.85	0.7	0.2
13	120-130	2	blade	1.2	2.7	1.2	0.4

Table 28 cont. Blade(let) Raw Material & Metric Data

Square	Depth	R.M.	Retouch	Location	Wt.gms	L	W
13	120-130	2	bladelet	prox.	0.2		0.65
10	130-140	2	bladelet	prox.	0.1		0.4
13	130-140	2	bladelet		0.2	1.6	0.65
10	140-150	2	bladelet		0.2	1.6	0.5
12	140-150	2	bladelet	dist.	0.1		0.6
20	140-150	2	bladelet		0.3	1.5	0.75
22	140-150	2	bladelet		0.3	1.4	0.6
21	160-170	2	blade		1.8	3.05	1.7
10	170-180	2	bladelet	prox.	0.3		1.1
11	170-180	2	bladelet		0.4	2.35	0.95
11	170-180	2	bladelet		0.6	1.8	0.8
11	180-190	2	blade		0.9	2.4	1.3
22	190-200	2	bladelet		0.3	1.25	0.55
22	190-200	2	bladelet	prox.	0.5		0.65
12	200-210	2	bladelet		0.1	1.1	0.5
19	200-210	2	blade		2.7	3.85	1.4
11	210-220	2	bladelet		0.2	1.4	0.6
19	210-220	2	bladelet		0.1	1.2	0.35
22	210-220	2	blade	prox.	1.3		1.3
21	220-230	2	blade		2.1	2.65	1.5
12	240-250	2	blade	prox.	1		1.5
19	240-250	2	bladelet		1.5	3.05	1.05
10	250-260	2	bladelet		0.6	1.9	1
12	250-260	2	bladelet		0.2	2.5	0.6
12	250-260	2	bladelet	prox.	0.2		0.6
12	250-260	2	bladelet	med.	0.2		0.8
19	250-260	2	bladelet		0.7	2.2	0.75
19	250-260	2	bladelet		1.3	2.9	1.1
22	250-260	2	blade		1.4	2.2	1.6
20	260-270	2	bladelet	prox.	0.4		0.85
21	260-270	2	blade		0.9	2.2	1.15
22	270-280	2	bladelet		0.3	1.65	0.65
22	280-290	2	bladelet		0.2	1.75	0.55
11	310-320	2	blade	med.	0.8		1.5
12	340-350	2	blade	prox.	2.3		2.1
20	340-350	2	bladelet		0.2	1.7	0.7
22	340-350	2	blade	prox.	0.8		1.15
22	340-350	2	bladelet	prox.	0.4		1.05
11	360-370	2	bladelet		1.1	2.75	0.95
21	360-370	2	bladelet	Uni/Unilat	1.1	2.55	1
20	390-400	2	blade	dist.	1.6		1.65
21	400-410	2	blade	med.	1.2		1.4
22	400-410	2	blade	prox. Uni/Uni	0.8		1.7
11/12	410-420	2	blade	prox.	2		1.8
21	410-420	2	blade	prox.	2.3		1.9
11/12	420-430	2	bladelet	med.	0.5		0.95
11/12	420-430	2	bladelet	prox.	0.7		0.95
20	420-430	2	blade		11.7	4.8	2.2
23	420-430	2	bladelet		1	2	0.9
11/12	430-440	2	bladelet	prox.	0.1		0.5
11/12	440-450	2	blade	prox.	9.5		2.9
21	440-450	2	bladelet		0.1	1.3	0.6
11/12	450-460	2	blade	prox.	0.9		1.4

Table 28 cont. Blade(let) Raw Material & Metric Data

Square	Depth	R.M.	Retouch	Location	Wt.gms	L	W	T
11/12	470-480	2	blade		2.7	3.45	1.2	0.35
12	520-530	2	bladelet		0.1	1.2	0.6	0.2
21	540-550	2	blade		1	2.95	1.4	0.35
12	550-560	2	blade		1.3	2.6	1.3	0.5
12	560-570	2	bladelet		0.1	1.35	0.55	0.2
21	570-580	2	bladelet		0.3	1.75	0.9	0.25
21	580-590	2	bladelet		0.1	1.2	0.6	0.2
12	590-600	2	blade		1.3	3.05	1.6	0.4
23	650-660	2	bladelet		0.2	1.6	0.7	0.2
13	50-60	3	bladelet		0.1	1.35	0.6	0.2
20	50-60	3	bladelet		0.4	2.35	0.65	0.35
22	50-60	3	bladelet		0.2	1.4	0.5	0.2
11	70-80	3	bladelet		0.2	1.7	0.85	0.2
14	70-80	3	bladelet		0.2	1.2	0.7	0.25
27	70-80	3	bladelet	prox.	0.2			0.2
22	80-90	3	bladelet		0.8	1.6	0.8	0.4
23	80-90	3	bladelet		0.8	2.25	1	0.2
19	90-100	3	bladelet	Uni/Bilat	1.2	2.8	0.8	0.5
12	100-110	3	bladelet	med.	0.2		0.7	0.2
13	100-110	3	bladelet		0.2	1.45	0.6	0.25
15	100-110	3	bladelet		0.6	2.4	1.1	0.25
18	100-110	3	bladelet		0.3	1.5	0.95	0.3
24	100-110	3	bladelet		0.1	1.5	0.7	0.1
25	100-110	3	bladelet		0.2	1.2	0.5	0.1
10	110-120	3	bladelet		0.5	2.95	0.75	0.2
12	110-120	3	bladelet		0.3	2.05	0.6	0.3
13	110-120	3	bladelet		0.3	1.4	0.7	0.3
13	110-120	3	bladelet		0.2	1.6	0.45	0.3
15	110-120	3	blade	prox.	0.6		1.25	0.35
15	110-120	3	bladelet		0.3	1.65	1	0.2
15	110-120	3	bladelet		0.4	1.55	0.9	0.2
17	110-120	3	bladelet		0.7	2.15	0.9	0.45
23	110-120	3	bladelet		0.3	1.3	0.4	0.1
28	110-120	3	bladelet		0.7	1.6	0.8	0.4
11	120-130	3	bladelet	prox.uni	0.2		0.55	0.35
12	120-130	3	bladelet		0.2	1.35	0.7	0.25
13	120-130	3	bladelet		0.3	1.9	0.65	0.[illegible]
17	120-130	3	bladelet		0.1	1.45	0.4	0.15
17	120-130	3	bladelet		0.1	1.2	0.5	0.[illegible]
21	120-130	3	bladelet		0.2	1.6	0.7	0.[illegible]
25	120-130	3	bladelet	prox.	0.2			0.[illegible]
26	120-130	3	bladelet		0.2	1.5	0.5	0.[illegible]
27	120-130	3	bladelet		0.3	1.6	0.8	0.15
27	140-150	3	bladelet		0.3	1.6	0.8	0.[illegible]
29	140-150	3	blade	Bi/Bilat	3.3	3.4	1.4	0.[illegible]
21	160-170	3	bladelet		0.2	1.15	0.55	0.[illegible]
12	170-180	3	bladelet	prox.	0.5	2.15	0.8	0.[illegible]
10	180-190	3	bladelet		0.4	2	1	0.[illegible]
21	180-190	3	bladelet		0.2	1.45	0.6	0.[illegible]
11	230-240	3	bladelet		0.2	1.3	0.7	0.[illegible]
22	230-240	3	bladelet		0.6	1.75	0.75	0.[illegible]
22	230-240	3	bladelet		0.4	1.45	0.75	0.[illegible]
23	230-240	3	bladelet		0.7	1.6	0.8	0.[illegible]

Table 28 cont. Blade(let) Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
23	230-240	3	bladelet	1	1.7	1	0.3
12	240-250	3	blade	2.2	3.3	1.6	0.4
21	240-250	3	bladelet	0.3	1.65	0.8	0.3
22	240-250	3	bladelet	0.3	1.3	0.5	0.2
12	250-260	3	bladelet	0.5	1.9	0.7	0.5
12	250-260	3	bladelet	0.3	1.6	0.85	0.25
12	250-260	3	bladelet	0.2	1.45	0.7	0.3
21	250-260	3	bladelet	0.5	1.85	0.9	0.3
22	250-260	3	blade	2	3	1.2	0.55
22	250-260	3	bladelet	0.3	1.7	0.7	0.25
11	260-270	3	bladelet	0.3	1.65	0.75	0.25
23	260-270	3	bladelet	0.4	2.1	0.6	0.3
19	270-280	3	bladelet	0.4	1.35	0.65	0.3
21	280-290	3	bladelet	0.4	2	0.95	0.25
22	280-290	3	bladelet	0.2	1.5	0.4	0.4
11	290-300	3	bladelet med.	0.2		0.95	0.15
11	300-310	3	bladelet prox.	0.3		1.1	0.25
22	330-340	3	bladelet	0.3	1.7	0.95	0.2
12	360-370	3	bladelet	0.1	1.25	0.5	0.2
11	370-380	3	blade	2.6	3.1	1.7	0.5
21	400-410	3	blade	2.9	3.4	1.85	0.6
11/12	410-420	3	blade	3.3	3.85	1.85	0.7
22	410-420	3	blade	2.5	3.1	1.6	0.5
22	410-420	3	blade	1.6	3.2	1.25	0.55
22	420-430	3	blade	1.9	2.25	1.45	0.5
11/12	430-440	3	blade prox.	1.1		1.5	0.5
11/12	430-440	3	blade prox.	0.6		1.3	0.25
20	430-440	3	bladelet	0.4	1.9	1	0.2
21	430-440	3	blade prox.	1.9		1.6	0.5
22	430-440	3	bladelet	0.2	1.2	0.6	0.2
21	460-470	3	bladelet	0.2	1.5	0.6	0.25
11/12	470-480	3	blade prox.	1.1		1.6	0.4
21	470-480	3	bladelet	0.5	1.9	0.9	0.3
12	480-490	3	blade prox.	2.8		1.95	0.35
21	480-490	3	bladelet prox.	0.4		1	0.2
21	480-490	3	bladelet	0.2	1.55	0.65	0.2
23	490-500	3	blade Uni/Bilat	5.2	3.7	1.9	1
12	500-510	3	blade Uni/Unilat/Di	12	4.4	2.25	1.1
21	500-510	3	bladelet	0.2	1.3	0.75	0.2
22	530-540	3	bladelet	0.1	1.3	0.6	0.2
23	690-700	3	blade prox.	7.5		2.6	0.7
20	0-10	4	bladelet	0.1	1.3	0.55	0.2
12	20-30	4	bladelet	0.6	1.9	1.15	0.4
14	30-40	4	bladelet	0.1	1.2	0.5	0.25
21	40-50	4	bladelet prox.	0.2		0.6	0.2
22	40-50	4	bladelet	0.4	1.2	0.65	0.3
18	50-60	4	bladelet	0.2	1.6	0.6	0.15
18	50-60	4	bladelet	0.2	1.45	0.55	0.2
18	60-70	4	bladelet	0.4	2.15	0.9	0.3
14	70-80	4	bladelet prox.	0.1		0.45	0.2
12	80-90	4	bladelet	0.1	1.4	0.55	0.2
15	80-90	4	bladelet	0.1	1.2	0.45	0.25
22	80-90	4	bladelet	0.5	1.9	0.7	0.2

Table 28 cont. Blade(let) Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W
25	80-90	4	bladelet	0.2	1.5	0.6
11	90-100	4	bladelet	0.2	1.55	0.6
12	90-100	4	bladelet med.	0.2		0.8
21	90-100	4	bladelet	0.1	0.95	0.5
21	90-100	4	bladelet	0.1		0.6
13	100-110	4	bladelet	0.4	1.85	0.7
19	100-110	4	bladelet prox.	0.3		0.95
24	100-110	4	blade prox.	0.3		1.4
11	110-120	4	bladelet prox.	0.2		0.65
13	110-120	4	bladelet	0.1	1	0.55
13	110-120	4	bladelet prox.	0.2		0.75
15	110-120	4	blade	1	2.4	1.35
20	110-120	4	bladelet	0.2	1.4	0.9
17	120-130	4	bladelet	0.3	1.4	0.6
18	120-130	4	bladelet	0.5	2	1.2
18	120-130	4	bladelet	0.1	1.25	0.6
20	120-130	4	bladelet prox.	0.2		0.8
22	120-130	4	bladelet	0.4	1.5	0.8
22	120-130	4	bladelet	0.5	1.8	0.75
25	120-130	4	bladelet prox.	0.2		
11	160-170	4	blade prox.	1.9		2
21	160-170	4	bladelet prox.	0.1		0.55
22	180-190	4	bladelet	0.2	1.1	0.3
21	190-200	4	bladelet	0.5	2	0.9
21	230-240	4	bladelet prox.	0.4		0.95
21	230-240	4	bladlet	0.2	1.25	0.55
22	240-250	4	blade prox.	0.8		1.35
22	240-250	4	bladelet	0.3	1	0.6
22	250-260	4	bladelat prox.	0.2	1.35	1
23	250-260	4	bladelet med.	0.6		1
19	260-270	4	bladelet	0.5	1.8	0.8
22	270-280	4	bladelet	0.3	1.2	0.75
22	280-290	4	bladelet prox.	0.1		0.75
22	400-410	4	blade	1.5	3.6	1.45
23	410-420	4	blade	1.2	3	1.2
23	420-430	4	bladelet	0.5	1.4	0.7
22	430-440	4	bladelet	0.4	1.3	0.7
11/12	450-460	4	bladelet	0.4	1.85	1.1
11/12	470-480	4	blade	0.9	2.95	1.3
21	470-480	4	blade	2	3.1	1.5
23	470-480	4	blade prox.	0.5		1.5
12	480-490	4	blade	0.9	2.6	1.2
12	540-550	4	bladelet med.	0.1		0.8
23	560-570	4	bladelet	0.9	3.2	1
23	570-580	4	blade prox.	0.7		1.3
12	590-600	4	bladelet prox.	0.2		0.85
23	30-40	5	bladelet	0.8	2.3	0.7
22	60-70	5	bladelet prox.	0.3		
12	100-110	5	bladelet	0.3	1.6	0.7
20	110-120	5	bladelet	0.1	1.1	0.6
29	110-120	5	bladelet	0.7	2.6	1
14	120-130	5	bladelet	0.1	1.4	0.45
18	120-130	5	bladelet	0.1	1.45	0.45

Table 28 cont. Blade(let) Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
19	120-130	5	bladelet	0.1	1.3	0.45	0.25
21	150-160	5	bladelet	0.5	1.4	0.9	0.4
23	220-230	5	blade	2.1	2.7	1.4	0.4
11	250-260	5	bladelet prox.	0.3		0.95	0.25
22	350-360	5	blade	5.5	3.55	2.4	0.7
22	350-360	5	blade prox.	0.8		1.4	0.35
11/12	410-420	5	blade prox.	0.3		1.35	0.2
23	470-480	5	bladelet prox.	0.5		0.9	0.5
21	500-510	5	blade	5	4	1.9	0.55
21	510-520	5	bladelet	0.3	1.5	0.8	0.25
12	550-560	5	bladelet	0.3	1.9	0.85	0.25
23	80-90	6	bladelet	0.9	2.25	1.1	0.1
15	100-110	6	bladelet	0.4	1.55	0.85	0.3
21	540-550	6	blade prox.	0.2		1.3	0.2
12	20-30	7	bladelet	0.3	1.8	0.75	0.35
14	30-40	7	blade	2.1	3.6	1.9	0.4
12	60-70	7	blade Uni/Unilat	6.4	4	2.2	0.7
13	60-70	7	bladelet	0.4	1.45	0.8	0.4
12	70-80	7	bladelet	1	2.4	0.95	0.5
18	70-80	7	blade	0.6	2.1	1.2	0.3
21	70-80	7	bladelet	0.2	1.3	0.6	0.25
11	80-90	7	bladelet	0.8	2.3	1.05	0.35
17	80-90	7	bladelet	1	2.6	0.8	0.6
19	80-90	7	bladelet	0.5	1.45	0.8	0.3
10	90-100	7	blade	2.3	3.5	1.65	0.5
11	90-100	7	blade	4.3	4.2	1.85	0.6
10	100-110	7	bladelet	0.4	1.55	0.7	0.3
12	100-110	7	blade	1.5	2.7	1.4	0.45
12	100-110	7	bladelet	1	2.3	0.95	0.55
12	100-110	7	bladelet	0.1	1.25	0.65	0.2
14	100-110	7	bladelet	0.1	1.4	0.6	0.15
15	100-110	7	bladelet	0.2	1.5	0.65	0.2
18	100-110	7	bladelet	0.2	1.75	0.55	0.3
18	100-110	7	bladelet	0.2	1.7	0.85	0.2
10	110-120	7	bladelet	0.2	1.2	0.7	0.25
12	110-120	7	bladelet	0.5	2.1	1	0.25
13	110-120	7	bladelet	0.4	1.7	0.9	0.25
13	110-120	7	bladelet	0.1	1.3	0.6	0.2
13	110-120	7	bladelet	0.1	1.1	0.5	0.3
13	110-120	7	bladelet	0.2	1.3	0.7	0.2
13	110-120	7	bladelet	0.1	1	0.5	0.15
13	110-120	7	bladelet prox.	0.1		0.75	0.25
14	110-120	7	bladelet	0.6	2.5	0.6	0.3
14	110-120	7	bladelet	0.1	1.4	0.45	0.2
15	110-120	7	bladelet	1.1	2.35	1	0.45
15	110-120	7	bladelet Uni/Unilat	0.1	1.9	0.4	0.2
15	110-120	7	bladelet	0.3	1.8	0.7	0.25
11	120-130	7	bladelet med.	0.1		0.45	0.2
13	120-130	7	bladelet	0.8	2.25	1.05	0.3
13	120-130	7	bladelet	0.4	1.95	0.7	0.25
14	120-130	7	bladelet	0.2	1.4	0.85	0.35
14	120-130	7	bladelet	0.1	1.1	0.65	0.15
14	120-130	7	bladelet prox.	0.4		0.7	0.35

Table 28 cont. Blade(let) Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
15	120-130	7	bladelet prox.	0.5		1	0.3
17	120-130	7	bladelet	0.2	1.45	0.5	0.25
17	120-130	7	blade prox.	1.2		1.2	0.4
18	120-130	7	bladelet	0.5	1.95	0.75	0.4
13	140-150	7	bladelet	0.3	1.7	0.65	0.3
25	140-150	7	bladelet prox.	0.6			0.35
11	150-160	7	bladelet	0.2	1.4	0.7	0.25
12	150-160	7	bladelet	0.1	1.25	0.65	0.15
21	150-160	7	bladelet	1.2	2.35	1.1	0.55
12	160-170	7	bladelet	0.2	1.8	0.55	0.15
20	170-180	7	blade	1.4	2.55	1.45	0.4
10	180-190	7	blade	2.2	2.9	1.15	0.65
10	180-190	7	bladelet	0.2	1.6	0.6	0.2
12	180-190	7	bladelet	0.2	1.6	0.7	0.2
22	200-210	7	bladelet prox.	0.3		0.85	0.2
10	220-230	7	bladelet	0.5	2.1	0.65	0.35
21	220-230	7	bladelet prox.	0.8		1.05	0.4
22	220-230	7	bladelet	0.5	1.9	0.7	0.2
22	220-230	7	bladelet	0.4	1.75	0.5	0.3
22	230-240	7	blade prox.	1.8		1.4	0.5
22	230-240	7	bladelet	0.4	1.45	0.65	0.2
22	230-240	7	bladelet prox.	0.4		0.7	0.2
12	240-250	7	blade Uni/Unilat	2.9	3	1.6	0.65
12	240-250	7	blade prox. Uni/Bi	1.1		1.3	0.4
23	250-260	7	blade	2.2	3.5	1.4	0.4
23	250-260	7	blade	3.1	3	1.6	0.5
11	260-270	7	bladelet	0.2	1.65	0.45	0.3
11	260-270	7	blade	2.3	3.55	1.3	0.6
12	260-270	7	bladelet	0.2	1.4	0.7	0.2
20	290-300	7	blade	2	3.6	1.35	0.35
11	330-340	7	blade	8	4.85	2.35	0.7
22	330-340	7	blade prox.	8.2		2.6	0.9
12	340-350	7	blade	2.6	3.95	1.45	0.5
21	340-350	7	blade Uni/Unilat	0.4	4.5	1.5	0.65
22	340-350	7	blade prox.	1		1.7	0.4
12	380-390	7	blade	2.4	3	1.7	0.4
22	390-400	7	bladelet prox.	0.9		1.05	0.4
22	390-400	7	bladelet	0.4	1.7	0.65	0.25
23	390-400	7	blade	8	5.2	2.2	0.7
20	400-410	7	bladelet	0.1	1.5	0.4	0.1
21	400-410	7	bladelet	1.3	2.7	1	0.4
22	400-410	7	blade	3.6	3.5	2.2	0.55
22	400-410	7	blade Uni/Unilat	1.1	2.65	1.2	0.35
20	410-420	7	blade prox.	2.8		2.1	0.45
20	410-420	7	blade	1	3.2	1.5	0.4
22	410-420	7	blade	2.3	3.05	1.5	0.6
22	410-420	7	bladelet	0.3	1.95	0.6	0.3
11/12	420-430	7	blade	1.9	2.8	1.25	0.6
11/12	420-430	7	bladelet	0.2	1.85	0.8	0.2
11/12	420-430	7	bladelet	0.2	1.5	0.6	0.2
11/12	420-430	7	bladelet prox.	0.2		0.75	0.2
23	420-430	7	blade prox.	1.5	2.6	1.4	0.3
11/12	430-440	7	bladelet prox.	0.1		0.6	0.2

Table 28 cont. Blade(let) Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
21	430-440	7	bladelet med.	0.4		0.8	0.35
23	430-440	7	blade	9.5	5.2	2.3	0.7
11/12	440-450	7	blade	2.3	3.4	1.35	0.5
11/12	440-450	7	blade	9.1	4.65	2.65	0.8
21	440-450	7	blade	0.7	2.5	1.2	0.2
22	440-450	7	blade	2.7	3.5	1.8	0.45
11/12	450-460	7	blade	1.3	3.15	1.6	0.25
11/12	450-460	7	blade prox.	1.6		1.5	0.3
11/12	470-480	7	blade	2.5	3.6	1.6	0.45
11/12	470-480	7	blade prox.	1		1.5	0.3
11/12	470-480	7	bladelet	0.1	1.35	0.6	0.2
21	470-480	7	bladelet	0.5	2.35	1.05	0.2
23	470-480	7	bladelet	0.6	1.9	0.5	0.3
21	480-490	7	blade	0.9	1.8	1.15	0.4
23	490-500	7	blade	8.3	5.4	2.8	0.6
21	500-510	7	bladelet	0.2	1.6	0.75	0.25
21	500-510	7	blade	3.6	4.2	1.85	0.6
22	500-510	7	bladelet	0.3	1.7	0.6	0.5
12	510-520	7	bladelet prox.	0.3		1	0.25
21	510-520	7	blade prox.	3.5		1.8	0.65
12	520-530	7	bladelet	0.2	1.55	0.6	0.3
12	520-530	7	blade	15.2	4.6	2.4	1.25
12	540-550	7	blade prox.	1.2		1.2	0.45
12	540-550	7	bladelet prox.	0.3		0.95	0.25
12	540-550	7	bladelet prox.	0.1		0.8	0.2
21	540-550	7	blade	6	4.65	2.5	0.5
12	550-560	7	blade	1.3	3.55	1.2	0.4
12	560-570	7	blade	1.8	4.05	1.4	0.4
12	560-570	7	blade Uni/Unilat pr	2.1		2	0.45
12	560-570	7	blade	10.3	5.1	2.3	1
12	560-570	7	bladelet	0.8	2.35	1.05	0.3
12	560-570	7	bladelet	0.4	1.95	0.75	0.3
23	560-570	7	blade	5.8	5.2	2.2	0.7
12	580-590	7	bladelet dist.	0.4		1	0.3
12	650-660	7	bladelet	0.3	1.55	0.6	0.35
12	660-670	7	blade prox.	7.1		2.1	0.9
12	10-20	8	bladelet prox.	0.3		1	0.2
16	20-30	8	blade	1.1	2.6	1.2	0.4
16	20-30	8	bladelet	0.8	1.9	0.95	0.8
21	20-30	8	bladelet	0.2	1.45	0.6	0.3
12	30-40	8	bladelet	0.1	1.3	0.5	0.2
16	30-40	8	bladelet	0.3	1.8	0.6	0.3
25	30-40	8	bladelet	0.9	2.5	1	0.3
22	40-50	8	bladelet	0.3	1.2	0.7	0.15
22	40-50	8	bladelet	0.5	1.55	0.85	0.25
15	50-60	8	bladelet	0.1	1.55	0.65	0.15
16	50-60	8	blade	1.1	2.6	1.2	0.4
16	50-60	8	bladelet	0.8	1.9	0.95	0.5
17	60-70	8	bladelet	0.7	2.3	1.15	0.4
12	70-80	8	bladelet	0.1	1.25	0.7	0.3
16	70-80	8	bladelet	0.6	2.2	0.65	0.45
16	70-80	8	bladelet prox.	0.1		0.65	0.15
23	70-80	8	bladelet	0.4	2.4	0.6	0.2

Table 28 cont. Blade(let) Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
12	80-90	8	blade prox.	0.6		1.4	0.3
17	80-90	8	bladelet prox.	0.1		0.75	0.15
11	100-110	8	bladelet	0.4	1.85	0.8	0.2
12	100-110	8	bladelet	0.2	1.6	0.75	0.15
12	100-110	8	bladelet	0.1	1.05	0.6	0.15
14	100-110	8	blade	1.4	2.2	1.2	0.6
14	100-110	8	bladelet	0.1	1.45	0.7	0.15
14	100-110	8	bladelet	0.1	1.35	0.6	0.15
13	110-120	8	bladelet	0.2	1.4	0.8	0.2
14	110-120	8	bladelet	0.1	1.2	0.55	0.2
18	110-120	8	bladelet	0.7	1.8	1.05	0.35
19	110-120	8	bladelet prox.	0.2		0.7	0.2
20	110-120	8	bladelet	0.5	2.15	1	0.25
23	110-120	8	bladelet	0.6	1.4	0.3	0.3
13	120-130	8	bladelet	0.2	2	0.55	0.2
14	120-130	8	bladelet	0.1	1.25	0.6	0.15
15	120-130	8	bladelet	0.7	2.9	0.85	0.4
15	120-130	8	bladelet dist.	0.1		0.55	0.2
16	120-130	8	bladelet	0.1	1.8	0.45	0.2
16	120-130	8	bladelet	0.2	1.4	0.75	0.2
18	120-130	8	bladelet	0.4	2.1	0.8	0.2
21	120-130	8	bladelet	0.2	1.6	0.7	0.25
21	120-130	8	bladelet	0.6	2	0.9	0.25
19	140-150	8	bladelet	0.4	2.05	0.65	0.25
20	140-150	8	bladelet prox.	0.2		0.8	0.2
22	140-150	8	bladelet	0.4	1.8	0.7	0.3
25	140-150	8	bladelet	0.6	1.85	0.9	0.35
21	150-160	8	bladelet	0.3	1.65	0.7	0.35
12	180-190	8	bladelet prox.	0.2		0.7	0.2
12	190-200	8	bladelet prox.	0.3		0.8	0.25
20	190-200	8	bladelet	0.2	1.55	0.65	0.25
22	190-200	8	bladelet prox.	0.3		0.55	0.2
11	210-220	8	bladelet dist.	0.2		0.7	0.25
23	210-220	8	bladelet	0.7	1.8	0.9	0.3
22	220-230	8	blade prox.	1.2		1.7	0.3
10	230-240	8	bladelet	0.6	2.2	1	0.3
19	230-240	8	blade med.	0.5		1.35	0.3
21	230-240	8	bladelet med.	0.1		0.65	0.2
22	230-240	8	blade prox.	0.8		1.25	0.35
22	230-240	8	blade prox.	1.3		1.4	0.45
22	230-240	8	bladelet	1	3	0.75	0.45
22	230-240	8	bladelet	0.2	0.95	0.5	0.15
22	230-240	8	bladelet	0.8	2	0.95	0.35
11	240-250	8	blade	1.5	2.9	1.3	0.5
12	240-250	8	bladelet dist.	0.4		0.9	0.35
12	240-250	8	bladelet	1.2	2.85	1.05	0.4
20	240-250	8	bladelet	0.9	2.45	1	0.35
20	240-250	8	bladelet	0.5	2.05	0.8	0.25
20	240-250	8	bladelet	0.5	2	0.7	0.4
20	240-250	8	bladelet	0.1	1.25	0.65	0.15
12	250-260	8	bladelet	0.4	2.15	0.6	0.4
21	250-260	8	blade	1.9	2.5	1.3	0.8
21	250-260	8	blade	1.5	3.3	1.5	0.4

Table 28 cont. Blade(let) Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
11	260-270	8	bladelet	0.4	2.1	0.95	0.25
12	260-270	8	bladelet prox.	0.1		0.85	0.1
12	260-270	8	blade	2.5	3.1	1.8	0.5
22	270-280	8	blade	1.6	2.85	1.25	0.5
21	290-300	8	blade prox.	1.1		1.3	0.35
21	340-350	8	bladelet	0.3	2	0.7	0.2
22	350-360	8	blade prox.	0.8		1.6	0.3
22	350-360	8	bladelet prox.	0.2		0.65	0.25
11	360-370	8	blade	2.2	3.2	1.65	0.5
12	370-380	8	blade dist.	0.7		1.35	0.3
22	370-380	8	bladelet prox.	0.6		1.1	0.25
11	380-390	8	bladelet	0.4	1.95	0.7	0.25
11	380-390	8	bladelet dist.	0.4		0.9	0.4
12	380-390	8	bladelet	0.2	1.8	0.6	0.2
22	380-390	8	bladelet	0.2	1.55	0.6	0.2
22	380-390	8	blade	8.2	4	2.25	0.85
22	380-390	8	blade	2.5	3.1	1.65	0.5
22	390-400	8	blade	1.2	2.9	1.55	0.35
22	390-400	8	blade prox.	0.7		1.25	0.4
22	390-400	8	blade prox.	1.1		1.5	0.35
21	400-410	8	blade prox.	1.7		1.7	0.45
22	400-410	8	blade Uni/Unilat	1.8	2.7	1.5	0.4
22	400-410	8	blade prox.	1.2		1.5	0.45
21	410-420	8	blade	2	3.1	1.65	0.5
21	410-420	8	bladelet	0.2	1.5	0.75	0.2
22	420-430	8	blade	2.1	2.7	1.65	0.55
22	420-430	8	bladelet prox.	0.4		1	0.25
23	420-430	8	blade prox.	1		1.2	0.4
21	430-440	8	blade	1.6	3.15	1.55	0.35
22	430-440	8	blade	3	3.25	1.7	0.6
22	430-440	8	blade Uni/Unilat/Di	5.7	3.8	2.3	0.8
11/12	440-450	8	bladelet	0.1	1.2	0.6	0.2
22	440-450	8	blade	3.6	3.7	2	0.5
11/12	450-460	8	blade	1.5	2.45	1.25	0.6
11/12	450-460	8	bladelet	0.3	1.65	0.75	0.3
22	450-460	8	bladelet dist.	0.4		0.8	0.3
11/12	460-470	8	blade prox.	0.7		1.2	0.3
11/12	460-470	8	blade prox.	0.3		0.95	0.3
11/12	460-470	8	bladelet prox.	0.2		0.75	0.3
21	460-470	8	blade Uni/Unilat	0.8	2.95	1.9	0.2
22	460-470	8	bladelet prox.	0.4		1.05	0.2
11/12	470-480	8	blade prox.	1.2		1.5	0.35
11/12	470-480	8	bladelet	0.3	1.95	0.6	0.3
22	480-490	8	blade dist.	0.8		1.2	0.35
23	510-520	8	blade Uni/Unilat	2.2	3.2	1.5	0.5
12	520-530	8	blade prox.	2.2		1.65	0.5
12	540-550	8	bladelet	0.2	1.4	0.65	0.35
21	540-550	8	bladelet	0.2	1.7	0.75	0.2
23	550-560	8	bladelet	0.5	2	0.8	0.2
12	590-600	8	bladelet	0.2	2.1	0.8	0.2
15	10-20	9	blade	0.8	2.3	1.2	0.4
19	20-30	9	bladelet	0.2	1.5	0.55	0.15
10	30-40	9	bladelet	0.3	1.75	0.6	0.3

Table 28 cont. Blade(let) Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
11	30-40	9	bladelet	0.3	1.4	0.55	0.35
17	30-40	9	bladelet	0.2	1.45	0.7	0.2
11	40-50	9	bladelet	0.1	1.05	0.4	0.2
12	40-50	9	bladelet	0.4	1.35	0.85	0.35
12	40-50	9	bladelet	0.3	1.4	0.9	0.35
12	40-50	9	bladelet	0.1	1.05	0.4	0.2
17	40-50	9	bladelet prox.	0.1		0.75	0.2
10	50-60	9	bladelet prox.	0.2		0.85	0.2
11	50-60	9	bladelet	0.3	1.8	0.9	0.2
12	50-60	9	bladelet	0.9	1.8	1	0.6
14	50-60	9	bladelet	0.2	1.5	0.65	0.3
14	50-60	9	bladelet	0.1	1.15	0.45	0.1
21	50-60	9	bladelet prox.	0.1		0.5	0.1
11	60-70	9	bladelet	0.2	1.45	0.65	0.3
13	60-70	9	bladelet	0.1	0.95	0.5	0.15
14	60-70	9	bladelet	0.2	1.55	0.65	0.25
16	60-70	9	bladelet	0.3	1.5	0.7	0.3
22	60-70	9	bladelet	0.3	1.7	0.35	0.2
12	70-80	9	bladelet	0.3	1.7	0.85	0.2
13	70-80	9	bladelet	0.3	1.85	0.6	0.35
14	70-80	9	bladelet	0.1	1	0.5	0.1
15	70-80	9	bladelet	0.2	1.65	0.8	0.2
16	70-80	9	bladelet prox.	0.2		0.7	0.25
17	70-80	9	bladelet	0.1	1.05	0.45	0.15
20	70-80	9	bladelet prox.	0.2		0.8	0.25
10	80-90	9	bladelet	0.3	1.65	0.7	0.3
11	80-90	9	bladelet	0.2	1.35	0.55	0.25
11	80-90	9	bladelet	0.1	0.9	0.45	0.2
14	80-90	9	bladelet	0.1	1.45	0.45	0.3
15	80-90	9	bladelet	0.1	1.5	0.45	0.2
15	80-90	9	bladelet	0.1	1	0.5	0.15
17	80-90	9	bladelet prox.	0.4		0.8	0.3
19	80-90	9	bladelet	0.4	2	0.6	0.2
19	80-90	9	bladelet	0.3	1.9	0.6	0.25
21	80-90	9	bladelet	0.2	1.75	0.7	0.2
11	90-100	9	bladelet prox.	0.1		0.65	0.15
12	90-100	9	bladelet	0.2	1.6	0.5	0.25
12	90-100	9	bladelet	0.2	1.4	0.65	0.2
14	90-100	9	bladelet prox.	0.2		0.6	0.2
15	90-100	9	bladelet	0.3	1.6	0.9	0.25
15	90-100	9	bladelet	0.2	1.5	0.65	0.2
15	90-100	9	bladelet	0.1	1	0.55	0.2
20	90-100	9	bladelet prox.	0.1		0.4	0.15
10	100-110	9	bladelet	0.2	1.4	0.6	0.3
11	100-110	9	bladelet	0.1	1.5	0.6	0.15
11	100-110	9	bladelet	0.3	1.65	0.8	0.2
11	100-110	9	bladelet	0.1	1.35	0.65	0.2
11	100-110	9	bladelet	0.1	1.15	0.5	0.15
11	100-110	9	bladelet	0.3	1.4	0.85	0.35
12	100-110	9	bladelet	0.6	2.45	0.75	0.2
12	100-110	9	bladelet	0.1	1.4	0.5	0.1
13	100-110	9	bladelet	0.3	1.75	0.95	0.2
13	100-110	9	bladelet	0.2	1.5	0.6	0.2

Table 28 cont. Blade(let) Raw Material & Metric Data

Square	Depth	R.M.	Retouch	Location	Wt.gms	L	W	T
13	100-110	9	bladelet	dist.	0.1		0.5	0.2
14	100-110	9	bladelet		0.1	1.15	0.6	0.15
15	100-110	9	bladelet		0.1	1.45	0.65	0.2
16	100-110	9	bladelet		0.2	1.35	0.5	0.4
18	100-110	9	bladelet	prox.	0.1		0.45	0.2
20	100-110	9	bladelet		0.8	2.65	0.8	0.35
20	100-110	9	bladelet		0.2	1.6	0.65	0.15
10	110-120	9	bladelet		0.2	1.6	0.6	0.2
11	110-120	9	bladelet	Uni/Unilat	0.7		1.1	0.55
12	110-120	9	bladelet	Uni/Unilat	0.3	2	0.6	0.3
13	110-120	9	bladelet		0.9	2.55	0.9	0.4
13	110-120	9	bladelet		0.3	2.3	0.65	0.2
13	110-120	9	bladelet		0.3	1.8	0.9	0.2
14	110-120	9	bladelet		0.3	2.1	0.5	0.3
14	110-120	9	bladelet		0.2	1.6	0.65	0.25
14	110-120	9	bladelet		0.3	1.6	0.75	0.3
14	110-120	9	bladelet		0.2	1.4	0.7	0.2
14	110-120	9	bladelet		0.1	1.05	0.4	0.1
14	110-120	9	bladelet	prox.	0.1		0.7	0.15
14	110-120	9	bladelet	prox.	0.1		0.55	0.1
15	110-120	9	blade		2.7	3.4	1.7	0.5
15	110-120	9	bladelet		0.1	1.3	0.5	0.2
15	110-120	9	bladelet		0.1	1.1	0.6	0.1
15	110-120	9	bladelet		0.1	1.1	0.3	0.2
15	110-120	9	bladelet	prox.	0.2		0.7	0.3
17	110-120	9	bladelet		0.2	1.8	0.5	0.25
17	110-120	9	bladelet		0.1	1.1	0.5	0.15
17	110-120	9	bladelet		0.1	1	0.5	0.1
11	120-130	9	bladelet		0.5	2	1	0.25
11	120-130	9	bladelet		0.2	1.2	0.7	0.2
12	120-130	9	bladelet		0.2	1.6	0.5	0.2
12	120-130	9	bladelet		0.1	1.45	0.5	0.2
12	120-130	9	bladelet	prox.	0.1		0.55	0.2
13	120-130	9	bladelet	prox.	0.4		0.85	0.35
13	120-130	9	bladelet		0.1	1.2	0.65	0.15
14	120-130	9	bladelet		0.2	1.4	0.6	0.2
14	120-130	9	bladelet		0.1	1.55	0.4	0.2
14	120-130	9	bladelet		0.1	1.2	0.45	0.2
14	120-130	9	bladelet		0.1	1.4	0.6	0.2
15	120-130	9	bladelet		0.1	1.1	0.6	0.2
15	120-130	9	bladelet	prox.	0.1		0.65	0.25
16	120-130	9	bladelet		0.1	1.05	0.5	0.2
16	120-130	9	bladelet		0.1	1.15	0.65	0.1
17	120-130	9	bladelet		0.6	2.3	0.8	0.3
17	120-130	9	bladelet		0.3	2	0.6	0.2
17	120-130	9	bladelet		0.1	1.15	0.3	0.15
17	120-130	9	bladelet		0.1	1.15	0.5	0.1
18	120-130	9	bladelet		0.1	1.1	0.6	0.15
18	120-130	9	bladelet		1.5	3.45	1.05	0.4
20	120-130	9	bladelet	prox.	0.3		0.8	0.3
21	120-130	9	blade	prox.	1.2		1.55	0.4
22	120-130	9	bladelet		0.4	1.75	0.7	0.25
13	130-140	9	bladelet		0.2	1.45	0.5	0.2

Table 28 cont. Blade(let) Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
13	130-140	9	bladelet	0.1	1.2	0.35	0.35
13	130-140	9	bladelet prox.	0.2		0.8	0.2
13	130-140	9	bladelet prox.	0.1		0.55	0.1
22	130-140	9	bladelet	0.1	1.2	0.4	0.1
12	140-150	9	bladelet	0.3	2.1	0.75	0.25
19	140-150	9	bladelet prox.	0.3		0.85	0.2
20	140-150	9	bladelet	0.4	1.5	0.75	0.35
12	150-160	9	bladelet	0.2	1.4	0.55	0.3
21	150-160	9	bladelet	0.5	1.4	0.75	0.4
21	150-160	9	bladelet	0.3	1.4	0.95	0.2
11	170-180	9	bladelet prox.	0.3		1	0.25
20	170-180	9	bladelet	0.2	1.25	0.45	0.2
21	170-180	9	bladelet	0.4	2.45	1	0.4
21	170-180	9	bladelet prox.	0.3		0.75	0.25
11	180-190	9	bladelet	0.4	1.5	0.7	0.3
21	180-190	9	bladelet	0.5	1.7	0.75	0.35
21	180-190	9	blade	17.4	4.8	2.95	1.45
20	210-220	9	bladelet prox.	0.3		0.9	0.25
20	210-220	9	bladelet	0.5	1.8	0.95	0.2
21	210-220	9	bladelet	0.1	1.3	0.7	0.15
11	220-230	9	bladelet	0.4	2.05	0.9	0.4
21	220-230	9	bladelet	0.2	1.7	0.55	0.2
11	230-240	9	bladelet	0.4	1.85	1.05	0.35
11	230-240	9	bladelet prox.	0.4		0.95	0.25
12	230-240	9	blade	0.4	1.85	1.2	0.3
21	230-240	9	bladelet prox.	0.7		1.1	0.35
21	230-240	9	bladlet	0.2	1.25	0.55	0.3
22	230-240	9	bladelet Uni/Unilat	1.3	2.15	0.95	0.55
20	240-250	9	blade prox.	0.6		1.2	0.25
21	240-250	9	bladelet	0.4	1.9	0.65	0.35
22	240-250	9	blade	5.3	3.75	2.6	0.65
22	240-250	9	bladelet	0.6	2.35	1	0.2
22	240-250	9	bladelet	0.5	1.6	0.7	0.2
22	240-250	9	bladelet	0.5	1.45	0.65	0.3
22	240-250	9	bladelet	0.3	1.35	0.65	0.2
11	250-260	9	bladelet	0.3	1.65	0.8	0.2
19	250-260	9	bladelet	1.6	3.4	1.1	0.3
19	250-260	9	bladelet	0.4	1.55	0.7	0.2
19	250-260	9	bladelet	0.5	2.1	0.8	0.3
21	250-260	9	bladelet	0.3	1.85	0.85	0.2
21	250-260	9	blade	2.1	3.5	1.25	0.6
22	250-260	9	bladelet	0.2	1.25	0.55	0.2
11	260-270	9	bladelet	0.2	1.65	0.45	0.3
19	260-270	9	bladelet	0.5	1.8	0.9	0.2
21	260-270	9	bladelet	0.6	2.3	0.7	0.3
11	270-280	9	bladelet	0.2	1.4	0.7	0.2
11	270-280	9	bladelet prox.	0.2		0.7	0.3
21	270-280	9	bladelet	0.2	1.35	0.7	0.2
21	270-280	9	bladelet	0.8	2.1	1	0.5
11	280-290	9	bladelet	0.9	2.6	0.6	0.45
12	280-290	9	bladelet	0.2		0.7	0.25
21	290-300	9	blade prox.	0.3		1.35	0.15
12	340-350	9	bladelet	0.2	1.45	0.5	0.2

Table 28 cont. Blade(let) Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
20	360-370	9	blade	1	2.6	1.35	0.35
22	360-370	9	blade Uni/Dist	7	6.3	2.4	0.45
22	360-370	9	blade prox.U/Unilat	1.9		1.55	0.35
22	380-390	9	bladelet prox.	0.3		1.05	0.2
11	390-400	9	bladelet	0.1	1.5	0.55	0.15
22	390-400	9	blade	0.8	2.55	1.35	0.3
22	390-400	9	blade prox.	1.2		1.35	0.25
21	400-410	9	bladelet	1.7	2.7	1.1	0.6
21	400-410	9	blade dist.	0.8		1.2	0.3
11/12	410-420	9	blade med.	0.9		1.4	0.3
11/12	410-420	9	bladelet	0.3	1.75	0.55	0.3
21	410-420	9	bladelet	0.1	1.4	0.55	0.2
11/12	420-430	9	bladelet prox.	0.1		0.75	0.15
20	420-430	9	bladelet prox.	0.2		0.75	0.25
22	420-430	9	bladelet	0.2	1.6	0.8	0.25
22	430-440	9	blade dist.	2.2		1.55	0.4
11/12	440-450	9	blade med.	1.3		1.5	0.3
11/12	440-450	9	blade dist.	0.5		1.2	0.35
22	440-450	9	blade	2.2		2	0.5
11/12	450-460	9	blade	2.3	3.6	1.8	0.5
11/12	450-460	9	blade dist.	1		1.2	0.3
21	450-460	9	bladelet	0.2	1.7	0.85	0.2
21	450-460	9	bladelet	0.2	1.3	0.6	0.35
21	450-460	9	blade	2.5	4.1	1.6	0.5
11/12	460-470	9	blade	1.8	2.55	1.65	0.75
11/12	460-470	9	blade	0.5	2.15	1.15	0.15
21	460-470	9	blade prox.	0.8		1.4	0.3
21	460-470	9	bladelet	0.2	1.8	0.7	0.2
11/12	470-480	9	bladelet	0.4	1.9	0.7	0.2
11/12	470-480	9	blade	2.9	3.55	1.7	0.65
11/12	470-480	9	bladelet prox.	0.4		1.1	0.3
12	480-490	9	bladelet	0.1	1.6	0.55	0.1
21	480-490	9	blade prox.	0.3		1.2	0.2
21	480-490	9	blade prox.	0.6		1.25	0.3
12	490-500	9	blade prox.	0.5		1.45	0.25
12	490-500	9	bladelet	0.2	1.8	0.75	0.2
12	490-500	9	bladelet	0.1	1.1	0.5	0.1
21	490-500	9	bladelet	0.9	2.6	0.95	0.35
23	490-500	9	blade prox.	1			0.3
12	500-510	9	blade Uni/Unilat	3.4	3.55	1.55	0.2
21	500-510	9	bladelet	0.2	1.7	0.75	0.3
21	520-530	9	blade prox.	1.4		1.65	0.35
12	540-550	9	bladelet	0.4	1.7	0.8	0.3
21	540-550	9	blade	1.5	3	1.6	0.45
12	550-560	9	bladelet prox.	0.1		0.6	0.25
12	560-570	9	blade	1.3	2.8	1.5	0.4
12	560-570	9	bladelet	0.1	1.4	0.55	0.15
12	560-570	9	bladelet	0.2	1.45	0.65	0.3
12	570-580	9	blade	1.8	3.1	1.7	0.75
12	590-600	9	blade	0.9	2.65	1.3	0.35
Totals:		869	Bladelets Totals:	887.9	gm		
		239	Blades Means:	0.801	1.47	0.89	0.31

Table 28 cont. Blade(let) Raw Material & Metric Data

200-300cm	212 Bladelets	Totals:	315.7	gm			
Early LSA	47 Blades	Means:	1.219	2.1	1.04	0.34	
	204 Whole						
300-420cm	51 Bladelets	Totals:	89.5	gm			
Large Blade	57 Blades	Means:	0.829	2.34	1	0.32	
	65 Whole						
420-450cm	25 Bladelets	Totals:	10.6	gm			
Upper MSA	25 Blades	Means:	1.215	0.35	0.63	0.22	
	30 Whole						

Retouch Location Key:
bladelet = width < 12 mm
J. Deacon 1984
blade = width > 12 mm
J. Deacon 1984
B.P.= Bipolar
Prox.= Proximal Fragment
Med. = Medial Fragment
Dist.= Distal Fragment
Uni. = Unifacial
Unilat = Unilateral
Bilat. = Bilateral

Raw Material:
1 = Quartz
2 = Brown Chert
3 = Chalcedony
4 = Jasper
5 = Transparent w/ black flecks
6 = Black Chert
7 = Silcrete
8 = Multi-Color Chert
9 = Other Fine Grained Raw Mat'l

Table 29 Backed Blade/Bladelet Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
11	10-20	1	Uni/Unilat	0.4	1.45	0.8	0.3
20	20-30	1	Uni/Unilat prox.	0.3		0.9	0.25
10	60-70	1	Uni/Unilat	0.5	2.2	0.75	0.4
14	90-100	1	Uni/Unilat	0.2	1.3	0.6	0.2
21	210-220	1	Uni/Unilat	0.6	1.95	0.95	0.35
11	240-250	1	Uni/Unilat	0.4	1.55	0.8	0.3
19	260-270	1	Uni/Unilat prox.	0.7		1.1	0.3
22	270-280	1	Uni/Unilat	0.6	1.5	0.75	0.35
22	50-60	2	Uni/Unila prox.	0.4		1	0.35
12	120-130	2	Uni/Unilat	0.5	1.95	0.85	0.3
25	120-130	2	Uni/Unilat prox.	0.4			0.4
22	130-140	2	Uni/Unilat	0.7	1.95	1	0.2
11	350-360	2	Uni/Unilat	0.6	2.2	0.6	0.55
22	30-40	3	Uni/Bilat	0.7	1.75	1	0.3
26	80-90	3	Uni/Bilat	0.3	1.8	0.55	0.2
17	90-100	3	Uni/Unilat	0.1	1	0.55	0.25
28	120-130	3	Uni/Unilat	0.1	1	0.3	0.1
27	130-140	3	Uni/Unilat	0.5	2.3	0.7	0.4
13	10-20	4	Uni/Unilat	0.3	1.2	0.7	0.25
12	30-40	4	Uni/Bilat prox.	0.2		0.65	0.3
18	50-60	4	Uni/Unilat prox.	0.2		0.8	0.2
22	80-90	4	Uni/Bilat	0.5	1.45	0.75	0.35
12	100-110	4	Uni/Unilat	1.2	2.75	1.15	0.35
22	120-130	4	Uni/Unilat	1.2	3	0.85	0.6
22	140-150	5	Uni/Unilat	0.6	1.6	0.7	0.55
22	610-620	5	Uni/Unilat	1.1	2.7	0.95	0.55
20	0-10	7	Uni/Unilat	0.5	1.4	0.85	0.35
22	100-110	7	Uni/Unilat prox.	0.3		0.8	0.25
11	240-250	7	Uni/Unilat	0.6	2.15	0.7	0.35
11	260-270	7	Uni/Unilat	1	2.8	0.9	0.35
23	0-10	8	Uni/Unilat	1.4	2.2	0.9	0.6
22	20-30	8	Uni/Unilat	0.2	0.9	0.55	0.2
20	40-50	8	Uni/Unilat	0.8	2.6	0.95	0.35
19	250-260	8	Uni/Unilat	0.5	1.65	0.6	0.3
20	250-260	8	Uni/Unilat	1.6	3.5	1.1	0.45
22	60-70	9	Uni/Unilat	1.1	2.4	1.4	0.4
23	60-70	9	Uni/Unilat prox.	0.5			0.2
11	90-100	9	Uni/Unilat prox.	0.1		0.5	0.15
22	140-150	9	Uni/Unilat	0.5	1.5	0.8	0.3
20	240-250	9	Uni/Unilat prox.	0.4		0.45	0.5
21	240-250	9	Uni/Unilat prox.	0.2		0.85	0.25
19	250-260	9	Uni/Unilat	0.3	1.7	0.6	0.2
20	310-320	9	Uni/Unilat prox.	5.3		2.55	0.6
Totals:		43	Totals:	28.6 gm			
		31 Whole	Means:	0.665	1.92	0.8	0.34

200-300cm	11		Totals:	8.1			
Early LSA	8 Whole		Means:	0.736	2.19	0.74	0.35
300-420cm	2			0.5			
Large Blade	1 Whole			0.25	1.7	0.73	0.23
420-450cm							
Upper MSA		None					

Key:
Uni. = Unifacial
Unilat. = Unilateral
Bilat. = Bilateral
Prox.= Proximal Fragment

Raw Material
1 = Quartz
2 = Brown Chert
3 = Chalcedony
4 = Jasper
5 = Transparent w/ black flecks
6 = Black Chert
7 = Silcrete
8 = Multi-Color Chert
9 = Other Fine Grained Raw Mat'

Table 30 Crescents (Segments) R.M. & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
19	0-10	1	Uni/Unilat	0.2	1.25	0.5	0.25
15	20-30	1	Uni/Unilat	0.2		0.65	0.25
20	20-30	1	Uni/Unilat	0.3	1.4	0.75	0.35
21	20-30	1	Uni/Unilat dist.	0.1		0.55	0.25
16	30-40	1	Uni/Unilat	0.3	1.5	0.7	0.3
22	30-40	1	Uni/Unilat	0.9	2.3	1	0.35
19	40-50	1	Uni/Unilat	0.2	1.25	0.5	0.15
18	50-60	1	Uni/Unilat	0.1	1.25	0.55	0.3
18	50-60	1	Uni/Unilat	0.3		0.9	0.3
22	50-60	1	Uni/Unilat	0.4	1.05	0.75	0.3
11	60-70	1	Uni/Unilat	0.2	1.3	0.7	0.3
15	60-70	1	Uni/Unilat	0.2	1.1	0.75	0.3
19	60-70	1	Uni/Unilat	0.4	1.3	0.6	0.4
14	70-80	1	Uni/Unilat	0.4	1.65	0.8	0.25
21	90-100	1	Uni/Unilat	0.2	1.1	0.55	0.25
14	110-120	1	Uni/Unilat	0.1		0.65	0.2
19	110-120	1	Uni/Unilat	0.2	1.4	0.6	0.2
13	150-160	1	Uni/Unilat	1.1		0.9	0.4
12	190-200	1	Uni/Unilat	0.1	0.9	0.5	0.3
21	220-230	1	Uni/Unilat	0.2	1.65	0.6	0.25
22	230-240	1	Uni/Unilat	0.5		0.9	0.2
23	250-260	1	Uni/Unilat	0.7	1.4	0.7	0.3
21	340-350	1	Uni/Unilat	0.3		0.7	0.35
21	350-360	1	Uni/Unilat	0.2	1.2	0.6	0.2
22	380-390	1	Uni/Unilat	0.9	1.95	1.15	0.35
10	0-10	2	Uni/Unilat	0.5	2.2	0.8	0.3
18	20-30	2	Uni/Unilat	0.5	1.85	0.9	0.4
19	20-30	2	Uni/Unilat	0.3		0.65	0.25
12	40-50	2	Uni/Unilat	0.2	1.25	0.8	0.25
20	50-60	2	Uni/Unilat	0.3	1.45	0.6	0.4
28	60-70	2	Uni/Unilat	0.1	0.6	0.35	0.3
11	80-90	2	Uni/Unilat	0.4	1.65	0.75	0.35
18	80-90	2	Uni/Unilat	0.5		0.9	0.4
11	140-150	2	Uni/Unilat	1.3	2.75	1.1	0.5
19	220-230	2	Uni/Unilat	0.8	2.9	0.8	0.5
22	270-280	2	Uni/Unilat	0.9	1.65	1.05	0.45
23	270-280	2	Uni/Unilat	0.6	2.1	1.1	0.25
20	300-310	2	Uni/Unilat	0.5		0.7	0.45
13	40-50	3	Uni/Unilat	0.5		1	0.45
14	40-50	3	Uni/Unilat	0.5	1.45	0.6	0.2
29	60-70	3	Uni/Unilat	0.4	1.7	0.8	0.35
16	70-80	3	Uni/Unilat	0.2	1.55	0.5	0.25
24	70-80	3	Uni/Unilat prox.	0.5		1.15	0.2
29	70-80	3	Uni/Unilat	0.1	1.6	0.6	0.2
12	540-550	3	Uni/Unilat	0.1	1.2	0.6	0.15
19	0-10	4	Uni/Unilat	0.2		0.7	0.12
15	30-40	4	Uni/Unilat	0.1		0.5	0.25
18	30-40	4	Uni/Unilat	0.4	1.4	0.65	0.5
21	30-40	4	Uni/Unilat	0.2	1.2	0.65	0.25
21	60-70	4	Uni/Bilat	0.3	1.3	0.75	0.35
11	80-90	4	Uni/Unilat	0.3	1.4	0.75	0.45
12	130-140	4	Uni/Unilat	0.1	1.15	0.5	0.2

Table 30 cont. Crescents (Segments) R.M. & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
19	50-60	5	Uni/Unilat	0.1	0.8	0.6	0.25
22	60-70	7	Uni/Unilat	1.9	3.15	1.4	0.4
20	70-80	7	Uni/Unilat	3.6	4.35	1.6	0.6
12	190-200	7	Uni/Unilat dist.	0.5		0.9	0.35
22	230-240	7	Uni/Unilat	0.8	1.95	0.9	0.45
12	260-270	7	Uni/Unilat	0.8	2.1	0.95	0.4
22	270-280	7	Uni/Unilat	0.7	1.9	0.85	0.35
20	420-430	7	Uni/Unilat	2.5	2.95	1.5	0.5
21	20-30	8	Uni/Unilat	0.3	1.7	0.65	0.3
22	20-30	8	Uni/Unilat	0.2	0.9	0.55	0.2
22	20-30	8	Uni/Unilat	0.5	1.7	1.1	0.5
25	40-50	8	Uni/Unilat	0.3	1.6	0.6	0.15
22	110-120	8	Uni/Unilat	0.3	1.35	0.6	0.2
23	400-410	8	Uni/Unilat	2		1.7	0.5
23	0-10	9	Uni/Unilat	0.6	1.7	0.9	0.3
11	20-30	9	Uni/Unilat	0.5	1.9	0.75	0.35
23	20-30	9	Uni/Unilat	0.4	1.4	0.5	0.2
19	30-40	9	Uni/Unilat	0.4	1.5	0.6	0.25
10	40-50	9	Uni/Unilat	0.2	1.15	0.7	0.35
10	50-60	9	Uni/Unilat	0.1	0.9	0.7	0.2
15	50-60	9	Uni/Unilat	0.1	1.2	0.5	0.2
15	70-80	9	Uni/Unilat	0.4	1.75	0.85	0.35
18	70-80	9	Uni/Unilat	0.2		0.65	0.25
19	250-260	9	Uni/Unilat	0.6	2.3	0.85	0.3
21	250-260	9	Uni/Unilat	0.4		1.05	0.35
11/12	400-410	9	Uni/Unilat	0.6	2.15	1.1	0.2

Totals:	78		Totals:	97.7 gm			
	60 Whole		Means:	1.253	1.63	0.78	0.31
200-300cm	11		Totals:	16.7 gm			
Early LSA	9 Whole		Means:	0.727	1.86	0.86	0.31
300-420cm	6		Totals:	1.6			
Large Blade	3 Whole		Means:	0.267	2.43	0.71	0.28
420-450cm	1		Totals:	2.5			
Upper MSA	1 Whole		Means:	2.5	2.95	1.5	0.5

Key:

Uni. = Unifacial
Unilat. = Unilateral
Dist. = Distal
Prox. = Proximal

Raw Material
1 = Quartz
2 = Brown Chert
3 = Chalcedony
4 = Jasper
5 = Transparent w/ black flecks
6 = Black Chert
7 = Silcrete
8 = Multi-Color Chert
9 = Other Fine Grained Raw Mat'l

Table 31 Backed Points Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
13	50-60	1	Uni/Unilat/Dist	0.6	1.75	0.8	0.5
11	60-70	1	Uni/Unilat/Dist	0.4	2.05	0.55	0.35
22	100-110	1	Uni/Unilat	3.4	3.6	1.75	0.55
10	210-220	1	Uni/Unilat/Dist	0.2	1.5	0.7	0.2
22	230-240	1	Uni/Unilat	0.4	1.9	0.7	0.15
12	250-260	1	Uni/Unilat/Dist	0.5	2.3	0.9	0.3
19	250-260	1	Uni/Unilat	0.3	1.7	0.65	0.2
21	250-260	1	Uni/Unilat	0.3	2.05	0.5	0.3
21	260-270	1	Uni/Unilat	0.5	1.75	0.8	0.3
11	310-320	1	Uni/Unilat/Dist	0.5	2.3	0.85	0.3
11	310-320	1	Uni/Unilat/Dist	0.2	1.65	0.5	0.3
22	50-60	2	Uni/Bilat/Dist	0.5	1.75	0.65	0.25
23	70-80	2	Uni/Unilat/Prox	0.3	2.2	0.7	0.3
12	190-200	2	Uni/Unilat	0.2	1.7	0.4	0.25
22	230-240	2	Uni/Unilat	0.3	1.55	0.6	0.2
19	270-280	2	Uni/Unilat	0.4	1.6	0.65	0.2
12	50-60	3	Uni/Unilat/Dist	1	2.5	1.25	0.4
19	80-90	3	Uni/Unilat	0.6	2	0.9	0.3
19	250-260	3	Uni/Unilat	0.6	1.8	1	0.25
21	250-260	3	Uni/Unilat	0.4	2.3	0.8	0.2
21	250-260	3	Uni/Unilat	0.3	2.05	0.55	0.35
21	280-290	3	Uni/Unilat/Dist	0.2	1.65	0.6	0.2
13	50-60	7	Uni/Unilat/Dist	0.9	2.4	0.95	0.4
20	240-250	7	Uni/Unilat	0.9	2.6	0.7	0.4
12	250-260	7	Uni/Unilat/Dist	0.5	2.4	0.9	0.25
20	280-290	7	Uni/Unilat/Dist	0.8	2.2	0.85	0.4
12	80-90	8	Uni/Unilat/Dist	0.3	2.15	0.8	0.2
22	90-100	8	Uni/Bilat	0.3	1.6	0.6	0.25
19	260-270	8	Uni/Unilat/Dist	0.5	1.8	0.65	0.35
22	280-290	8	Uni/Unilat	0.9	3.15	1	0.3
11	60-70	9	Uni/Unilat/Dist	0.1	1.3	0.4	0.15
11	60-70	9	Uni/Unilat/Dist	0.6	2.1	0.8	0.3
21	100-110	9	Uni/Unilat	0.5	2.5	0.65	0.35
11/12	460-470	9	Uni/Unilat/Dist	0.4	1.6	1.05	0.25

Totals:		34		Totals:	18.8		
		34 Whole		Means:	0.553	2.04	0.77	0.29
200-300cm		17		Totals:	9		
Early LSA		17 Whole		Means:	0.529	2.06	0.78	0.28
300-420cm		2		Totals:	1.1		
Large Blade		2 Whole		Means:	0.55	2.3	0.73	0.33
420-450cm		None					
Upper MSA							

Key:
Uni. = Unifacial
Uilat. = Unilateral
Dist. = Distal
Prox. = Proximal

Raw Material
1 = Quartz
2 = Brown Chert
3 = Chalcedony
7 = Silcrete
8 = Multi-Color Chert
9 = Other Fine Grained Raw Mat'l

Table 32 Points Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
15	50-60	1	Uni/Bilat/dist.frag	1.6			0.6
12	330-340	1	Bi/Bilat/dist.frag	0.8		1.6	0.5
23	380-390	1	Uni/Bilat	1.2	2.1	1.4	0.5
21	460-470	1	Bi/Bilat dist.	1.2			0.4
21	460-470	1	Bi/Bilat	10.3	4.1	2.3	1.35
11/12	470-480	1	Bi/Bilat	1.1	1.7	1.25	0.55
22	520-530	1	Bi/Bilat	4	2.4	2.25	0.7
12	580-590	1	Bi/Bilat	7.4	3.25	2.8	0.8
12	670-680	1	Bi/Bilat dist.	4.6		1.65	1.15
23	670-680	1	Levallois Uni/Unila	7.9	3.5	2.5	0.9
20	410-420	2	Levallois	5.1	3.2	2.1	0.7
11/12	440-450	2	Levallois	3.1	3	2.05	0.7
21	480-490	2	Uni/Bilat	2.4			0.55
22	510-520	2	Uni/Bilat dist.	0.9			0.45
12	520-530	2	Uni/Bilat	3.2			0.65
23	490-500	3	Bi/Bilat prox.	2.5		1.9	0.6
21	540-550	3	Uni/Bilat	6.3	4.1	2.1	0.8
21	540-550	3	Uni/Bilat	6.5	3.5	2.45	0.8
22	470-480	4	Uni/Unilat/Prox.	6.3	3.4	2.5	0.9
23	530-540	4	Uni/Unilat med.	0.6			0.7
23	480-490	5	Bi/Bilat	4.1	2.6	2.25	0.75
19	180-190	7	Levallois	5.8	3.4	2.4	0.6
11/12	410-420	7	Levallois	1.4	2.3	1.8	0.4
22	420-430	7	Uni/Bilat	5.9	4	2.35	0.7
22	430-440	7	Uni/Bilat	4.9	3.3	2	0.75
21	440-450	7	Uni/Unilat	0.5	1.6	1.15	0.4
22	440-450	7	Uni/Unilat/dist.	1.2			0.35
22	440-450	7	Uni/Unilat/Prox.	12.1	4.6	2.6	1.35
21	450-460	7	Uni/Bilat dist.	4.7		2.5	0.6
11/12	460-470	7	Levallois	2.9	3.35	1.95	0.7
21	460-470	7	Uni/Bilat	1.8	2.3	1.5	0.65
22	480-490	7	Levallois Uni/Bilat	6.7	3.2	2.55	0.9
23	480-490	7	Bi/Bilat	2.2	1.9	1.65	0.7
21	490-500	7	bi/Bilat	9.6	4.15	2.4	0.9
23	490-500	7	Uni/Bilat	4.1	3.5	2.3	0.5
23	490-500	7	Bi/Bilat	36.7	5.6	4.3	1.5
21	500-510	7	Uni/Bilat	3.9	2.9	1.9	0.85
12	520-530	7	Uni/Unilat	3.1	3.15	2.1	0.6
12	520-530	7	Bi/Bilat	2.9	2.9	2.2	0.55
12	520-530	7	Uni/Bilat	2.1	2.65	1.6	0.55
21	520-530	7	Uni/Bilat	11.5	4.3	3.1	1.1
23	520-530	7	Uni/Bilat	4.6	3	2.2	1.6
21	530-540	7	Uni/Bilat dist.	3			0.75
23	530-540	7	Uni/Bilat	3.2	2.8	1.9	0.8
12	540-550	7	Uni/Bilat	6.9	3.4	2.8	0.75
12	540-550	7	Bi/Bilat	1.3	2.1	1.55	0.5
12	550-560	7	Uni/Bilat	7.6	3.3	2.65	1
12	550-560	7	Bi/Bilat	4.8	3.5	2.2	0.8
12	560-570	7	Uni/Bilat	12.8	4.8	2.85	1.2
21	560-570	7	Uni/Bilat	1.6	2.15	1.7	0.6
12	580-590	7	Uni/Bilat	1.9	3.2	1.9	0.45
12	580-590	7	Uni/Unilat	1.5	2.85	1.2	0.5

Table 32 cont. Points Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
12	590-600	7	Uni/Bilat	6.6	3.2	2.5	1
12	590-600	7	Levallois	3.9	2.6	2.35	0.9
12	650-660	7	Uni/Bilat dist.	2.7		2.05	0.75
23	650-660	7	Uni/Bilat	3.6	2.5	2	0.8
22	430-440	8	Uni/Bilat	4.9	2.8	2.5	0.75
22	430-440	8	Bi/Bilat	8.7	3.7	2.8	0.8
22	430-440	8	Bi/Bilat	2.7	2.3	2	0.65
23	430-440	8	Bi/Bilat	4.9	4.4	1.6	0.7
23	450-460	8	Bi/Bilat	5	3	2.4	0.75
23	460-470	8	Uni/Bilat	5.1	3	2.7	0.8
23	460-470	8	Uni/Bilat med.	2.3			0.5
21	480-490	8	Bi/Bilat prox.	1.4		1.5	0.45
21	520-530	8	Levallois	1.9	3.6	1.8	0.4
23	520-530	8	Uni/Bilat	7.3	3.2	2.8	0.9
12	550-560	8	Bi/Bilat dist.				0.4
23	560-570	8	Uni/Bilat dist.	4.7	2.6	2.1	0.9
23	170-180	9	Bi/Bilat	7.9	4.1	2.7	0.8
21	430-440	9	Uni/Bilat	3.9	3.2	2.3	0.65
22	440-450	9	Levallois	1.1	2.3	1.45	0.4
22	440-450	9	Uni/Unilat	6.5	3.5	2.2	1
23	440-450	9	Bi/Bilat/Prox.	12.2	5.2	3.1	0.8
21	470-480	9	Bi/Bilat prox.	4.8		2.1	0.7
23	490-500	9	Uni/Unilat frag.	4.4			0.7
12	510-520	9	Bi/Bilat	3.1	3	2	0.55
21	510-520	9	Uni/Bilat/Prox	7.6	4.95	2.55	0.85
12	540-550	9	Bi/Bilat dist.	3.7			0.75
12	550-560	9	Bi/Bilat prox.	11.2		3.05	1.1
21	560-570	9	Uni/Bilat	3.1	2.5	1.9	0.8
21	590-600	9	Bi/Bilat	3.4	2.2	2.05	0.9
21	610-620	9	Bi/Bilat	2.7	2.6	1.85	0.7
23	650-660	9	Uni/Bilat	6	3.2	2.6	0.8

Totals:	84		Totals:	401.6		
	64	Whole	Means:	4.781	3.14	2.16	0.73
200-300cm Early LSA		None				
300-420cm	4		Totals:	16.6		
Large Blade	3	Whole	Means:	4.15	2.73	1.45	0.75
420-450cm	14		Totals:	60.9		
Upper MSA	13	Whole	Means:	4.35	2.04	1.59	0.75

Key:
Uin. = Unifacial
Bilat. = Bilateral
Bi. = Bifacial
Levallois = Unretouched
Prox. = Proximal Fragment
Dist. = Distal Fragment
Med. = Medial Fragment

Raw Material
1 = Quartz
2 = Brown Chert
3 = Chalcedony
4 = Jasper
5 = Transparent w/ black flecks
7 = Silcrete
8 = Multi-Color Chert
9 = Other Fine Granied Raw Mat'l

Table 33 Side Scrapers Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
22	20-30	1	Uni/Unilat	2.1	2.1	1.3	0.7
10	30-40	1	Uni/Unilat	55.5	5.1	5.85	1.95
15	30-40	1	Uni/Unilat	4.6	2.85	2.1	0.6
16	30-40	1	Uni/Unilat	0.3	0.9	0.7	0.3
19	30-40	1	Uni/Unilat	0.6	1.2	0.75	0.25
20	40-50	1	Uni/Unilat	2.3	2.15	1.85	0.75
14	50-60	1	Uni/Unilat	0.4	1.45	0.65	0.4
15	50-60	1	Uni/Unilat	0.3	1.2	0.8	0.35
17	50-60	1	Uni/Unilat	2.6	2.2	1.8	0.7
20	50-60	1	Uni/Unilat	8.5	2.75	2.7	0.95
20	50-60	1	Uni/Unilat	3.2	2.1	1.8	0.75
22	50-60	1	Uni/Unilat	1.1	1.6	1.3	0.5
12	60-70	1	Uni/Unilat	2.7	2.85	1.8	0.55
22	60-70	1	Uni/Unilat	0.4	1.3	0.65	0.35
10	70-80	1	Uni/Unilat	0.9	1.8	1	0.5
10	70-80	1	Uni/Unilat	2	2.3	1.2	0.7
17	70-80	1	Uni/Unilat	0.9	1.35	1.15	0.7
23	70-80	1	Uni/Bilat	1.9	1.5	1.4	0.6
10	90-100	1	Uni/Unilat	7.3	3.55	2	1
11	100-110	1	Uni/Unilat	2.7	2.55	1.8	0.65
21	110-120	1	Uni/Unilat	0.4	1.4	0.8	0.3
22	110-120	1	Uni/Unilat	6.1	3.55	2.15	0.8
22	110-120	1	Uni/Unilat	2.3	1.7	1.7	0.65
28	110-120	1	Uni/Unilat	1	1.9	1.2	0.3
12	120-130	1	Uni/Unilat	1.8	1.85	1.3	0.65
25	120-130	1	Uni/Unilat	0.7	1.25	0.75	0.5
23	130-140	1	Uni/Unilat	1.5	2.3	1.8	0.4
29	130-140	1	Uni/Unilat	7.9	3.1	2.3	1
11	150-160	1	Uni/Unilat	0.2	1	0.65	0.2
23	160-170	1	Uni/Unilat	3.1	2	1.6	0.75
11	170-180	1	Uni/Unilat	3.4	2.35	1.7	0.75
19	170-180	1	Uni/Unilat	1.5	2.75	1.25	0.7
21	180-190	1	Uni/Unilat	0.4	1.5	0.8	0.25
21	180-190	1	Uni/Unilat	0.6		1.15	0.3
21	190-200	1	Uni/Unilat	0.6	1.55	0.8	0.55
19	200-210	1	Uni/Unilat	10.1	3.4	2.65	1.2
23	210-220	1	Uni/Unilat	4.5	2.8	2.6	0.6
20	220-230	1	Uni/Unilat	5.1	2.65	2	1.2
10	240-250	1	Uni/Unilat	0.7	1.75	0.9	0.4
20	240-250	1	Uni/Unilat	0.7	1.7	1.15	0.3
21	240-250	1	Uni/Unilat	4.5		1.75	1.05
21	240-250	1	Uni/Bilat	0.8	1.7	0.9	0.35
19	250-260	1	Uni/Unilat	1.4	2.2	1	0.55
19	250-260	1	Uni/Unilat	0.4	1.3	0.8	0.25
21	250-260	1	Uni/Unilat	0.4	1.5	0.95	0.25
22	260-270	1	Uni/Unilat	12.5	3.9	2.5	1.2
23	260-270	1	Uni/Unilat	1	1.8	0.95	0.55
19	270-280	1	Uni/Bilat	1.1	1.4	1.3	0.5
21	280-290	1	Uni/Unilat	6.2	3.1	1.9	1.15
22	320-330	1	Uni/Bilat	18.6	4.7	3.2	1.4
22	340-350	1	Uni/Bilat	12.6	3.7	3.3	1.1
21	390-400	1	Uni/Unilat	2.4	2.05	1.2	0.25

Table 33 cont. Side Scrapers Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
21	410-420	1	Uni/Unilat	0.9	1.65	1.6	0.4
21	410-420	1	Uni/Unilat	1	1.5	1.35	0.4
11/12	430-440	1	Uni/Unilat	1.3	2	1.35	0.4
11/12	440-450	1	Uni/Unilat	3.8	2.65	2.3	0.7
11/12	460-470	1	Uni/Unilat	9.7	3	2.5	1.25
11/12	460-470	1	Uni/Unilat	1.3	1.65	1.55	0.45
21	490-500	1	Uni/Unilat	2.5	2.6	1.4	0.6
22	490-500	1	Uni/Unilat	1.6	2.1	1.3	0.55
22	490-500	1	Uni/Unilat	4.2	2.5	2.1	0.75
21	510-520	1	Uni/Unilat	0.8	1.7	1.15	0.25
22	510-520	1	Uni/Unilat	3.4	2.3	1.8	0.75
12	530-540	1	Uni/Unilat	4.7	2.7	1.9	0.7
21	580-590	1	Uni/Unilat	3.8	2.25	2	0.9
11	30-40	2	Bifacial/Unilat	1.2	1.55	1.15	0.5
14	60-70	2	Uni/Unilat	3.2	2.3	1.6	0.8
12	90-100	2	Uni/Unilat	1.5	1.8	1.3	0.65
10	100-110	2	Uni/Unilat	0.6	1.5	0.95	0.4
11	100-110	2	Bi/Bilat/Dist	3.7	2.35	1.9	0.8
11	100-110	2	Uni/Unilat	2.6	2.4	1.5	0.7
20	100-110	2	Uni/Unilat	0.8	1.6	1	0.55
12	110-120	2	Uni/Unilat	0.7	1.6	1.1	0.5
23	120-130	2	Uni/Unilat	1.3	1.3	1.2	0.5
22	230-240	2	Uni/Unilat	8.1	3.65	2.2	0.85
22	240-250	2	Uni/Unilat	0.9	1.75	0.9	0.5
21	360-370	2	Uni/Unilat	7	3.35	2.5	1.2
11/12	410-420	2	Uni/Bilat	1.3	2.2	1.6	0.35
21	410-420	2	Uni/Unilat	0.4	1.55	0.9	0.3
12	520-530	2	Uni/Unilat	3.5	3.3	2.3	0.5
12	580-590	2	Uni/Unilat	8.4	4	3	0.9
27	20-30	3	Bifacial/Unilat	1.6	2.4	1.7	0.4
21	30-40	3	Uni/Unilat	0.6	1.4	0.9	0.4
23	40-50	3	Uni/Bilat	0.8	1.9	1.2	0.5
27	40-50	3	Uni/Unilat	0.8	1.7	0.75	0.4
12	60-70	3	Uni/Unilat/Dist	0.8	1.4	1	0.45
15	60-70	3	Uni/Unilat	0.6	1.6	0.85	0.4
20	60-70	3	Uni/Unilat	0.5	1.7	0.85	0.4
12	80-90	3	Uni/Unilat	1.3	2	1.1	0.55
22	120-130	3	Uni/Unilat	5.2	3.25	2.4	0.7
22	130-140	3	Uni/Unilat	0.4	1.4	0.9	0.35
26	140-150	3	Uni/Unilat	0.8	1.6	1.2	0.5
10	220-230	3	Uni/Unilat	4	3.5	2.05	0.6
19	260-270	3	Uni/Unilat	4.5	2.3	2.3	0.75
21	280-290	3	Uni/Unilat	2.9	2.45	1.35	0.85
21	390-400	3	Uni/Unilat	4.4	2.5	2.3	0.75
21	490-500	3	Uni/Unilat	1.4	1.6	1.5	0.5
12	540-550	3	Bi/Unilat	1.4	1.45	1.5	0.5
27	0-10	4	Uni/Unilat	4.9	2.3	2	1
12	20-30	4	Uni/Unilat	4.5	2.65	1.85	1
19	20-30	4	Uni/Unilat	0.3	1.25	0.95	0.35
13	40-50	4	Uni/Unilat	0.8	1.7	1.2	0.45
22	40-50	4	Uni/Unilat	0.3	1.3	0.75	0.3
23	40-50	4	Uni/Unilat	0.6	1.6	1.2	0.5
23	40-50	4	Uni/Bilat	0.5	1.2	0.9	0.4

Table 33 cont. Side Scrapers Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
25	40-50	4	Uni/Unilat	2.3	2.25	1.4	0.65
15	60-70	4	Uni/Unilat	0.4	1.45	0.75	0.3
22	60-70	4	Uni/Unilat	0.5	1.3	1	0.3
11	70-80	4	Uni/Unilat	2.7	2.2	1.6	0.9
12	70-80	4	Uni/Unilat	1.4	1.55	1.15	0.8
15	70-80	4	Uni/Unilat	0.5	1.3	0.8	0.5
22	90-100	4	Uni/Unilat	0.7	1.55	0.8	0.45
14	110-120	4	Uni/Unilat	7.8	2.75	2.7	0.9
22	110-120	4	Uni/Unilat	0.6	1.35	0.95	0.4
22	120-130	4	Uni/Unilat	0.6	1.35	0.85	0.4
22	400-410	4	Uni/Unilat	2.4	2.9	1.9	0.5
22	530-540	4	Uni/Unilat	4.8	2.5	2.2	0.9
21	550-560	4	Bi/Unilat	13.4	4.5	3.55	0.95
16	20-30	5	Uni/Bilat	0.6	1.4	0.9	0.4
16	50-60	5	Uni/Bilat	0.6	1.4	0.9	0.4
17	70-80	5	Uni/Unilat	1.3	1.65	1.1	0.7
26	90-100	5	Uni/Unilat	0.9	2.1	1.1	0.4
19	100-110	5	Uni/Unilat	0.8	1.55	0.75	0.3
22	220-230	5	Uni/Unilat	0.4	1.85	1.6	0.6
21	470-480	6	Uni/Unilat	6.5	2.9	2.05	1
11	30-40	7	Uni/Unilat	0.3	1.2	0.65	0.4
11	50-60	7	Uni/Unilat	5.8	2.5	2.4	0.95
22	50-60	7	Bi/Bilat	8.9	3	2.3	1.2
22	60-70	7	Uni/Unilat	0.6	1.2	0.95	0.3
23	70-80	7	Uni/Bilat	3	2.4	2	0.7
22	90-100	7	Uni/Unilat	0.4	1.25	0.8	0.3
14	100-110	7	Uni/Unilat	0.4	1.4	1.05	0.3
11	110-120	7	Uni/Unilat	5.7	3	1.8	0.9
12	110-120	7	Uni/Unilat	12	3.8	2.55	1.35
18	110-120	7	Uni/Unilat	1	2.1	0.95	0.5
11	110-120	7	Uni/Unilat	2.3	2.45	2.1	0.5
14	120-130	7	Bi/Bilat	16.1	4.7	3.2	1.1
11	180-190	7	Uni/Unilat	20.2	5.3	4.05	1.3
11	180-190	7	Uni/Bilat	2.1	2.05	1.6	0.75
20	180-190	7	Uni/Unilat	8.4	4.2	2.5	0.7
20	180-190	7	Uni/Unilat	7.5	3.2	2.7	0.95
19	190-200	7	Uni/Unilat	2.1	2.8	1	0.75
21	240-250	7	Uni/Unilat	3.6	2.5	1.8	0.8
21	240-250	7	Uni/Bilat	13	3.85	2.35	1.1
21	370-380	7	Uni/Unilat	10.3	4.7	2.8	0.95
11/12	400-410	7	Uni/Unilat	1.1	1.95	1.1	0.6
21	400-410	7	Uni/Unilat	4	2.5	2.15	0.7
11/12	420-430	7	Uni/Unilat	3.5	2.9	2.5	0.45
11/12	430-440	7	Uni/Unilat	12.5	3.2	3.1	1.3
11/12	430-440	7	Uni/Unilat	1.4	1.75	2.2	0.5
21	440-450	7	Uni/Unilat	4.3	2.6	2.55	0.55
21	440-450	7	Uni/Unilat	3.3	2.1	2.55	0.6
21	440-450	7	Uni/Unilat	4.9	2.7	2.2	1.2
22	450-460	7	Uni/Unilat	1.7	2.7	1.4	0.65
11/12	460-470	7	Uni/Unilat	6.6	3.15	3.3	0.8
11/12	460-470	7	Uni/Unilat	0.3	1.7	0.8	0.3
21	480-490	7	Uni/Bilat	2.6	2.75	1.9	0.5
21	480-490	7	Uni/Unilat	0.8	1.9	1.5	0.3

Table 33 cont. Side Scrapers Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
23	500-510	7	Uni/Unilat	4.2	2.6	2.6	0.8
23	500-510	7	Uni/Bilat	8.2	3.5	2.8	1
21	520-530	7	Uni/Unilat	2.5	3	1.6	0.6
23	540-550	7	Uni/Unilat	9.9	4.8	2.6	0.7
12	560-570	7	Uni/Unilat	18.2	4.8	3.6	1.1
23	560-570	7	Uni/Unilat	3.8	3.1	2.5	0.5
12	580-590	7	Uni/Unilat	11.1	4.4	2.6	1.2
17	30-40	8	Uni/Unilat	0.8	1.5	0.85	0.65
22	40-50	8	Uni/Unilat	0.3	1.3	1	0.35
10	60-70	8	Uni/Unilat	1.3	2.7	1.45	0.4
21	60-70	8	Uni/Unilat/Dist	5.1	2.5	1.8	0.95
22	60-70	8	Uni/Unilat	0.8	1.45	1	0.45
19	70-80	8	Uni/Unilat	1.9	1.75	1.4	0.75
21	70-80	8	Uni/Unilat	0.6	1.6	0.95	0.35
11	80-90	8	Uni/Unilat	1.7	1.8	1.3	0.65
19	80-90	8	Uni/Bilat	2.6	2.2	2.1	0.55
10	90-100	8	Uni/Unilat	10.7	3.75	2.6	1.05
22	90-100	8	Uni/Unilat	1.3	2	1.15	0.4
12	110-120	8	Uni/Unilat	4.9	3.45	2.45	0.95
15	110-120	8	Uni/Unilat	0.8	1.6	1.3	0.45
21	120-130	8	Uni/Unilat	0.7	1.5	1.4	0.4
23	120-130	8	Uni/Unilat	0.3	1.1	0.8	0.35
21	240-250	8	Uni/Unilat	2.1	1.8	2	0.6
21	240-250	8	Uni/Unilat	0.8	1.5	1.3	0.6
21	280-290	8	Uni/Unilat	8.8	3.1	2.6	0.95
20	420-430	8	Uni/Unilat	2.7	2.75	2.2	0.5
11/12	440-450	8	Uni/Unilat	2.4	2.6	1.65	0.65
22	440-450	8	Uni/Unilat	3.6	2.25	2.1	0.8
21	460-470	8	Uni/Bilat	2.8	2.3	1.4	0.65
23	460-470	8	Uni/Unilat	10	3.55	2.5	1.1
11/12	470-480	8	Uni/Bilat	3.8	2.9	2.7	0.6
21	470-480	8	Uni/Unilat	3	2.4	2.1	0.6
22	470-480	8	Uni/Unilat	10	3.7	2.65	1.3
23	480-490	8	Uni/Bilat	18.2	4.6	3.3	1.35
23	560-570	8	Uni/Unilat/Prox	1.6	2.6	1.9	0.3
10	10-20	9	Uni/Bilat	0.5	1.55	0.9	0.5
14	20-30	9	Uni/Unilat	0.6	1.5	0.8	0.4
21	20-30	9	Uni/Unilat	0.5	1.55	0.9	0.25
20	30-40	9	Uni/Unilat	0.6	1.5	0.8	0.45
21	30-40	9	Uni/Unilat	0.6	1.95	1	0.3
13	50-60	9	Uni/Unilat	0.3	1.05	0.8	0.2
14	70-80	9	Uni/Bilat	0.7	1.75	0.85	0.5
17	70-80	9	Uni/Unilat	0.3	1	0.9	0.3
21	90-100	9	Uni/Unilat	0.5	1.9	0.85	0.5
10	100-110	9	Uni/Unilat	0.5	1.65	0.9	0.45
10	110-120	9	Uni/Unilat	0.7	1.7	1.05	0.35
14	110-120	9	Uni/Bilat	0.5	1.55	0.9	0.35
14	120-130	9	Uni/Unilat	4	2.75	2	0.8
23	120-130	9	Uni/Unilat	0.8	1.5	1.2	0.35
13	130-140	9	Uni/Unilat	0.4	1.4	0.9	0.25
21	140-150	9	Uni/Unilat	0.2	1.1	0.6	0.15
21	150-160	9	Uni/Unilat	0.2	1.15	0.55	0.25
21	170-180	9	Uni/Unilat	1.5	2.25	1.15	0.7

Table 33 cont. Side Scrapers Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
13	180-190	9	Uni/Unilat	0.9	1.7	1	0.55
19	220-230	9	Uni/Unilat	0.5	1.9	1.05	0.3
21	360-370	9	Uni/Unilat	2	3	1.8	0.3
21	400-410	9	Uni/Unilat	2.9	2.3	2	0.6
22	400-410	9	Uni/Unilat	2.9	3.2	2	0.5
11/12	450-460	9	Uni/Unilat	2.4	2.5	1.7	0.55
11/12	470-480	9	Uni/Unilat	2.4	2.05	1.8	0.65
23	480-490	9	Uni/Unilat	9.3	3.9	2.7	0.9
12	510-520	9	Uni/Unilat	3	2.2	1.8	0.7
12	520-530	9	Uni/Unilat	4.2	3.1	1.95	0.7
12	520-530	9	Uni/Unilat	1.7	2.3	1.7	0.55
12	530-540	9	Uni/Unilat	5.1	3	2.2	1
23	560-570	9	Uni/Unilat	4	2.8	2.1	0.8
23	670-680	9	Uni/Unilat	5	1.9	1.9	0.6

Totals:	225		Totals:	784 gm			
	223 Whole		Means:	3.484	2.28	1.63	0.63
200-300cm	26		Totals:	145.4 gm			
Early LSA	25 Whole		Means:	5.592	2.93	2.08	0.76
300-420cm	16		Totals:	76.5 gm			
Large Blade	16 Whole		Means:	4.781	2.82	1.99	0.66
420-450cm	11		Totals:	27.6 gm			
Upper MSA	11 Whole		Means:	2.509	2.05	1.59	0.59

Key:
Uni. = Unifacial
Unilat = Unilateral
Bilat = Bilateral
Bi. = Bifacial
Dist. = Distal
Prox. = Proximal

Raw Material
1 = Quartz
2 = Brown Chert
3 = Chalcedony
4 = Jasper
5 = Transparent w/ black flecks
6 = Black Chert
7 = Silcrete
8 = Multi-Color Chert
9 = Other Fine Grained Raw Mat'l

Table 34 End Scrapers Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
12	0-10	1	Uni/Dist	0.4	1	1.2	0.4
22	40-50	1	Uni/Dist	0.4	1	0.8	0.3
12	50-60	1	Uni/Dist	2	2.2	1.9	0.6
23	70-80	1	Uni/Dist	0.2	0.9	0.7	0.2
15	80-90	1	Uni/Dist	0.3	1.1	0.95	0.4
20	120-130	1	Uni/Dist	2	1.9	1.8	0.5
29	130-140	1	Uni/Dist	0.2	1.2	0.7	0.3
19	160-170	1	Uni/Prox	6.3	2.2	2.3	1.1
19	160-170	1	Uni/Dist	4.1	3	1.95	0.85
21	180-190	1	Uni/Dist	2.3	2.1	1.6	0.5
23	210-220	1	Uni/Dist	0.6	1	0.8	0.2
22	240-250	1	Uni/Dist	1.1	1.5	1.05	0.5
11	250-260	1	Uni/Dist	1.9	1.95	1.55	0.6
19	250-260	1	Uni/Dist	33.7	4.9	4.3	1.65
19	260-270	1	Uni/Dist	5.1	2.25	2.1	0.85
22	280-290	1	Uni/Dist	9	2.85	2.6	1.15
22	280-290	1	Uni/Dist	5	2.55	2.2	0.85
22	300-310	1	Uni/Unilat/Dist	0.7	1.15	1.05	0.5
19	320-330	1	Uni/Dist	0.5	1.25	0.9	0.45
22	320-330	1	Uni/Dist	9.3	3.7	3.05	1
22	320-330	1	Uni/Bilat	14	3.6	2.75	1.1
22	330-340	1	Uni/Dist	16	3.4	2.75	1.6
22	340-350	1	Uni/Dist	6.5	3.3	2.4	0.75
21	420-430	1	Uni/Dist	1.9	1.9	1.6	0.65
22	480-490	1	Uni/Dist	5	2.4	2.3	0.8
21	490-500	1	Uni/Dist	1.3	1.7	1.5	0.5
22	490-500	1	Uni/Dist	3.7	1.9	2.35	0.7
22	490-500	1	Uni/Dist	4	1.8	2.1	1.1
21	610-620	1	Uni/Dist	23.5	4.25	4.1	1.3
12	70-80	2	Uni/Dist	0.8	1	1.65	0.6
19	80-90	2	Uni/Dist	0.7	1.5	1.45	0.35
19	80-90	2	Uni/Dist	0.2	0.7	0.85	0.2
28	120-130	2	Uni/Dist	0.7	1	0.9	0.4
22	270-280	2	Bi/Dist	10	2.9	3.05	1.25
21	360-370	2	Uni/Prox	1	1.55	1.45	0.5
21	440-450	2	Uni/Dist	1.9	2	1.7	0.8
22	480-490	2	Uni/Prox	1.5	1.8	2.1	0.6
21	410-420	3	Uni/Dist	0.4	1.6	1	0.35
12	0-10	4	Uni/Dist	0.8	1.2	1.3	0.5
22	10-20	4	Uni/Dist	0.9	1.4	1	0.5
23	30-40	4	Uni/Dist	2.8	2.5	1.4	0.8
13	40-50	4	Uni/Dist	0.2	1	1	0.25
11	60-70	4	Uni/Dist	0.8	1.45	1.35	0.65
12	90-100	4	Uni/Dist	0.6	1.1	1.5	0.45
22	90-100	4	Uni/Dist	0.8	1.65	1.2	0.35
21	150-160	4	Uni/Dist	0.2	1	0.95	0.2
23	210-220	4	Uni/Dist	3.1	2.6	1.5	0.9
21	440-450	4	Uni/Dist	2.7	2.35	1.6	0.5
19	180-190	6	Uni/Dist	1.4	2	1.45	0.6
14	20-30	7	Uni/Dist	0.7	1.1	1.3	0.45
10	70-80	7	Uni/Dist	1	2.2	1.7	0.4
19	80-90	7	Uni/Dist	4	1.95	2.5	1.05

Table 34 cont. End Scrapers Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
23	100-110	7	Uni/Dist	19.2	4.3	3.5	1.4
11	110-120	7	Uni/Dist	2.7	2.05	1.65	1
15	110-120	7	Bi/Dist	1.6	1.7	2.15	0.5
21	180-190	7	Uni/Dist	4.3	3.45	2.4	0.5
11/12	420-430	7	Uni/Prox	0.5	1.05	1.4	0.3
22	430-440	7	Uni/Prox	4.5	2.6	2.3	0.6
22	450-460	7	Uni/Prox	2.5	2.05	2.05	0.65
11/12	470-480	7	Uni/Dist	16.8	4.7	4.35	1.4
21	490-500	7	Uni/Dist	2.4	1.8	2.25	0.6
12	540-550	7	Uni/Dist	5.4	2.8	1.9	0.55
21	60-70	8	Uni/Prox	1.4	2.4	1.35	0.5
20	100-110	8	Uni/Dist	3.4	2.2	1.9	0.75
19	150-160	8	Uni/Prox	1.6	1.95	1.6	0.55
19	160-170	8	Uni/Dist	1.7	1.1	1.9	0.85
22	260-270	8	Uni/Dist	6.4	2.5	1.9	1
22	380-390	8	Uni/Dist	3.6	2.25	1.7	1.1
26	10-20	9	Uni/Dist	0.7	1.35	1	0.5
11	20-30	9	Uni/Dist	1	1.2	1.75	0.5
12	30-40	9	Uni/Dist	0.4	0.95	1.1	0.35
29	40-50	9	Uni/Dist	1	1.5	1.2	0.6
11	60-70	9	Uni/Dist/Prox	0.5	1.1	1.25	0.35
11	100-110	9	Uni/Dist	0.3	0.95	0.85	0.4
12	110-120	9	Uni/Dist	0.3	1.05	1	0.3
19	120-130	9	Uni/Dist	0.4	1.5	0.85	0.3
19	160-170	9	Uni/Prox	1.3	2.2	1.7	0.45
22	240-250	9	Uni/Dist	1.6	1.7	2.2	0.5
11	260-270	9	Uni/Dist	3.1	2.1	2.3	0.65
11/12	410-420	9	Uni/Dist	1.2	1.9	1.5	0.5
21	480-490	9	Uni/Dist	9.2	3.05	3.15	0.9
23	490-500	9	Uni/Dist	4.1	3.3	2.1	0.8

Totals:	82		Totals:	301.3 gm			
	82 Whole		Means:	3.674	2.003	1.77	0.65
200-300cm	12		Totals:	38 gm			
Early LSA	12 Whole		Means:	3.167	2	1.75	0.65
300-420cm	10		Totals:	42.8 gm			
Large Blade	10 Whole		Means:	4.28	2.5	2.15	0.64
420-450	5		Totals:	13.4 gm			
Upper MSA	5 Whole		Means:	2.68	1.68	1.65	0.79

Key:
Uni = Unifacial
Dist. = Distal
Prox. = Proximal
Unilat. = Unilateral
Bi. = Bilateral

Raw Material
1 = Quartz
2 = Brown Chert
3 = Chalcedony
4 = Jasper
6 = Black Chert
7 = Silcrete
8 = Multi-Color Chert
9 = Other Fine Grained Raw Mat

Table 35 Denticulates Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
19	220-230	1	Uni/Unilat	0.9	1.8	1	0.4
19	250-260	1	Uni/Unilat	2.3	1.9	1.3	0.7
11/12	460-470	1	Uni/Bilat	11.3	4	3.65	0.9
22	490-500	1	Uni/Unilat	3.9	2.4	2.3	0.6
11	60-70	2	Uni/Dist	0.8	1.8	1.55	0.35
12	100-110	2	Uni/Dist	1.6	1.8	2.4	0.45
11	370-380	2	Uni/Unilat	7.3	3.15	2.7	0.75
21	450-460	2	Uni/Unilat	1.2	2.5	1.75	0.35
23	500-510	3	Uni/Unilat	1.5	2.6	1.9	0.3
12	510-520	3	Uni/Unilat	2	3.25	1.6	0.3
21	410-420	4	Uni/Unilat	3.4	2.8	2	0.6
11	100-110	7	Uni/Dist	3.5	3.3	2.1	0.6
11/12	460-470	7	Uni/Unilat	4.5	3.05	2.5	0.8
12	550-560	7	Uni/Unilat	4	2.7	2.55	0.85
21	560-570	7	Uni/Unilat	16.2	4.95	2.9	1.2
21	600-610	7	Uni/Unilat	14.7	4.4	3	1.3
12	100-110	8	Uni/Unilat	3	2.8	2.2	0.8
11/12	440-450	8	Uni/Unilat	2.4	2.75	2.1	0.65
22	450-460	8	Uni/Unilat	1	2.85	1.45	0.3
22	450-460	8	Uni/Unilat	0.6	2.05	1.05	0.5
12	480-490	8	Uni/Unilat	3.5	4.85	2.5	0.6
21	150-160	9	Uni/Unilat	2.3	2.8	1.8	0.5
11	360-370	9	Uni/Bilat	8.4	3.7	2.4	0.9
22	410-420	9	Uni/Unilat	3.3	3.85	2.4	0.3
11/12	450-460	9	Uni/Unilat	3	2.75	2.4	0.55

Totals:	25		Totals:	106.6 gm			
	25 Whole		Means:	4.264	2.992	2.14	0.62
200-300cm	2		Totals:	8.9 gm			
Early LSA	2 Whole		Means:	4.45	2.475	2.55	0.6
300-420cm	4		Totals:	8.1 gm			
Large Blade	4 Whole		Means:	2.025	2.788	1.81	0.39
420-450cm	1		Totals:	2.4 gm			
Upper MSA	1 Whole		Means:	2.4	2.75	2.1	0.65

Key:
Uni. = Unifacial
Unilat. = Unilateral
Bilat. = Bilateral
Dist. = Distal

Raw Material
1 = Quartz
2 = Brown Chert
3 = Chalcedony
4 = Jasper
7 = Silcrete
8 = Multi-Color Chert
9 = Other Fine Grained Raw Mat'l

Table 36 Notches Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
11	30-40	1	Uni/Unilat	0.6	1.6	1	0.4
17	100-110	1	Uni/Unilat	0.3	1	0.95	0.25
11	170-180	1	Uni/Unilat	3.3	3.55	1.55	0.65
21	180-190	1	Uni/Unilat	4	2.5	2.25	0.7
19	230-240	1	Uni/Unilat	2.5	2.1	1.7	0.65
21	320-330	1	Uni/Unilat	0.4	1.5	1.1	0.25
22	350-360	1	Uni/Unilat	3.3	2.9	1.9	0.7
22	390-400	1	Uni/Unilat	4.4	3.5	2	0.45
22	420-430	1	Uni/Unilat	5.8	3.55	2	0.9
11	60-70	2	Uni/Unilat	0.2	1.05	0.95	0.2
21	70-80	2	Uni/Unilat	1.1	2.2	1.25	0.4
18	100-110	2	Uni/Dist	1.9	2.1	2.4	0.35
11	140-150	2	Uni/Unilat	1.3	2.45	1.3	0.55
23	370-380	2	Uni/Unilat	3.3	2.7	1.4	0.4
12	260-270	4	Uni/Unilat	0.9	1.55	1.5	0.5
21	320-330	4	Uni/Unilat	1.3	1.9	2.1	0.5
17	120-130	5	Uni/Unilat	8.1	3.4	2.6	0.9
11	360-370	5	Uni/Unilat	0.5	1.7	1.2	0.2
20	90-100	7	Uni/Unilat	0.65	3.6	2.8	1
15	110-120	7	Uni/Dist	11.4	3	3.55	1.15
17	110-120	7	Uni/Dist	1	1.9	2.05	0.4
11	120-130	7	Uni/Unilat	0.8	1.35	1.25	0.35
15	120-130	7	Uni/Unilat	3.3	2.75	2	0.7
15	120-130	7	Uni/Dist	2.8	2.6	1.85	0.8
20	170-180	7	Uni/Unilat	3.1	2.55	1.8	0.7
11/12	420-430	7	Uni/Unilat	1.1	1.8	2.05	0.35
22	440-450	7	Uni/Bilat	5.8	2.95	2.75	1
21	480-490	7	Uni/Unilat	2.7	2.4	2.35	0.4
12	80-90	8	Uni/Unilat	5.8	2.95	2.6	0.8
22	380-390	8	Uni/Dist	1.2	1.55	1.2	0.55
11/12	470-480	8	Uni/Bilat	0.8	1.9	1.45	0.35
17	70-80	9	Uni/Unilat	0.7	1.85	1.3	0.35
15	110-120	9	Uni/Unilat	0.5	1.45	0.8	0.4
14	120-130	9	Uni/Unilat	2	1.85	1.75	0.65
18	120-130	9	Uni/Unilat	0.5	1.4	1.05	0.45
12	500-510	9	Uni/Dist	1.2	1.7	1.9	0.4
Totals:		36	Totals:	88.55	gm		
		36	Whole Means:	2.46	2.244	1.768	0.549
200-300cm		2	Totals:	4.1	gm		
Early LSA		2	Whole Means:	2.05	2.05	1.625	0.525
300-420cm		7	Totals:	22.5	gm		
Large Blade		7	Whole Means:	3.214	2.4	2.086	0.657
420-450cm		3	Totals:	2	gm		
Upper MSA		3	Whole Means:	0.667	1.733	1.183	0.367

Key:
Uni. = Unifacial
Unilat. = Unilateral
Dist. = Distal
Bilat. = Bilateral

Raw Material
1 = Quartz
2 = Brown Chert
4 = Jasper
5 = Transparent w/ black flecks
7 = Silcrete
8 = Multi-Color Chert
9 = Other Fine Grained Raw Mat'l

Table 37 Bec's Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
14	50-60	1	Uni/Dist	1.3	2.5	1.05	0.5
22	250-260	1	Uni/Dist	0.4	1.6	0.7	0.25
22	260-270	1	Uni/Unilat	0.4	1.7	0.65	0.25
22	270-280	1	Uni/Unilat/Dist	1.1	2.25	0.9	0.45
22	290-300	1	Uni/Unilat/Dist	0.2	1.1	0.55	0.2
22	340-350	1	Uni/Unilat/Dist	0.5	1.3	0.8	0.4
14	100-110	2	Uni/Unilat	0.7	2.1	0.9	0.4
23	180-190	2	Uni/Dist	1.1	2.3	0.8	0.2
12	550-560	2	Uni/Bilat	7	3.8	2.25	0.95
25	30-40	4	Uni/Dist	0.7	1.85	0.6	0.4
21	520-530	7	Uni/Unilat	8.9	5.5	1.6	0.9
15	70-80	8	Uni/Unilat	0.3	1.8	0.75	0.2
22	260-270	8	Uni/Unilat	0.4	1.75	0.7	0.25
22	260-270	8	Uni/Unilat	0.5	1.6	0.8	0.3
22	490-500	8	Uni/Unilat	1.2	2.85	1.8	0.35

Totals:	15		Totals:	24.7 gm			
	15 Whole		Means:	1.647	2.267	0.99	0.4
200-300cm	6		Totals:	18.9 gm			
Early LSA	6 Whole		Means:	3.15	2.808	1.158	0.542
300-420cm	1		Totals:	0.5 gm			
Large Blade	1 Whole		Means:	0.5	1.3	0.8	0.4
420-450cm	None						
Upper MSA							

Key:
Uni.= Unifacial
Dist. = Distal
Unilat. = Unilateral
Bilat. = Bilateral

Raw Material
1 = Quartz
2 = Brown Chert
4 = Jasper
7 = Silcrete
8 = Multi-Color Chert

Table 38 Burins Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
12	0-10	1	burin	0.3	1.2	1.1	0.3
12	0-10	1	burin	0.3	1.45	0.75	0.2
12	10-20	1	burin	0.3	1.65	0.6	0.25
15	10-20	1	burin	1.4	2.25	1.6	0.6
20	10-20	1	burin	0.3	1.3	0.75	0.25
20	10-20	1	burin	0.3	1.3	0.8	0.3
12	20-30	1	burin	0.6	1.3	1.2	0.35
21	20-30	1	burin	0.5	2.4	1.6	0.4
11	30-40	1	burin	0.5	1.95	1.1	0.4
12	30-40	1	burin	0.5	1.55	1.1	0.4
12	30-40	1	burin	0.4	1.15	1.15	0.45
12	30-40	1	burin	0.6	1.65	1.05	0.3
14	30-40	1	burin	0.3	1.6	1.4	0.2
10	40-50	1	burin	1.5	2.05	1.8	0.5
11	40-50	1	burin	0.6	1.8	1.2	0.3
12	40-50	1	burin	0.6	1.5	1.5	0.4
12	40-50	1	burin	0.6	1.8	1.4	0.35
12	40-50	1	burin	0.2	1.05	0.8	0.4
18	40-50	1	burin	0.2	1	0.9	0.3
12	50-60	1	burin	0.2	1.4	0.8	0.25
13	50-60	1	burin	1	1.55	1.3	0.4
14	50-60	1	burin	0.2	1	0.7	0.25
18	50-60	1	burin	0.3	1.45	1.1	0.25
11	60-70	1	burin	2	2.45	1.9	0.4
11	60-70	1	burin	0.4	1.2	1.15	0.4
12	60-70	1	burin	0.2	0.95	0.75	0.3
14	60-70	1	burin	0.2	1.2	0.6	0.25
15	60-70	1	burin	0.3	1.45	0.75	0.4
20	60-70	1	burin	0.6	1.55	1.05	0.45
10	70-80	1	burin	0.3	1.15	0.75	0.3
12	70-80	1	burin	11.5	4.5	2.9	0.8
12	70-80	1	burin	0.2	1.15	0.85	0.2
11	80-90	1	burin	0.5	1.55	1	0.3
11	80-90	1	burin	0.4	1.15	1.05	0.4
12	80-90	1	burin	0.5	1.7	1	0.4
12	80-90	1	burin	0.6	1.65	1.35	0.35
12	80-90	1	burin	0.2	0.95	0.9	0.3
12	80-90	1	burin	0.1	0.75	0.55	0.2
10	90-100	1	burin	1	1.7	1.25	0.45
11	90-100	1	burin	0.4	1.55	1.1	0.2
12	100-110	1	burin	0.5	1.5	1.05	0.35
12	100-110	1	burin	0.4	1.25	1.3	0.3
12	100-110	1	burin	0.3	1.3	0.8	0.3
12	100-110	1	burin	0.2	1.2	0.85	0.15
12	100-110	1	burin	0.1	0.9	0.75	0.2
14	100-110	1	burin	0.1	0.95	0.75	0.2
15	100-110	1	burin	0.2	1.15	0.7	0.3
15	100-110	1	burin	0.1	1	0.5	0.15
20	100-110	1	burin	0.1	0.9	0.7	0.15
11	110-120	1	burin	0.2	1.25	1.05	0.25
12	110-120	1	burin	1	2.15	2.05	0.25
20	110-120	1	burin	0.5	1.5	0.9	0.35

Table 38 cont. Burins Raw Material & Metric Data

Square	Depth	R.M.	Retouch	Location	Wt.gms	L	W	T
20	110-120	1	burin		0.2	1.15	0.65	0.2
20	110-120	1	burin		0.3	1.25	1	0.3
12	120-130	1	burin		0.1	1	0.7	0.2
12	130-140	1	burin		0.1	0.95	0.5	0.25
12	140-150	1	burin		1.9	1.9	2.1	0.45
20	140-150	1	burin		0.7	1.4	1.2	0.4
21	140-150	1	burin		0.6	1.7	1.35	0.35
12	160-170	1	burin		0.1	0.7	0.55	0.2
10	180-190	1	burin		0.4	1.8	1.1	0.3
21	180-190	1	burin	Uni/Dist	0.7	1.65	0.9	0.5
11	190-200	1	burin		0.4	1.45	0.95	0.35
11	190-200	1	burin		0.2	1.2	0.7	0.3
12	190-200	1	burin		1.1	1.7	1.5	0.6
21	190-200	1	burin		2	2.8	1.3	0.55
21	190-200	1	burin		0.6	1.6	1.2	0.4
21	190-200	1	burin		0.7	1.3	1.6	0.35
10	200-210	1	burin		1.1	1.7	1.15	0.55
12	200-210	1	burin		0.2	1.05	0.9	0.25
21	210-220	1	burin		0.5	1.7	1.3	0.35
20	220-230	1	burin		0.7	1.95	1.8	0.25
21	220-230	1	burin		0.7	1.6	1.15	0.4
10	230-240	1	burin		0.9	1.9	1.5	0.35
21	230-240	1	burin		0.6	1.45	1.2	0.45
21	230-240	1	burin		0.3	1.5	0.55	0.35
10	240-250	1	burin		0.3	1.2	1	0.25
11	240-250	1	burin		0.3	1.4	0.95	0.2
12	240-250	1	burin		1.8	1.9	1.6	0.8
12	240-250	1	burin		0.5	1.6	1.2	0.35
20	240-250	1	burin		0.5	1.5	0.95	0.3
21	240-250	1	burin		2.8	2.75	1.6	0.6
21	240-250	1	burin		0.5	1.6	1.05	0.35
21	240-250	1	burin		0.6	1.85	1	0.45
21	240-250	1	burin		0.4	1.15	1.2	0.35
10	250-260	1	burin		0.6	1.8	1.1	0.35
10	250-260	1	burin		0.7	1.35	1.35	0.5
11	250-260	1	burin		1.1	1.9	1.3	0.45
11	250-260	1	burin		0.3	1.2	0.9	0.4
12	250-260	1	burin		0.5	1.6	1.25	0.4
12	250-260	1	burin		0.3	1.3	1	0.25
12	250-260	1	burin		0.3	1.4	0.85	0.2
12	250-260	1	burin		0.1	1.2	0.65	0.15
12	250-260	1	burin		0.2	0.85	0.75	0.2
12	250-260	1	burin		0.1	0.95	0.8	0.2
21	250-260	1	burin		0.4	1.2	1	0.25
21	250-260	1	burin		0.1	0.95	0.5	0.2
22	250-260	1	burin		13	3.55	2.7	1.6
22	250-260	1	burin		5.1	2.65	2.3	0.7
22	250-260	1	burin		4.2	2.65	2.15	0.65
22	250-260	1	burin		3.2	2.45	1.95	0.85
22	250-260	1	burin		1	1.6	1.5	0.4
22	250-260	1	burin		0.7	1.65	1.4	0.3
22	250-260	1	burin		1	1.65	1.15	0.55
22	250-260	1	burin		0.8	1.4	1.2	0.45

Table 38 cont. Burins Raw Material & Metric Data

Square	Depth	R.M.	Retouch	Location	Wt.gms	L	W	T
22	250-260	1	burin		0.5	1.7	1.15	0.25
22	250-260	1	burin		0.7	1.45	0.95	0.5
22	250-260	1	burin		0.3	1.5	0.7	0.3
22	250-260	1	burin		0.4	1.35	1	0.25
22	250-260	1	burin		0.4	1.05	0.6	0.3
11	260-270	1	burin		0.4	1.2	1.3	0.35
11	260-270	1	burin		0.1	0.85	1	0.15
19	260-270	1	burin	Uni/Unilat	1.4	2.8	0.9	0.4
20	260-270	1	burin	Uni/Unilat	0.3	1.7	0.85	0.25
21	260-270	1	burin		0.4	1.55	0.95	0.3
21	260-270	1	burin		0.3	1.2	1.1	0.3
21	260-270	1	burin		0.5	1.15	1.1	0.45
21	260-270	1	burin		0.3	1.3	0.8	0.25
21	260-270	1	burin		0.2	1.1	1	0.2
21	260-270	1	burin		0.2	1.2	1.05	0.25
21	260-270	1	burin		0.1	1	0.85	0.15
22	260-270	1	burin		2.4	2.35	1.45	0.6
22	260-270	1	burin		1.4	1.55	1.5	0.45
22	260-270	1	burin		0.9	1.7	1.2	0.4
22	260-270	1	burin		0.6	1.5	1.2	0.3
12	270-280	1	burin		0.4	1.05	0.85	0.25
12	270-280	1	burin		0.3	0.7	0.75	0.25
19	270-280	1	burin		0.9	1.85	1	0.35
21	270-280	1	burin		0.3	1.2	0.9	0.25
21	270-280	1	burin		0.6	1.5	1	0.35
21	270-280	1	burin		0.3	1.1	0.9	0.3
22	270-280	1	burin	double	2.9	2.4	2.4	0.5
22	270-280	1	burin		0.8	1.3	1.15	0.4
22	270-280	1	burin		2.3	2.65	1.45	0.6
22	270-280	1	burin		0.7	1.9	1.55	0.35
22	270-280	1	burin		0.6	1.5	1.1	0.4
22	270-280	1	burin		0.4	1.3	1	0.3
11	280-290	1	burin		0.7	1.8	1	0.4
11	280-290	1	burin		0.1	0.9	0.65	0.3
12	280-290	1	burin		0.1	0.75	0.6	0.2
12	280-290	1	burin		0.1	1	0.5	0.25
21	280-290	1	burin		0.3	1.2	0.85	0.2
22	280-290	1	burin		2.5	1.95	1.8	0.6
22	280-290	1	burin		0.4	1.2	1	0.25
21	290-300	1	burin		0.9	1.7	1.2	0.4
21	290-300	1	burin		0.5	1.5	0.9	0.4
22	290-300	1	burin		0.3	0.75	0.75	0.3
22	290-300	1	burin		0.7	1.5	1.1	0.35
22	290-300	1	burin		1	1.65	1.1	0.65
22	290-300	1	burin		0.7	1.45	1.1	0.5
22	290-300	1	burin		0.6	1.25	1	0.5
22	290-300	1	burin		4.1	2.5	1.9	1.15
21	300-310	1	burin		0.3	1.85	0.85	0.25
21	300-310	1	burin		0.2	1.35	0.9	0.3
22	300-310	1	burin		2.7	2.65	1.75	0.65
22	300-310	1	burin		0.8	1.55	1.25	0.45
22	300-310	1	burin		0.9	1.55	0.95	0.45
22	300-310	1	burin		0.3	1.15	0.95	0.3

Table 38 cont. Burins Raw Material & Metric Data

Square	Depth	R.M.	Retouch	Location	Wt.gms	L	W	T
11	310-320	1	burin		0.5	1.5	1	0.3
12	310-320	1	burin		0.5	1.1	1.55	0.45
21	310-320	1	burin		1.4	2.1	2	0.5
22	320-330	1	burin		0.7	1.3	1.1	0.4
22	320-330	1	burin		0.3	1.1	0.55	0.3
11	330-340	1	burin		0.6	1.55	1.1	0.4
22	330-340	1	burin		0.2	1.6	0.65	0.35
22	330-340	1	burin		0.2	1	0.7	0.25
12	340-350	1	burin		0.4	1.3	1.15	0.3
22	340-350	1	burin		1.5	1.65	2	0.45
22	340-350	1	burin		1.7	1.8	1.7	0.65
22	340-350	1	burin		0.3	1.25	0.95	0.25
20	350-360	1	burin		0.6	2.1	1.2	0.3
20	350-360	1	burin		0.4	1.55	1.6	0.25
20	350-360	1	burin		0.3	1.35	0.8	0.3
22	350-360	1	burin	double	1	2	1.45	0.4
22	350-360	1	burin		1.3	1.6	1.5	0.45
22	350-360	1	burin		0.8	1.8	0.75	0.5
22	350-360	1	burin		1.4	1.7	1	0.8
22	350-360	1	burin		0.3	1.2	0.6	0.3
20	360-370	1	burin		0.2	1.05	0.8	0.25
20	370-380	1	burin		1.6	2.1	1.7	0.5
22	370-380	1	burin		1.2	2.4	1.1	0.45
22	370-380	1	burin		1.2	1.6	1.3	0.55
12	390-400	1	burin		0.1	0.7	0.65	0.15
22	390-400	1	burin		1.2	1.4	1.2	0.45
22	390-400	1	buirn		2.6	2.25	1.8	0.7
20	400-410	1	burin		1.1	2.5	0.95	0.45
20	400-410	1	burin		0.2	1.15	1	0.4
21	400-410	1	burin	Uni/Unilat	0.4	1.6	0.85	0.3
21	400-410	1	burin		0.3	1.5	1	0.25
21	400-410	1	burin		0.4	1.55	1.15	0.35
21	400-410	1	burin		0.2	1.3	0.7	0.2
21	410-420	1	burin		1.2	2.1	1.6	0.4
21	410-420	1	burin		0.6	1.6	1.35	0.5
21	410-420	1	burin		0.6	1.3	1.25	0.45
21	410-420	1	burin		0.6	1.65	0.8	0.45
21	410-420	1	burin		0.4	1.4	1.3	0.3
21	410-420	1	burin		0.5	1.25	0.95	0.3
21	410-420	1	burin		0.4	1.2	1	0.4
20	420-430	1	burin		0.6	1.7	1.2	0.4
21	420-430	1	burin		0.8	1.6	1.2	0.4
21	420-430	1	burin		0.4	1.3	1	0.3
22	420-430	1	burin		1.1	1.85	1.4	0.45
22	420-430	1	burin		0.9	2	1.3	0.4
22	420-430	1	burin		0.7	1.45	0.8	0.5
22	420-430	1	burin		1.2	2.6	0.9	0.6
21	430-440	1	burin	double	1.7	2.5	1.3	0.55
21	430-440	1	burin		0.2	1.55	0.7	0.2
22	430-440	1	burin		0.8	1.7	1.1	0.35
22	430-440	1	burin	double	0.9	1.65	1.15	0.5
11/12	440-450	1	burin		0.2	1.5	0.8	0.2
21	440-450	1	burin		0.6	1.7	1	0.35

Table 38 cont. Burins Raw Material & Metric Data

Square	Depth	R.M.	Retouch	Location	Wt.gms	L	W	T
21	440-450	1	burin		0.3	1.45	1	0.3
21	440-450	1	burin		0.2	1.25	0.7	0.2
11/12	450-460	1	burin		0.4	1.5	1.3	0.2
11/12	450-460	1	burin		0.5	1.4	1.3	0.3
11/12	450-460	1	burin		0.2	1.3	0.7	0.2
21	450-460	1	burin		0.2	1	0.85	0.2
11/12	460-470	1	burin		0.3	1.3	1.3	0.2
11/12	460-470	1	burin		0.4	1.45	1.5	0.25
11/12	460-470	1	burin		0.1	1	0.75	0.2
11/12	470-480	1	burin		1.1	2.1	1.4	0.45
11/12	470-480	1	burin		0.3	1.4	1.2	0.3
11/12	470-480	1	burin		0.3	1.3	0.95	0.25
11/12	470-480	1	burin		0.3	1.3	0.8	0.25
12	480-490	1	burin		0.3	1.2	1.25	0.25
21	480-490	1	burin		0.7	1.65	1	0.45
21	480-490	1	burin		0.3	1.1	0.95	0.35
12	500-510	1	burin		0.6	1.8	1.05	0.4
12	510-520	1	burin		0.2	1.5	0.9	0.2
21	510-520	1	burin		0.7	1.9	1.4	0.3
21	520-530	1	burin		1.5	1.95	1.5	0.55
12	540-550	1	burin		0.8	1.9	1	0.4
21	540-550	1	burin		0.6	1.4	1.2	0.45
21	540-550	1	burin		0.5	1.4	1.35	0.4
12	550-560	1	burin		0.4	1.25	1.1	0.5
12	550-560	1	burin		0.2	1.45	1.1	0.2
21	550-560	1	burin	double	0.2	1.15	1	0.2
22	550-560	1	burin		4	2.9	1.9	0.85
22	550-560	1	burin		0.5	1.5	1.45	0.3
22	550-560	1	burin		1.5	2	1.4	0.6
21	560-570	1	burin	double	0.5	1.6	0.9	0.3
12	580-590	1	burin		0.5	1.6	1.25	0.3
21	580-590	1	burin		0.3	1.3	0.9	0.25
21	590-600	1	burin	Uni/Unilat	0.6	1.3	1.2	0.45
21	590-600	1	burin		0.3	1.25	0.8	0.4
21	600-610	1	burin		0.5	1.15	1	0.35
21	610-620	1	burin		0.3	1.3	1	0.2
22	610-620	1	burin		1	1.7	1.1	0.45
12	0-10	2	burin		0.7	1.45	1.35	0.4
12	30-40	2	burin		0.2	1.25	0.65	0.35
12	100-110	2	burin		0.7	1.6	1.15	0.35
13	100-110	2	burin		0.2	1.15	0.95	0.2
11	110-120	2	burin		2.1	2.15	1.4	0.8
12	170-180	2	burin		0.9	1.95	1.45	0.4
12	220-230	2	burin		0.2	7	1	0.25
11	240-250	2	burin		0.9	2.5	1.7	0.35
21	290-300	2	burin		0.9	1.95	1.3	0.3
21	360-370	2	burin		1.4	2.55	2	0.3
21	360-370	2	burin		0.4	1.95	1.3	0.25
22	380-390	2	burin		0.6	1.3	1	0.25
20	390-400	2	burin		2.8	2.8	1.85	0.85
21	400-410	2	burin		1.6	1.9	1.6	0.6
21	410-420	2	burin		0.1	0.8	0.7	0.2
22	410-420	2	burin		0.5	1.75	1	0.2

Table 38 cont. Burins Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
21	470-480	2	burin	1.4	1.9	1.85	0.4
22	490-500	2	burin	0.8	1.6	0.95	0.6
12	570-580	2	burin double	3.2	3.1	2.05	0.8
21	590-600	2	burin	0.3	1.1	1.05	0.3
12	70-80	3	burin	0.7	1.4	1.95	0.3
12	70-80	3	burin	0.2	1.2	0.8	0.3
20	110-120	3	burin	0.5	1.65	1.05	0.3
14	120-130	3	burin	1.1	1.95	1.6	0.45
12	250-260	3	burin	0.9	1.65	1.7	0.45
21	250-260	3	burin	0.2	1.1	0.65	0.25
22	300-310	3	burin	0.3	0.95	1.1	0.25
21	370-380	3	burin	2.7	2.7	2	0.55
21	420-430	3	burin	0.3	1.75	0.8	0.3
21	430-440	3	burin	1	1.7	1.4	0.55
11/12	450-460	3	burin	0.1	1.05	0.8	0.15
1/21	450-460	3	burin	1	2.3	1.3	0.4
11/12	460-470	3	burin	0.2	1.3	1	0.3
21	460-470	3	burin	2.3	2.4	1.7	0.5
21	460-470	3	burin	0.5	1.35	1.3	0.35
11/12	470-480	3	burin	0.1	1.35	0.9	0.15
21	480-490	3	burin	0.2	1.3	1.05	0.3
22	480-490	3	burin	1.6	2.1	1.8	0.5
12	510-520	3	burin	3.2	3.4	2.2	0.45
12	530-540	3	burin	0.2	1.05	1.05	0.15
12	540-550	3	burin	0.5	1.6	1.35	0.3
12	550-560	3	burin	0.8	1.7	1.4	0.45
11	10-20	4	burin	0.2	1.15	0.9	0.2
21	10-20	4	burin	0.8	1.65	1.25	0.5
12	20-30	4	burin	0.1	1	0.85	0.2
18	40-50	4	burin	0.1	0.85	0.65	0.15
12	80-90	4	burin	0.1	0.9	1.1	0.2
12	170-180	4	burin	0.1	1	0.9	0.2
21	180-190	4	burin	0.2	1.4	0.7	0.2
20	220-230	4	burin	1.9	2.65	2.3	0.45
22	250-260	4	burin	0.4	1.5	0.9	0.3
12	270-280	4	burin	0.4	1.4	1.2	0.2
11/12	460-470	4	burin	0.1	1.15	0.6	0.1
21	500-510	4	burin	1.1	1.6	1.55	0.4
21	500-510	4	burin	0.1	1.1	0.85	0.3
12	520-530	4	burin	0.2	1.45	0.9	0.2
22	550-560	4	burin	0.3	1.2	0.7	0.3
12	560-570	4	burin	0.3	1.5	1.1	0.25
22	330-340	5	burin	0.5	1.65	0.95	0.25
22	370-380	5	burin	0.4	1.95	0.55	0.4
12	590-600	5	burin	0.3	1.45	1	0.2
14	120-130	6	burin	1.3	2.4	1.6	0.45
20	430-440	6	burin	0.6	1.4	1.2	0.45
21	480-490	6	burin	0.3	1.6	1.05	0.2
12	80-90	7	burin	5	2.6	2.7	0.8
11	90-100	7	burin	0.3	1.55	0.8	0.3
10	180-190	7	burin	2.7	2.8	2.25	0.5
10	180-190	7	burin	2.1	2.85	1.8	0.6
10	180-190	7	burin	0.4	1.7	1	0.3

Table 38 cont. Burins Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
19	180-190	7	burin	1.4	2.2	1.6	0.4
12	190-200	7	burin	1.6	2.25	2.25	0.45
11	210-220	7	burin	1.5	2.2	1.5	0.6
20	240-250	7	burin	1	1.8	1.65	0.45
12	260-270	7	burin	0.2	0.9	0.75	0.3
12	270-280	7	burin	0.2	1.1	0.8	0.2
12	280-290	7	burin	0.3	1.05	1	0.25
22	290-300	7	burin Uni/Unilat	0.7	1.9	0.95	0.45
21	300-310	7	burin	3.2	3.1	2.8	0.65
22	380-390	7	burin Uni/Unilat	2.1	2.4	1.8	0.5
11/12	410-420	7	burin	0.3	1.65	1.4	0.2
22	410-420	7	burin	2.2	2.55	1.6	0.5
22	420-430	7	burin double	3.2	2.8	2.4	0.6
22	420-430	7	burin	0.9	2.15	1	0.4
22	420-430	7	burin	1.5	1.4	1.3	0.75
22	450-460	7	burin	2.5	2.4	1.55	0.8
11/12	460-470	7	burin	0.9	1.7	1.3	0.45
11/12	470-480	7	burin	1	1.4	1.9	0.4
11/12	470-480	7	burin	0.2	1.25	1.05	0.2
11/12	470-480	7	burin	0.1	1.4	0.7	0.2
21	470-480	7	burin	0.5	1.35	1.1	0.3
23	490-500	7	burin	3.7	2.5	2	0.9
21	500-510	7	burin	0.5	2.25	1	0.25
22	500-510	7	burin double	2.3	2	1.9	0.7
12	520-530	7	burin	0.2	1.4	1	0.2
21	520-530	7	burin	0.6	1.45	1.4	0.5
12	560-570	7	burin	0.1	1.6	0.7	0.2
22	600-610	7	burin	1.9	1.5	2.4	0.5
12	660-670	7	burin	0.2	1.2	0.95	0.3
11	0-10	8	burin	0.1	0.9	0.4	0.15
17	60-70	8	burin	0.4	1.4	0.85	0.3
21	70-80	8	burin	0.5	1.95	1.35	0.35
12	100-110	8	burin	1.5	1.9	1.7	0.45
12	110-120	8	burin	0.2	1.5	1	0.1
12	120-130	8	burin	1	1.95	1.45	0.35
17	120-130	8	burin	0.2	1.3	0.7	0.2
13	130-140	8	burin	0.4	1.4	0.9	0.25
10	160-170	8	burin	0.6	2.25	1.2	0.25
12	240-250	8	burin	0.2	1.3	1	0.25
12	250-260	8	burin	0.3	0.9	0.95	0.3
22	260-270	8	burin	5.1	2.45	2.4	0.75
22	270-280	8	burin	1.4	1.8	1.45	0.55
22	270-280	8	burin	1.5	1.55	1.3	0.7
22	270-280	8	burin	0.8	1.35	1.3	0.45
12	340-350	8	burin	1.5	1.95	1.9	0.4
22	340-350	8	burin	0.8	1.85	1.8	0.45
22	340-350	8	burin	0.8	1.8	1.2	0.4
22	350-360	8	burin	0.6	1.4	0.85	0.4
22	370-380	8	burin	0.5	1.7	1.05	0.25
22	370-380	8	burin	0.7	1.9	0.7	0.55
22	370-380	8	burin	0.4	1.15	1	0.35
22	370-380	8	burin double	0.5	1.5	0.8	0.35
22	380-390	8	burin	0.6	1.15	1.5	0.3

Table 38 cont. Burins Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
22	410-420	8	burin	2.4	2.9	1.5	0.6
22	410-420	8	burin double	9.1	3.3	4.15	0.9
11/12	420-430	8	burin	3	2.65	2.2	0.5
11/12	420-430	8	burin	1.3	2.25	1.45	0.65
20	420-430	8	burin	5	2.75	2.55	0.8
21	420-430	8	burin	0.6	1.9	1.6	0.2
22	420-430	8	burin	0.8	2.05	1.8	0.3
22	430-440	8	burin	1.1	2.1	1.6	0.5
22	440-450	8	burin	1.1	1.85	1.4	0.45
11/12	450-460	8	burin	0.1	0.8	0.75	0.15
21	450-460	8	burin	0.3	1.7	1.1	0.25
22	450-460	8	burin	0.2	1.1	0.8	0.3
11/12	470-480	8	burin	0.2	1.35	1.1	0.2
22	470-480	8	burin	0.6	2.2	1.05	0.4
12	480-490	8	burin	0.3	1.65	0.95	0.25
12	480-490	8	burin	0.2	1.25	0.9	0.2
12	480-490	8	burin	0.1	0.9	0.7	0.15
21	500-510	8	burin	0.1	0.95	0.85	0.25
12	520-530	8	burin	0.1	1.1	0.75	0.1
21	600-610	8	burin	0.9	1.9	1.6	0.4
20	10-20	9	burin	0.1	1	0.95	0.2
12	20-30	9	burin	0.2	1.1	1	0.4
11	30-40	9	burin	0.6	1.9	1.45	0.3
18	30-40	9	burin	0.1	1.15	0.85	0.15
14	60-70	9	burin	0.2	1.1	0.85	0.2
15	60-70	9	burin	0.2	1.3	0.9	0.25
17	60-70	9	burin	0.2	1.05	0.9	0.3
20	60-70	9	burin	0.3	1.2	1.1	0.35
20	60-70	9	burin	0.2	1.3	1	0.25
12	70-80	9	burin	0.2	1.3	0.6	0.25
12	80-90	9	burin	0.2	1.05	1.1	0.3
12	80-90	9	burin	0.1	1.1	1	0.2
10	90-100	9	burin	0.5	1.8	1.3	0.25
14	100-110	9	burin	0.5	1.8	1.3	0.25
14	110-120	9	burin	0.7	1.4	1.1	0.4
12	120-130	9	burin	0.3	1.4	1.2	0.25
11	180-190	9	burin	0.1	1.2	0.9	0.15
12	180-190	9	burin	0.1	1.2	0.8	0.2
12	200-210	9	burin	0.1	1	0.9	0.2
11	230-240	9	burin	1	1.9	1.2	0.45
11	230-240	9	burin	0.2	1.3	0.8	0.2
21	240-250	9	burin	0.5	1.75	0.9	0.35
21	240-250	9	burin	0.3	1.7	0.95	0.2
21	240-250	9	burin	0.2	1.35	0.85	0.25
22	250-260	9	burin	0.3	1	0.9	0.4
21	260-270	9	burin	1.8	2.5	1.45	0.4
21	260-270	9	burin	0.2	1.2	1.05	0.2
21	260-270	9	burin	0.2	1.3	0.9	0.2
21	270-280	9	burin	0.6	2	1	0.25
12	340-350	9	burin	0.2	1.6	0.8	0.1
21	350-360	9	burin	0.1	1.3	0.6	0.15
11	370-380	9	burin double	1.1	1.8	1.75	0.4
22	370-380	9	burin	1	2.1	1.55	0.35

Table 38 cont. Burins Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
21	400-410	9	burin	1	2.1	1.2	0.5
20	410-420	9	burin	0.5	1.9	1.5	0.35
11/12	420-430	9	burin double	0.3	1.4	0.9	0.25
22	420-430	9	burin	1.2	1.8	1.55	0.55
20	430-440	9	burin	0.3	1.65	0.9	0.25
21	430-440	9	burin	0.6	2.2	1.25	0.3
11/12	440-450	9	burin	0.8	1.85	1.6	0.35
11/12	440-450	9	burin	0.5	1.5	1.15	0.3
11/12	440-450	9	burin	0.1	1.05	0.8	0.2
21	450-460	9	burin	0.2	1.2	1	0.2
21	450-460	9	burin	0.2	1	0.75	0.3
22	450-460	9	burin	1.7	2.65	1.9	0.4
11/12	460-470	9	burin	0.9	2.25	1.15	0.35
11/12	460-470	9	burin	0.1	0.6	0.7	0.1
21	460-470	9	burin	0.5	1.8	1.1	0.35
11/12	470-480	9	burin	0.8	1.8	1.75	0.4
21	480-490	9	burin	0.1	1.2	0.9	0.3
21	490-500	9	burin	0.2	1.1	0.85	0.3
12	520-530	9	burin	0.4	1.5	1.4	0.2
12	520-530	9	burin	0.1	1.05	1.05	0.2
12	540-550	9	burin	0.3	1.6	1.35	0.2

Totals:	444		Totals:	358.2 gm			
	444 Whole		Means:	0.216	1.601	1.175	0.359
200-300cm	205		Totals:	84.8 gm			
Early LSA	205 Whole		Means:	0.414	0.867	0.627	0.212
300-420cm	78		Totals:	63.7 gm			
Large Blade	78 Whole		Means:	0.817	1.711	1.227	0.354
420-450cm	35		Totals:	41 gm			
Upper MSA	35 Whole		Means:	1.171	1.83	1.396	0.421

Key:

Burin = One Burin Facet
Uni. = Unifacial
Dist. = Distal
Unilat. = Unilateral
Double = Two Burin Facets

Raw Material
1 = Quartz
2 = Brown Chert
3 = Chalcedony
4 = Jasper
5 = Transparent w/ black flecks
6 = Black Chert
7 = Silcrete
8 = Multi-Color Chert
9 = Other Fine Grained Raw Mat'l

Table 39 Awls Raw Material & Metric Data

Square	Depth	R.M.	Retouch	Location	Wt.gms	L	W	T
12	0-10	1	awl		0.2	1.2	0.5	0.3
12	0-10	1	awl		0.1	1.7	0.7	0.25
12	0-10	1	awl		0.1	0.9	0.6	0.25
10	10-20	1	awl		0.2	1.55	0.6	0.3
12	10-20	1	awl		0.2	1.25	0.75	0.3
15	10-20	1	awl	B.P.	0.2	1.5	0.55	0.35
20	10-20	1	awl		0.3	1.3	0.55	0.45
13	20-30	1	awl		0.2	1.4	0.75	0.35
16	30-40	1	awl	Uni/Unilat	1.5	2.6	1.2	0.5
15	40-50	1	awl		0.5	2	0.7	0.4
17	50-60	1	awl	B.P.	0.2	1.6	0.6	0.3
20	50-60	1	awl		0.3	1.65	0.75	0.3
12	60-70	1	awl	B.P.	0.3	1.75	0.6	0.4
12	60-70	1	awl		0.3	1.45	0.6	0.3
16	60-70	1	awl	B.P.	0.1	1.35	0.4	0.2
20	60-70	1	awl		0.3	1.3	0.6	0.35
12	70-80	1	awl	B.P.	0.6	2.15	0.65	0.4
12	70-80	1	awl		0.5	2	0.8	0.45
12	70-80	1	awl		0.2	1.4	0.8	0.25
12	70-80	1	awl		0.2	1.5	0.7	0.2
13	70-80	1	awl		0.3	1.6	0.6	0.35
14	70-80	1	awl		0.1	0.85	0.45	0.25
20	70-80	1	awl		0.2	0.95	0.8	0.3
20	70-80	1	awl		0.1	0.9	0.4	0.2
10	80-90	1	awl		0.2	1.2	0.65	0.4
10	80-90	1	awl		0.1	0.85	0.35	0.35
11	80-90	1	awl		0.2	1.15	0.55	0.3
11	80-90	1	awl		0.2	1.2	0.6	0.3
12	80-90	1	awl		0.1	1.15	0.5	0.35
12	80-90	1	awl		0.1	1.35	0.4	0.2
12	80-90	1	awl		0.1	1	0.3	0.2
12	80-90	1	awl		0.1	0.9	0.45	0.3
10	90-100	1	awl		0.8	2.15	0.9	0.4
10	90-100	1	awl		0.5	1.8	0.65	0.45
11	90-100	1	awl		0.3	1.35	1.15	0.25
12	90-100	1	awl		0.7	1.9	0.7	0.6
12	90-100	1	awl		0.2	1.3	0.7	0.4
15	90-100	1	awl		0.1	1.1	0.55	0.2
17	90-100	1	awl		0.3	1.2	0.9	0.25
18	90-100	1	awl	B.P.	0.5	1.5	0.8	0.5
20	90-100	1	awl		0.4	1.85	0.85	0.4
20	90-100	1	awl		0.2	1.3	0.45	0.35
12	100-110	1	awl		0.1	0.9	0.75	0.2
12	100-110	1	awl		0.3	1.05	0.95	0.3
12	100-110	1	awl		0.1	1	0.7	0.2
12	100-110	1	awl		0.1	1	0.6	0.2
12	100-110	1	awl		0.1	1.1	0.4	0.2
18	100-110	1	awl	B.P.	0.2	1.6	0.4	0.35
18	100-110	1	awl		0.2	1.75	0.5	0.2
18	100-110	1	awl		0.1	1.75	0.4	0.35
18	100-110	1	awl	B.P.	0.2	1.15	0.4	0.4

Table 39 cont. Awls Raw Material & Metric Data

Square	Depth	R.M.	Retouch	Location	Wt.gms	L	W	T
10	110-120	1	awl	B.P.	1.3	2.3	1.1	0.6
11	110-120	1	awl	B.P.	0.4	1.5	0.75	0.45
12	110-120	1	awl	B.P.	0.7	1.8	0.75	0.6
12	110-120	1	awl		0.5	1.7	0.95	0.4
12	110-120	1	awl		0.3	1.35	0.55	0.4
14	110-120	1	awl		0.2	1.35	0.65	0.3
17	110-120	1	awl		0.2	1.25	0.85	0.3
17	110-120	1	awl	B.P.	0.1	1.2	0.35	0.2
20	110-120	1	awl		0.2	1.3	0.5	0.35
12	120-130	1	awl		0.2	1.45	0.8	0.15
12	120-130	1	awl		0.1	1.25	0.7	0.2
17	120-130	1	awl	B.P.	0.2	1.4	0.45	0.4
18	120-130	1	awl		0.4	1.5	0.85	0.4
18	120-130	1	awl		0.3	1.25	0.65	0.5
10	130-140	1	awl	B.P.	0.2	1.4	0.5	0.3
12	130-140	1	awl	B.P.	0.3	1.5	0.5	0.4
10	140-150	1	awl		0.1	1.15	0.45	0.25
10	140-150	1	awl		0.1	1.1	0.4	0.25
12	140-150	1	awl		0.2	1.25	0.8	0.25
12	140-150	1	awl		0.1	0.95	0.55	0.25
20	150-160	1	awl		0.1	1.5	0.6	0.2
12	160-170	1	awl		0.2	1.6	0.4	0.25
11	170-180	1	awl	B.P.	1.7	2.9	1.15	0.55
11	170-180	1	awl	B.P.	0.3	1.4	0.5	0.45
11	170-180	1	awl		0.1	1	0.6	0.15
12	170-180	1	awl		1.5	2.1	1.3	0.55
12	170-180	1	awl		0.1	1.25	0.55	0.25
10	180-190	1	awl		0.3	1.6	0.5	0.4
10	180-190	1	awl		0.1	1.35	0.5	0.2
12	180-190	1	awl		0.1	0.9	0.6	0.25
20	180-190	1	awl		0.4	1.75	0.8	0.35
20	180-190	1	awl		0.2	1.3	0.45	0.35
21	180-190	1	awl	Uni/Dist	3.4	2.8	1.45	0.9
10	190-200	1	awl		0.4	1.25	0.85	0.55
11	190-200	1	awl		0.1	1.1	0.35	0.35
12	190-200	1	awl		0.2	1.2	0.9	0.25
12	190-200	1	awl	B.P.	0.1	0.8	0.45	0.3
20	190-200	1	awl		0.3	1.3	0.55	0.3
20	190-200	1	awl		0.2	1.4	0.55	0.3
21	190-200	1	awl		0.2	1.3	0.5	0.3
21	190-200	1	awl		0.8	2.3	0.65	0.6
21	190-200	1	awl	Uni/Unilat/Di	0.5	1.6	1.1	0.4
21	200-210	1	awl		0.3	1.3	0.55	0.4
10	220-230	1	awl		0.2	1	0.5	0.3
11	220-230	1	awl		0.2	1.35	0.7	0.25
11	220-230	1	awl	double	0.2	1.1	0.6	0.35
21	220-230	1	awl		0.4	1.9	0.75	0.4
21	220-230	1	awl		0.4	1.6	0.6	0.45
21	220-230	1	awl		0.5	1.55	0.8	0.55
21	220-230	1	awl		0.2	1.5	0.5	0.45
10	230-240	1	awl		0.3	1.45	0.6	0.55
11	230-240	1	awl		0.1	1.55	0.4	0.2

Table 39 cont. Awls Raw Material & Metric Data

Square	Depth	R.M.	Retouch	Location	Wt.gms	L	W	T
11	230-240	1	awl	B.P.	0.2	1.6	0.35	0.3
21	230-240	1	awl		0.6	1.6	0.9	0.35
21	230-240	1	awl		0.3	1.4	0.75	0.5
21	230-240	1	awl		0.2	1.8	0.5	0.45
10	240-250	1	awl		0.2	1.1	0.45	0.25
11	240-250	1	awl	B.P.	2.4	3.4	0.85	0.85
12	240-250	1	awl	B.P.	0.1	1.35	0.45	0.15
20	240-250	1	awl		0.4	1.75	0.9	0.3
20	240-250	1	awl		0.3	1.5	0.55	0.4
20	240-250	1	awl		0.2	1.5	0.55	0.4
20	240-250	1	awl		0.1	0.95	0.3	0.35
21	240-250	1	awl		0.2	1.4	0.5	0.35
21	240-250	1	awl		0.3	1.75	0.65	0.3
21	240-250	1	awl		0.3	1.6	0.6	0.4
21	240-250	1	awl		0.2	1.5	0.7	0.3
21	240-250	1	awl		0.4	1.6	0.6	0.45
21	240-250	1	awl		0.3	1.25	0.75	0.4
21	240-250	1	awl		0.3	1.3	0.5	0.4
21	240-250	1	awl		0.6	1.8	0.75	0.45
21	240-250	1	awl		0.3	1.7	0.6	0.3
21	240-250	1	awl		0.2	1.3	0.6	0.3
10	250-260	1	awl		0.3	1.4	0.55	0.55
10	250-260	1	awl		0.3	1.1	0.55	0.35
11	250-260	1	awl	B.P.	0.5	2.05	0.7	0.4
11	250-260	1	awl		0.3	1.4	0.6	0.45
11	250-260	1	awl		0.2	1.1	0.6	0.3
12	250-260	1	awl		0.7	2.05	0.75	0.6
12	250-260	1	awl		0.2	1.75	0.8	0.25
12	250-260	1	awl		0.4	1.7	0.85	0.3
12	250-260	1	awl		0.3	1.5	0.55	0.4
12	250-260	1	awl		0.2	1.55	0.7	0.3
12	250-260	1	awl		0.2	1.2	0.7	0.3
12	250-260	1	awl		0.2	1.25	0.7	0.3
12	250-260	1	awl		0.2	1.15	0.95	0.25
12	250-260	1	awl		0.1	0.8	0.75	0.25
19	250-260	1	awl	Bilat/Dist	0.3	1.7	0.55	0.2
20	250-260	1	awl	Uni/Unilat/Di	0.8	1.85	1.3	0.45
21	250-260	1	awl		0.3	1.7	0.6	0.25
21	250-260	1	awl		1.3	2.4	0.9	0.65
21	250-260	1	awl		2.1	2.5	1.5	0.75
21	250-260	1	awl		0.4	1.6	0.65	0.5
21	250-260	1	awl		0.2	1.3	0.75	0.25
21	250-260	1	awl		0.2	1.7	0.45	0.4
21	250-260	1	awl		0.2	1.35	0.55	0.4
21	250-260	1	awl		0.2	1.6	0.65	0.3
11	260-270	1	awl		0.1	1.35	0.6	0.2
11	260-270	1	awl		0.2	1.35	0.65	0.25
12	260-270	1	awl		0.3	1.7	0.7	0.3
19	260-270	1	awl	Dist	0.4	1.5	0.45	0.3
20	260-270	1	awl		0.3	1.6	0.55	0.35
21	260-270	1	awl		0.5	1.7	0.7	0.5
21	260-270	1	awl		0.3	1.3	0.55	0.45

Table 39 cont. Awls Raw Material & Metric Data

Square	Depth	R.M.	Retouch	Location	Wt.gms	L	W	T
21	260-270	1	awl		0.3	1.2	0.65	0.35
21	260-270	1	awl		0.4	1.4	0.75	0.3
21	260-270	1	awl		0.3	1.35	0.75	0.35
21	260-270	1	awl	Uni/Unilat	0.2	1.15	0.65	0.35
11	270-280	1	awl		0.1	0.95	0.5	0.25
12	270-280	1	awl		0.3	1.3	0.45	0.25
20	270-280	1	awl		0.4	1.3	0.7	0.4
21	270-280	1	awl		3.8	2.7	2.1	0.8
21	270-280	1	awl		0.6	1.4	1.1	0.4
21	270-280	1	awl		0.6	2.05	0.75	0.45
21	270-280	1	awl		0.3	1.3	0.6	0.3
11	280-290	1	awl		0.4	1.2	0.8	0.4
11	280-290	1	awl		0.1	0.95	0.45	0.3
21	280-290	1	awl		0.5	1.75	0.9	0.4
21	280-290	1	awl		0.5	1.6	0.9	0.4
21	280-290	1	awl		0.5	1.4	0.85	0.5
21	280-290	1	awl		0.3	1.1	0.75	0.3
21	280-290	1	awl		0.3	1.3	0.7	0.3
22	280-290	1	awl		1.3	1.65	0.95	0.8
22	280-290	1	awl		0.9	1.7	1.25	0.5
11	290-300	1	awl		0.1	0.8	0.6	0.25
11	290-300	1	awl		0.1	0.9	0.4	0.3
12	290-300	1	awl		0.1	1.1	0.55	0.3
12	290-300	1	awl		0.2	1.1	0.4	0.2
12	290-300	1	awl		0.1	1.1	0.3	0.15
12	290-300	1	awl		0.1	0.8	0.45	0.4
21	290-300	1	awl		2.5	2.3	1.7	0.75
21	290-300	1	awl		0.6	1.6	0.75	0.45
21	290-300	1	awl		0.3	1.85	0.65	0.25
21	290-300	1	awl		0.2	1.4	0.55	0.3
21	290-300	1	awl		0.4	1.15	0.85	0.45
21	290-300	1	awl		0.4	1.5	0.9	0.4
21	290-300	1	awl		0.2	1.25	0.65	0.35
22	290-300	1	awl	Uni/Unilat	0.4	1.75	0.6	0.55
22	290-300	1	awl	Uni/Unilat/Di	0.3	0.8	0.65	0.35
22	290-300	1	awl		0.3	1.05	0.65	0.3
22	300-310	1	awl		0.5	1.45	1.2	0.25
12	320-330	1	awl		0.2	1.1	0.6	0.3
21	320-330	1	awl		0.4	1.4	0.9	0.35
21	320-330	1	awl		0.2	1.1	0.5	0.45
12	330-340	1	awl	B.P.	0.4	1.2	0.8	0.5
12	330-340	1	awl	B.P.	0.3	1.35	0.6	0.4
12	330-340	1	awl	B.P.	0.2	1.35	0.55	0.4
22	330-340	1	awl		0.8	1.8	0.7	0.55
12	340-350	1	awl	B.P.	0.3	1.6	0.5	0.4
12	340-350	1	awl	B.P.	0.3	1.6	0.55	0.25
12	340-350	1	awl		0.2	1	0.85	0.3
12	340-350	1	awl		0.2	0.85	0.5	0.4
21	340-350	1	awl		0.6	1.6	0.95	0.5
21	340-350	1	awl		0.1	1.1	0.55	0.25
22	340-350	1	awl		0.4	1.2	1	0.4
22	340-350	1	awl		0.3	1.15	0.6	0.4

Table 39 cont. Awls Raw Material & Metric Data

Square	Depth	R.M.	Retouch	Location	Wt.gms	L	W	T
22	340-350	1	awl		0.4	1.2	0.7	0.35
22	340-350	1	awl		0.4	1.35	0.55	0.35
11	350-360	1	awl	B.P.	0.2	1.85	0.4	0.3
11	350-360	1	awl		0.1	1.3	0.6	0.25
11	350-360	1	awl	B.P.	0.1	1.25	0.4	0.2
21	350-360	1	awl		0.1	1.1	0.5	0.3
21	350-360	1	awl		0.3	0.9	0.75	0.45
21	350-360	1	awl		0.3	1.2	0.6	0.35
21	350-360	1	awl		0.1	1	0.45	0.25
22	350-360	1	awl		0.5	1.6	0.6	0.4
22	350-360	1	awl		0.6	1.4	0.8	0.55
11	360-370	1	awl	B.P.	0.2	1.4	0.5	0.25
12	360-370	1	awl	B.P.	0.2	2	0.6	0.3
12	370-380	1	awl	B.P.	0.2	1.25	0.75	0.2
12	370-380	1	awl		0.1	0.7	0.65	0.25
12	390-400	1	awl		0.8	2	1.05	0.35
21	390-400	1	awl		0.6	1.95	0.95	0.5
22	390-400	1	awl	B.P.	0.5	2.25	0.4	0.3
11/12	400-410	1	awl		0.2	1.6	0.6	0.3
11/12	400-410	1	awl	B.P.	0.2	1.4	0.4	0.3
11/12	400-410	1	awl		0.2	1.15	0.55	0.25
21	400-410	1	awl		1.6	2.5	1.1	0.8
21	400-410	1	awl		0.7	1.6	0.9	0.5
11/12	410-420	1	awl		0.1	0.95	0.55	0.25
11/12	410-420	1	awl		0.1	1.1	0.45	0.1
21	410-420	1	awl		0.3	1.4	0.4	0.4
21	410-420	1	awl		0.2	1.4	0.5	0.4
21	410-420	1	awl		0.5	1.75	0.7	0.4
21	410-420	1	awl		0.1	1	0.45	0.3
21	410-420	1	awl		0.1	1.1	0.45	0.4
21	410-420	1	awl		0.2	1	0.6	0.4
21	410-420	1	awl		0.1	1.1	0.4	0.25
21	410-420	1	awl		0.1	1.25	0.4	0.2
11/12	420-430	1	awl		0.1	1.2	0.6	0.2
21	420-430	1	awl		0.3	1.7	0.6	0.4
21	420-430	1	awl		1.1	2.2	1	0.4
21	420-430	1	awl		1.3	1.9	1	0.7
21	420-430	1	awl		0.6	1.9	0.95	0.35
21	420-430	1	awl		0.3	1.05	0.75	0.45
21	430-440	1	awl		0.4	1.6	0.5	0.4
21	430-440	1	awl		0.2	0.9	0.9	0.4
11/12	440-450	1	awl	Uni/Unilat	1.3	2	1.5	0.5
11/12	440-450	1	awl		1.2	1.9	1.25	0.5
11/12	440-450	1	awl		0.3	1.35	1.05	0.3
11/12	440-450	1	awl		0.2	1.25	0.6	0.2
11/12	440-450	1	awl		0.1	1.05	0.55	0.25
11/12	440-450	1	awl		0.1	1.1	0.7	0.2
11/12	440-450	1	awl		0.1	0.9	0.6	0.2
11/12	440-450	1	awl		0.1	0.6	0.6	0.2
21	440-450	1	awl		0.2	1.4	0.5	0.35
21	440-450	1	awl		1.5	2.35	1.1	0.5
21	440-450	1	awl		0.3	1.5	0.5	0.4

Table 39 cont. Awls Raw Material & Metric Data

Square	Depth	R.M.	Retouch	Location	Wt.gms	L	W	T
21	440-450	1	awl		0.2	1.4	0.7	0.3
21	440-450	1	awl		0.1	1.2	0.4	0.35
22	440-450	1	awl		0.3	1.1	0.45	0.2
21	450-460	1	awl		0.2	1.25	0.7	0.3
21	450-460	1	awl		0.7	2	0.65	0.6
21	450-460	1	awl		0.1	0.95	0.4	0.35
21	450-460	1	awl		0.2	0.75	0.6	0.4
11/12	460-470	1	awl		0.2	1.05	0.6	0.3
21	460-470	1	awl		0.2	1.15	0.45	0.4
21	460-470	1	awl		0.1	1.05	0.45	0.4
11/12	470-480	1	awl		0.2	1.6	0.75	0.2
11/12	470-480	1	awl		0.1	1.25	0.5	0.1
12	480-490	1	awl	B.P.	0.3	1.7	0.55	0.35
12	480-490	1	awl	B.P.	0.2	1.2	0.65	0.3
21	480-490	1	awl		3.2	3	2	0.7
21	480-490	1	awl		0.3	1.4	1.05	0.3
21	480-490	1	awl		0.6	1.75	1	0.4
21	480-490	1	awl		0.4	1.5	0.75	0.4
21	480-490	1	awl		0.5	1.6	0.75	0.6
21	480-490	1	awl		0.3	1.1	0.65	0.4
21	480-490	1	awl		0.1	0.75	0.4	0.25
22	480-490	1	awl	B.P.	0.4	1.7	0.6	0.4
22	480-490	1	awl		0.3	1.45	0.6	0.4
22	480-490	1	awl		0.2	1.3	0.55	0.4
21	500-510	1	awl		0.1	1	0.4	0.15
22	500-510	1	awl		0.8	1.9	0.9	0.45
12	510-520	1	awl	B.P.	0.5	1.9	0.65	0.65
21	530-540	1	awl		0.1	0.9	0.4	0.25
21	540-550	1	awl		0.3	1.6	0.6	0.35
21	550-560	1	awl		0.1	1.1	0.6	0.2
12	560-570	1	awl		2.1	3.25	1.65	0.45
12	560-570	1	awl		0.1	1	0.55	0.2
22	560-570	1	awl		0.2	1.6	0.7	0.4
12	580-590	1	awl		0.2	1.25	0.7	0.3
12	590-600	1	awl		0.2	1.95	0.7	0.3
21	590-600	1	awl		0.4	1.3	0.6	0.4
12	650-660	1	awl		0.3	1.25	0.6	0.45
12	660-670	1	awl		0.2	1.05	0.7	0.4
12	660-670	1	awl		0.1	0.9	0.4	0.3
10	30-40	2	awl	Uni/Unilat	0.4	1.6	1.15	0.25
13	60-70	2	awl		0.3	1.45	1	0.3
14	70-80	2	awl		0.2	1.05	0.7	0.3
11	100-110	2	awl		0.1	1.2	0.5	0.4
12	100-110	2	awl		0.1	1.35	0.35	0.35
12	100-110	2	awl		0.1	0.75	0.55	0.15
15	110-120	2	awl		0.2	1.5	0.6	0.3
17	110-120	2	awl		0.2	1.45	0.7	0.25
14	120-130	2	awl		0.2	1.9	0.6	0.3
21	390-400	2	awl		0.1	1	0.45	0.2
21	400-410	2	awl		0.3	1.65	0.7	0.35
21	530-540	2	awl		1.3	2.4	1.25	0.7
12	70-80	3	awl		0.1	1.1	0.6	0.2

Table 39 cont. Awls Raw Material & Metric Data

Square	Depth	R.M.	Retouch	Location	Wt.gms	L	W	T
14	100-110	3	awl		0.2	1.6	0.65	0.2
13	120-130	3	awl		0.1	0.95	0.4	0.25
21	180-190	3	awl	Uni/Dist	0.3	1.7	0.65	0.45
12	240-250	3	awl		0.4	1.3	1.3	0.35
21	490-500	3	awl		0.3	1.7	0.7	0.4
18	20-30	4	awl		0.3	1.45	0.7	0.35
12	30-40	4	awl		0.1	1.2	0.6	0.25
12	30-40	4	awl		0.1	1	0.7	0.3
13	60-70	4	awl		0.1	0.7	0.55	0.15
12	120-130	4	awl		0.1	0.9	0.55	0.25
18	120-130	4	awl		0.2	1.75	0.5	0.25
21	130-140	4	awl		1.1	2	1.1	0.5
22	280-290	4	awl		0.2	1.6	0.9	0.2
11/12	440-450	4	awl		0.2	1.3	0.8	0.2
11/12	450-460	4	awl		0.1	0.7	0.55	0.15
11/12	460-470	4	awl		0.3	1.35	0.55	0.5
12	530-540	4	awl		1.7	2.1	1.6	0.7
13	20-30	7	awl		0.3	1.75	0.65	0.3
15	70-80	7	awl		0.9	2.15	0.8	0.5
17	70-80	7	awl		0.2	1.95	0.5	0.25
12	100-110	7	awl		0.3	1.3	0.75	0.4
12	100-110	7	awl		0.3	1.2	0.6	0.5
11	120-130	7	awl		0.2	1.15	0.75	0.35
15	120-130	7	awl		0.4	1.9	0.8	0.4
17	120-130	7	awl		0.3	1.8	0.55	0.5
10	170-180	7	awl		0.3	1.65	0.7	0.4
12	170-180	7	awl		0.2	1.1	0.6	0.35
11	190-200	7	awl		0.6	2.1	1.2	0.5
10	220-230	7	awl		0.2	1.15	0.55	0.4
19	230-240	7	awl	dist.	0.6	2.4	0.5	0.45
20	240-250	7	awl		0.7	2.65	1.2	0.4
21	260-270	7	awl		3.9	3.2	1.7	1
11	350-360	7	awl		0.1	1	0.3	0.3
22	370-380	7	awl		0.3	1.9	0.5	0.2
11/12	400-410	7	awl		0.1	0.85	0.4	0.2
21	400-410	7	awl		0.6	1.7	0.8	0.5
21	400-410	7	awl		0.3	1.4	0.8	0.35
22	410-420	7	awl		1.8	3	1.35	0.6
11/12	420-430	7	awl		0.1	1.1	0.45	0.15
21	430-440	7	awl		0.7	1.85	0.9	0.6
21	440-450	7	awl		0.4	1.8	1	0.4
21	440-450	7	awl		0.1	1.2	0.4	0.3
12	480-490	7	awl		0.1	1	0.6	0.2
22	520-530	7	awl		0.3	1.2	0.75	0.4
21	540-550	7	awl		0.2	1.55	0.6	0.3
12	590-600	7	awl		0.4	1.5	1	0.4
12	670-680	7	awl		0.3	1.65	0.95	0.3
10	40-50	8	awl		0.2	1.25	0.55	0.35
11	40-50	8	awl		0.2	1.3	0.6	0.3
13	40-50	8	awl		0.3	1.45	0.8	0.25
13	80-90	8	awl		0.7	1.8	1	0.6
21	80-90	8	awl		3.4	2.95	1.9	0.9

Table 39 cont. Awls Raw Material & Metric Data

Square	Depth	R.M.	Retouch	Location	Wt.gms	L	W	T
13	120-130	8	awl		0.1	1.4	0.4	0.25
15	120-130	8	awl		0.7	2.05	0.75	0.6
22	330-340	8	awl		0.2	1.25	0.85	0.45
22	340-350	8	awl		1.6	2.1	1.55	0.6
22	370-380	8	awl		1.3	2.75	0.95	0.5
11/12	400-410	8	awl		0.2	1.2	0.6	0.3
20	410-420	8	awl		0.7	2.2	0.7	0.65
21	410-420	8	awl		0.8	2.1	1.05	0.55
11/12	420-430	8	awl		0.5	1.8	1.4	0.4
11/12	440-450	8	awl	Uni/Unilat	0.2	1.2	0.85	0.5
22	490-500	8	awl		2.4	2.75	1.4	0.8
21	610-620	8	awl		1.2	2.5	0.9	0.55
12	30-40	9	awl		0.3	1.2	1.05	0.3
13	30-40	9	awl		0.1	1.05	0.55	0.3
13	50-60	9	awl		0.2	1	0.65	0.35
11	60-70	9	awl		0.1	1.05	0.4	0.2
13	60-70	9	awl		0.2	1.35	0.8	0.25
14	60-70	9	awl		0.1	1.15	0.45	0.25
20	60-70	9	awl		0.1	1.05	0.55	0.25
21	60-70	9	awl		0.4	1.7	0.6	0.45
17	70-80	9	awl		0.1	1.25	0.7	0.1
18	70-80	9	awl		0.1	0.95	0.45	0.2
11	80-90	9	awl		0.1	1	0.8	0.35
17	80-90	9	awl		0.1	1.2	0.4	0.2
10	100-110	9	awl		0.3	1.3	0.6	0.3
12	100-110	9	awl		0.1	0.5	0.3	0.2
18	100-110	9	awl		0.2	1.45	0.9	0.35
12	110-120	9	awl		0.2	1.15	0.75	0.3
12	110-120	9	awl		0.1	1.15	0.55	0.15
15	110-120	9	awl		0.3	1.45	0.65	0.4
10	150-160	9	awl		0.1	1.25	0.55	0.25
10	170-180	9	awl		0.2	1.3	0.6	0.3
21	180-190	9	awl	Uni/Dist	0.6	1.5	0.95	0.55
10	210-220	9	awl		0.1	0.9	0.6	0.2
21	210-220	9	awl		0.4	2.1	0.65	0.45
11	230-240	9	awl		0.2	1.85	0.5	0.3
11	240-250	9	awl		0.1	1.5	0.6	0.2
21	240-250	9	awl		0.3	1.5	0.45	0.4
12	250-260	9	awl		0.6	2	0.8	0.35
21	250-260	9	awl		0.2	1.45	0.6	0.3
21	250-260	9	awl		0.1	0.9	0.55	0.3
11	260-270	9	awl		0.1	1.4	0.7	0.15
21	260-270	9	awl		0.3	1.6	0.75	0.3
12	290-300	9	awl		0.1	1	0.4	0.15
21	330-340	9	awl		0.3	1.7	0.75	0.3
11	360-370	9	awl		0.1	0.65	0.3	0.2
21	400-410	9	awl		0.3	1.5	0.8	0.25
21	410-420	9	awl		0.3	2	0.8	0.35
21	410-420	9	awl		0.1	1.5	0.4	0.2
21	420-430	9	awl		0.2	1.25	0.5	0.4
11/12	430-440	9	awl		0.7	2.5	1.15	0.35
11/12	440-450	9	awl		0.3	1.45	0.95	0.25

Table 39 cont. Awls Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
11/12	440-450	9	awl	0.1	1.15	0.55	0.15
11/12	450-460	9	awl	0.4	1.5	0.5	0.6
11/12	450-460	9	awl	0.4	1.8	0.8	0.3
11/12	450-460	9	awl	0.1	1.3	0.6	0.2
11/12	460-470	9	awl	0.5	1.55	0.7	0.35
11/12	460-470	9	awl	0.2	1.1	0.7	0.3
11/12	470-480	9	awl	0.1	1.3	1.1	0.15
21	510-520	9	awl	0.1	1.3	0.65	0.5
12	520-530	9	awl	0.3	1.9	0.7	0.3
12	520-530	9	awl	0.1	1.3	0.55	0.1

Totals:	425		Totals:	163.6 gm			
	425 Whole		Means:	0.385	1.458	0.692	0.356
200-300cm	115		Totals:	47 gm			
Early LSA	115 Whole		Means:	0.409	1.376	0.694	0.366
300-420cm	68		Totals:	25.1 gm			
Large Blade	68 Whole		Means:	0.369	1.449	0.715	0.345
420-450cm	33		Totals:	21.3 gm			
Upper MSA	33 Whole		Means:	0.645	1.729	0.823	0.424

Key:
B.P. = Bipolar
Uni. = Unifacial
Unilat. = Unilateral
Dist. = Distal
Double = Two Awl Points
Bilat. = Bilateral

Raw Material
1 = Quartz
2 = Brown Chert
3 = Chalcedony
4 = Jasper
5 = Transparent w/ black flecks
6 = Black Chert
7 = Silcrete
8 = Multi-Color Chert
9 = Other Fine Grained Raw Mat'l

Table 40 Drills Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
13	50-60	1	Uni/Bilat	0.4	1.5	0.55	0.35
11	100-110	1	Bi/Bilat	0.2		0.55	0.4
19	150-160	1	Uni/Bilat/Dist	0.3	1.2	0.6	0.3
19	200-210	1	Uni/Prox	0.6	1.9	0.8	0.4
21	230-240	1	Uni/Bilat	0.2	1.6	0.65	0.25
19	10-20	3	Uni/Bilat	0.2	1.3	0.5	0.2
22	10-20	4	Uni/Bilat	0.4	1.4	0.5	0.3
22	40-50	4	Uni/Bilat	0.3	1.1	0.55	0.3
22	120-130	4	Bi/Bilat/Dist	1	1.85	1.1	0.7
19	30-40	7	Uni/Bilat	0.6	1.35	0.6	0.25
21	80-90	9	Uni/Bilat	0.2		0.55	0.25
22	110-120	9	Bi/Bilat	1.2	2.25	1	0.55

Totals:	12		Totals:	5.6 gm			
	10 Whole		Means:	0.467	1.545	0.663	0.354
200-300cm	2		Totals:	1.4 gm			
Early LSA	2 Whole		Means:	0.7	1.125	0.775	0.4
300-420cm Large Blade		None					
420-450cm Upper MSA		None					

Key:
Uni. = Unifacial
Bilat. = Bilateral
Bi. = Bifacial
Dist. = Distal
Prox. = Proximal

Raw Material
1 = Quartz
3 = Chacledony
4 = Jasper
7 = Silcrete
9 = Other Fine Grained Raw Mat'l

Table 41 Combination Tools Raw Material & Metric Data

Square	Depth	R.M.	Retouch Location	Wt.gms	L	W	T
21	30-40	1	Uni/Unilat/Dist	0.6	1.2	1.1	0.4
12	130-140	1	Uni/Bilat SS/Notch	2.3	2	1.8	0.7
19	180-190	1	Uni/Unilat/Dist	16.9	4.5	3.4	1.3
20	190-200	1	Uni/Unilat SS/Notch	8.6	3.3	2.8	0.95
19	220-230	1	Uni/Unila/Dist/SSBU	4.4	2.65	2.25	0.8
19	250-260	1	Uni/Unilat/Dist E/SS	1.1	2.05	1.15	0.4
21	250-260	1	Uni/Unilat SS/AWL	1.4	2.05	1.25	0.5
22	420-430	1	Uni/Bilat SS/NOTCH	20.8	5	3.35	1.05
22	440-450	1	Blade BUR/AWL	6.2	3.55	2.2	0.75
19	40-50	2	Bifacial/Unilat	2.5	2.5	1.5	0.65
22	40-50	2	Prox/Dist	0.5	1.55	0.9	0.3
12	480-490	3	Uni/Unilat/DistE/SS	2.6	2.2	2.1	0.6
12	70-80	4	Uni/Bilat SS/Notch	0.8	1.45	1.25	0.35
22	170-180	4	Uni/Unilat/Dist	11.3	3.75	2.5	1.2
12	520-530	4	Uni/Unilat/DistE/SS	1.3	1.75	1.6	0.45
23	520-530	4	Uni/Unilat/DistE/SS	4.5	2	2.2	0.6
22	240-250	5	Uni/Unilat/Prox	1.4	1.6	1.55	0.5
10	100-110	7	Uni/Unilat/Dist	2.2	2.55	2.1	0.4
12	170-180	7	Uni/Unilat/BUR	0.8	2.4	0.8	0.4
22	270-280	7	Uni/Unilat SS/BUR	1	1.6	1.25	0.5
11/12	430-440	7	Uni/Bilat SS/DENT	3.2	3.3	2.3	0.5
22	440-450	7	Uni/Unilat/DistS/ES	3	1.9	2.6	0.65
11/12	460-470	7	Uni/Unilat/DistSS/N	40	5.15	5.3	1.4
22	470-480	7	Uni/Unilat/DistE/SS	16.5	4.4	3.2	0.75
21	510-520	7	Uni/Bilat/Dist E/SS	17.6	4.35	3.4	1.3
23	520-530	7	Uni/Unilat/ProxES/N	8.2	3	3.3	1
22	50-60	8	Uni/Unilat/Dist	0.6	1.4	1.15	0.35
22	80-90	8	Uni/Bilat/Prox	1.1	1.65	1.1	0.6
22	110-120	8	Uni/Unilat/Prox	2.1	2.15	1.5	0.65
11	220-230	8	Uni/Unilat/Bu/Notch	1.9	2.6	1.8	0.5
21	230-240	8	Uni/Unilat/Prox	13.9	3.65	3.8	1
21	240-250	8	Uni/Unilat/Dist E/SS	2.1	1.85	1.9	0.55
22	250-260	8	Uni/Unilat/BUR	16.1	4.3	3.15	1.55
22	420-430	8	Uni/Bilat SS/NOTCH	2.8	2.4	2.4	0.7
21	430-440	8	Uni/Unilat DENT/BUR	3.5	3.1	2.4	0.5
12	510-520	8	Uni/Unilat/DistE/SS	3.3	2.65	1.75	0.65
22	550-560	8	Uni/Bilat/Prox E/SS	3.1	2.3	2.1	0.6
14	30-40	9	Uni/Unilat SS/Notch	1.5	1.7	1.4	0.55
22	40-50	9	Prox	0.7	1.6	0.85	0.25
21	270-280	9	Uni/Unilat/DistE/SS	11	3.45	3.25	1.15
21	530-540	9	Uni/Unilat/DistE/SS	1.4	2.3	1.7	0.4

Totals:	41		Totals:	244.8 gm			
	41	Whole	Means:	5.971	2.65	2.13	0.69
200-300cm	10		Totals:	90.2 gm			
Early LSA	10	Whole	Means:	9.02	2.93	2.47	0.7
300-420cm		None					
Large Blade							

Table 41 cont. Combination Tools Raw Material & Metric Data

Square	Depth	R.M.	Retouch	Location	Wt.gms	L	W	T
420-450cm		6		Totals:	27.8 gm			
Upper MSA		6 Whole		Means:	4.633	2.41	2.11	0.68

Key:
Uni. = Unifacial
Unilat. = Uilateral
Dist. = Distal
Bilat. = Bilateral
SS = Side Scraper
Notch = Notch
BU = Burin
E = End Scraper
Prox. = Proximal
Dent. = Denticulate

Raw Material
1 = Quartz
2 = Brown Chert
3 = Chalcedony
4 = Jasper
5 = Transparent w/ black flecks
7 = Silcrete
8 = Multi-Color Chert
9 = Other Fine Grained Raw Mat'

Table 42 Square 10 Tool Totals By Depth

Depth in cm	CR	BB	BL	ES	SS	PT	DR	CT	BU	AL	NO	BE	DE	BP	MR	Totals
0-10	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2
10-20	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	3
20-30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30-40	0	0	3	0	1	0	0	0	0	1	0	0	0	0	0	5
40-50	1	0	1	0	0	0	0	0	1	1	0	0	0	0	0	4
50-60	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	3
60-70	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	3
70-80	0	0	3	1	2	0	0	0	1	0	0	0	0	0	0	7
80-90	0	0	3	0	0	0	0	0	0	2	0	0	0	1	0	6
90-100	0	0	3	0	2	0	0	0	2	1	0	0	0	0	0	8
100-110	0	0	4	0	2	0	0	1	0	1	0	0	0	0	0	8
110-120	0	0	4	0	1	0	0	0	0	1	0	0	0	0	0	6
120-130	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
130-140	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	3
140-150	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	3
150-160	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
160-170	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
170-180	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	3
180-190	0	0	5	0	0	0	0	0	4	2	0	0	0	1	0	12
190-200	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
200-210	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
210-220	0	0	2	0	0	0	0	0	0	1	0	0	1	0	0	4
220-230	0	0	2	0	1	0	0	0	0	2	0	0	0	0	0	5
230-240	0	0	2	0	0	0	0	0	1	1	0	0	0	0	0	4
240-250	0	0	1	0	1	0	0	0	1	1	0	0	0	1	0	5
250-260	0	0	1	0	0	0	0	0	2	2	0	0	0	0	0	5
Totals:	3	1	42	1	12	0	0	1	14	24	0	0	1	6	0	105

Key:
CR = Crescent (Segment)
BB = Backed Blade(let)
BL = Blade(let)
ES = End Scraper
SS = Side Scraper
PT = Point
DR = Drill
CT = Combination Tool
BU = Burin
AL = Awl
NO = Notch
BE = Bec
DE = Denticulate
BP = Backed Point
MR = Misc. Retouch

Table 43 Square 11 Tool Totals By Depth

Depth in cm	CR	BB	BL	ES	SS	PT	DR	CT	BU	AL	NO	BE	DE	BP	MR	Totals
0-10	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
10-20	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	2
20-30	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
30-40	0	0	1	0	2	0	0	0	2	0	1	0	0	0	0	6
40-50	0	0	1	0	0	0	0	0	1	1	0	0	0	0	1	4
50-60	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	2
60-70	1	1	5	2	0	0	0	0	2	1	1	0	1	3	0	17
70-80	0	0	4	0	1	0	0	0	0	0	0	0	0	0	1	6
80-90	2	0	4	0	1	0	0	0	2	3	0	0	0	0	0	12
90-100	0	1	5	0	0	0	0	0	2	1	0	0	0	0	4	13
100-110	0	0	14	1	3	0	1	0	0	1	0	0	1	0	0	21
110-120	0	0	4	0	1	1	0	0	2	1	0	0	0	0	1	10
120-130	0	0	5	0	1	0	0	0	0	1	1	0	0	0	1	9
130-140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
140-150	1	0	2	0	0	0	0	0	0	0	0	0	0	0	1	4
150-160	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	3
160-170	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
170-180	0	0	4	0	1	0	0	0	0	3	1	0	0	0	0	9
180-190	0	0	4	0	2	0	0	0	1	0	0	0	0	0	0	7
190-200	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	4
200-210	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
210-220	0	0	4	0	0	0	0	0	1	0	0	0	0	0	0	5
220-230	1	0	1	0	0	0	0	1	0	2	0	0	0	0	1	6
230-240	0	0	4	0	0	0	0	0	2	3	0	0	0	0	1	10
240-250	0	2	2	0	0	0	0	0	2	2	0	0	0	0	0	8
250-260	0	0	8	1	0	0	0	0	2	3	0	0	0	0	0	14
260-270	0	1	6	1	0	0	0	0	2	4	0	0	0	0	3	17
270-280	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	3
280-290	0	0	1	0	0	0	0	0	2	2	0	0	0	0	0	5
290-300	0	0	2	0	0	0	0	0	0	2	0	0	0	0	0	4
300-310	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
310-320	0	0	1	0	0	0	0	0	1	0	0	0	0	2	0	4
320-330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
330-340	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	3
340-350	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
350-360	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	3
360-370	0	0	1	0	0	0	0	2	0	2	1	0	0	0	0	6
370-380	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	3
380-390	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
390-400	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
Totals:	6	7	99	6	14	1	1	3	30	36	5	0	3	5	14	230

Key:

CR = Crescent (Segment)
BB = Backed Blade(let)
BL = Blade(let)
ES = End Scraper
SS = Side Scraper
PT = Point
DR = Drill
CT = Combination Tool
BU = Burin
AL = Awl
NO = Notch
BE = Bec
DE = Denticulate
BP = Backed Point
MR = Misc. Retouch

Table 44 Square 12 Tool Totals By Depth

Depth in cm	CR	BB	BL	ES	SS	PT	DR	CT	BU	AL	NO	BE	DE	BP	MR	Total
0-10	1	0	1	2	0	0	0	0	3	3	0	0	0	0	1	11
10-20	0	0	2	0	0	0	0	0	1	1	0	0	0	0	0	4
20-30	0	0	2	0	1	0	0	0	3	0	0	0	0	0	0	6
30-40	0	1	1	1	0	0	0	0	4	3	0	0	0	0	1	11
40-50	1	0	6	0	0	0	0	0	3	0	0	0	0	0	2	12
50-60	0	0	1	1	0	0	0	0	1	0	0	0	0	1	0	4
60-70	0	0	2	0	2	0	0	0	1	2	0	0	0	0	1	8
70-80	0	0	6	1	1	0	0	1	5	5	0	0	0	0	0	19
80-90	0	0	7	0	1	0	0	0	8	4	1	0	0	1	1	23
90-100	0	0	4	1	1	0	0	0	0	2	0	0	0	0	0	8
100-110	0	1	16	0	0	0	0	0	7	10	0	0	2	0	1	37
110-120	0	0	5	1	3	0	0	0	2	5	0	0	0	0	0	16
120-130	0	1	4	0	1	0	0	0	3	3	0	0	0	0	0	12
130-140	1	0	0	0	0	0	0	1	1	1	0	0	0	0	0	4
140-150	0	0	2	0	0	0	0	0	1	2	0	0	0	0	0	5
150-160	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
160-170	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	3
170-180	0	0	1	0	0	0	0	1	2	3	0	0	0	0	4	11
180-190	0	0	3	0	0	0	0	0	1	1	0	0	0	0	0	5
190-200	2	0	2	0	0	0	1	0	2	2	0	0	0	0	3	12
200-210	0	0	3	0	0	0	0	0	2	0	0	0	0	0	0	5
210-220	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
220-230	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
230-240	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
240-250	0	0	11	0	0	0	0	0	3	2	0	0	0	0	0	16
250-260	0	0	9	0	0	0	0	0	8	10	0	0	0	2	0	29
260-270	1	0	9	0	0	0	0	0	1	1	1	0	0	0	0	13
270-280	0	0	1	0	0	0	0	0	4	1	0	0	0	0	0	6
280-290	0	0	3	0	0	0	0	0	3	0	0	0	0	0	0	6
290-300	0	0	1	0	0	0	0	0	0	5	0	0	0	0	1	7
300-310	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
310-320	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
320-330	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	2
330-340	0	0	0	0	0	1	0	0	0	3	0	0	0	0	1	5
340-350	0	0	5	0	0	0	0	0	3	4	0	0	0	0	0	12
350-360	0	0	1	0	0	0	0	0	0	3	0	0	0	0	0	4
360-370	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	3
370-380	0	0	2	0	0	0	0	0	0	2	0	0	0	0	0	4
380-390	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
390-400	0	0	2	0	0	0	0	0	1	1	0	0	0	0	0	4
400-410	1	0	0	1	0	0	0	0	0	5	0	0	0	0	0	7
410-420	0	0	5	1	1	1	0	0	1	2	0	0	0	0	0	11
420-430	0	0	8	1	1	0	0	0	3	3	1	0	0	0	4	21
430-440	0	0	5	0	3	0	0	1	0	1	0	0	0	0	0	10
440-450	0	0	7	0	2	1	0	0	4	12	0	0	1	0	2	29
450-460	0	0	12	0	1	0	0	0	5	4	0	0	1	0	0	23
460-470	0	0	12	0	4	1	0	1	8	7	0	0	2	0	2	37
470-480	0	0	17	1	1	1	0	1	10	3	1	0	0	0	4	39
480-490	0	0	4	0	0	0	0	2	4	3	0	0	1	0	0	14
490-500	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4

Table 44 cont. Square 12 Tool Totals By Depth

Depth in cm	CR	BB	BL	ES	SS	PT	DR	CT	BU	AL	NO	BE	DE	BP	MR	Total
500-510	0	0	2	0	0	0	0	0	1	0	1	0	0	0	0	4
510-520	0	0	2	0	1	1	0	1	2	1	0	0	0	0	0	8
520-530	0	0	7	0	3	4	0	1	5	2	0	0	0	0	1	23
530-540	0	0	0	0	2	0	0	0	1	1	0	0	0	0	3	7
540-550	1	0	7	1	1	3	0	0	3	0	0	0	0	0	0	16
550-560	0	0	4	0	0	4	0	1	3	0	0	0	1	0	1	14
560-570	0	0	9	0	1	1	0	0	2	2	0	0	0	0	1	16
570-580	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
580-590	0	0	1	0	2	3	0	0	1	1	0	0	0	0	0	8
590-600	0	0	6	0	0	2	0	0	1	2	0	0	0	0	4	15
600-610	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
610-620	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
620-630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
630-640	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
640-650	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
650-660	0	0	2	0	0	1	0	0	0	1	0	0	0	0	0	4
660-670	0	0	1	0	0	0	0	0	1	2	0	0	0	0	0	4
670-680	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	2
Totals:	8	4	243	12	33	24	1	11	132	135	5	0	8	4	39	659

Key:
CR = Crescent (Segment)
BB = Backed Blade(let)
BL = Blade(let)
ES = End Scraper
SS = Side Scraper
PT = Point
DR = Drill
CT = Combination Tool
BU = Burin
AL = Awl
NO = Notch
BE = Bec
DE = Denticulate
BP = Backed Point
MR = Misc. Retouch

Table 45 Square 13 Tool Totals By Depth

Depth in cm	CR	BB	BL	ES	SS	PT	DR	CT	BU	AL	NO	BE	DE	BP	MR	Totals
0-10	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
10-20	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
20-30	0	0	2	0	0	0	0	0	0	2	0	0	0	0	0	4
30-40	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	2
40-50	1	0	0	1	1	0	0	0	0	1	0	0	0	0	0	4
50-60	0	2	3	0	1	0	1	0	1	1	0	0	0	0	1	10
60-70	0	0	4	0	0	0	0	0	0	3	0	0	0	0	0	7
70-80	0	0	4	0	0	0	0	0	0	1	0	0	0	0	0	5
80-90	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	2
90-100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100-110	0	0	6	0	0	0	0	0	1	0	0	0	0	0	1	8
110-120	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	16
120-130	0	0	8	0	0	0	0	0	0	2	0	0	0	0	0	10
130-140	0	0	8	0	1	0	0	0	1	0	0	0	0	0	0	10
140-150	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
150-160	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
160-170	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
170-180	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
180-190	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	2
Totals:	2	3	58	1	4	0	1	0	3	12	0	0	0	0	2	86

Table 46 Square 14 Tool Totals By Depth

Depth in cm	CR	BB	BL	ES	SS	PT	DR	CT	BU	AL	NO	BE	DE	BP	MR	Totals
0-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20-30	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	3
30-40	0	0	3	0	0	0	0	1	1	0	0	0	0	0	0	5
40-50	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	3
50-60	0	0	3	0	1	0	0	0	1	0	0	1	0	0	1	7
60-70	0	0	3	0	1	0	0	0	2	1	0	0	0	0	0	7
70-80	1	0	3	0	1	0	0	0	0	2	0	0	0	0	0	7
80-90	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
90-100	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
100-110	0	0	7	0	1	0	0	0	2	1	0	1	0	0	1	13
110-120	1	0	13	0	2	0	0	0	1	1	0	0	0	0	0	18
120-130	0	0	9	0	2	0	0	0	2	1	1	0	0	0	0	15
Totals:	3	1	46	1	9	0	0	1	9	6	1	2	0	0	2	81

Key:

CR = Crescent (Segment)
BB = Backed Blade(let)
BL = Blade(let)
ES = End Scraper
SS = Side Scraper
PT = Point
DR = Drill
CT = Combination Tool
BU = Burin
AL = Awl
NO = Notch
BE = Bec
DE = Denticulate
BP = Backed Point
MR = Misc. Retouch

Table 47 Square 15 Tool Totals By Depth

Depth in cm	CR	BB	BL	ES	SS	PT	DR	CT	BU	AL	NO	BE	DE	BP	MR	Totals
0-10	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	2
10-20	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	3
20-30	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
30-40	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	3
40-50	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
50-60	1	0	2	0	1	1	0	0	0	0	0	0	0	0	0	5
60-70	1	0	0	0	2	0	0	0	2	0	0	0	0	0	2	7
70-80	1	0	1	1	0	0	0	0	0	1	0	1	0	0	0	5
80-90	0	0	5	1	0	0	0	0	0	1	0	0	0	0	0	7
90-100	0	0	5	0	0	0	0	0	0	1	0	0	0	0	0	6
100-110	0	0	10	0	0	0	0	0	2	0	0	0	0	0	0	12
110-120	0	0	13	1	1	0	0	0	0	2	2	0	0	0	1	20
120-130	0	0	9	0	0	0	0	0	0	2	2	0	0	0	0	13
Totals:	5	0	48	3	5	1	0	0	5	9	4	1	0	0	4	85

Table 48 Square 16 Tool Totals By Depth

Depth in cm	CR	BB	BL	ES	SS	PT	DR	CT	BU	AL	NO	BE	DE	BP	MR	Totals
0-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20-30	0	0	2	0	1	0	0	0	0	0	0	0	0	0	1	4
30-40	1	0	1	0	1	0	0	0	0	1	0	0	0	0	0	4
40-50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50-60	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	2
60-70	0	0	3	0	0	0	0	0	0	1	0	0	0	0	0	4
70-80	1	0	4	0	0	0	0	0	0	0	0	0	0	0	1	6
80-90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90-100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100-110	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
110-120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
120-130	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4
Totals:	2	0	15	0	3	0	0	0	0	2	0	0	0	0	3	25

Key:

CR = Crescent (Segment)
BB = Backed Blade(let)
BL = Blade(let)
ES = End Scraper
SS = Side Scraper
PT = Point
DR = Drill
CT = Combination Tool
BU = Burin
AL = Awl
NO = Notch
BE = Bec
DE = Denticulate
BP = Backed Point
MR = Misc. Retouch

Table 49 Square 17 Tool Totals By Depth

Depth in cm	CR	BB	BL	ES	SS	PT	DR	CT	BU	AL	NO	BE	DE	BP	MR	Totals
0-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20-30	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
30-40	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	2
40-50	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
50-60	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	2
60-70	0	0	3	0	0	0	0	0	2	0	0	0	0	0	0	5
70-80	0	0	2	0	3	0	0	0	2	2	1	0	0	0	0	10
80-90	0	0	4	0	0	0	0	0	0	1	0	0	0	0	1	6
90-100	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	2
100-110	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
110-120	0	0	5	0	0	0	0	0	0	3	1	0	0	0	2	11
120-130	0	0	9	0	0	0	0	0	1	2	1	0	0	0	1	14
Totals:	0	1	27	0	5	0	0	0	5	9	4	0	0	0	4	56

Table 50 Square 18 Tool Totals By Depth

Depth in cm	CR	BB	BL	ES	SS	PT	DR	CT	BU	AL	NO	BE	DE	BP	MR	Totals
0-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20-30	1	0	2	0	0	0	0	0	0	1	0	0	0	0	0	4
30-40	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
40-50	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
50-60	2	1	2	0	0	0	0	0	1	0	0	0	0	0	0	6
60-70	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
70-80	1	0	3	0	0	0	0	0	0	1	0	0	0	0	1	6
80-90	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	3
90-100	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	2
100-110	0	0	6	0	0	0	0	0	0	5	1	0	0	0	2	14
110-120	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	3
120-130	0	0	9	0	0	0	0	0	0	3	1	0	0	0	1	14
Totals:	6	1	29	0	1	0	0	0	4	11	2	0	0	0	4	58

Key:

CR = Crescent (Segment)
BB = Backed Blade(let)
BL = Blade(let)
ES = End Scraper
SS = Side Scraper
PT = Point
DR = Drill
CT = Combination Tool
BU = Burin
AL = Awl
NO = Notch
BE = Bec
DE = Denticulate
BP = Backed Point
MR = Misc. Retouch

Table 51 Square 19 Tool Totals By Depth

Depth in cm	CR	BB	BL	ES	SS	PT	DR	CT	BU	AL	NO	BE	DE	BP	MR	Totals
0-10	2	0	1	0	0	0	0	0	0	0	0	0	0	0	1	4
10-20	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
20-30	1	0	2	0	1	0	0	0	0	0	0	0	0	0	0	4
30-40	1	0	0	0	1	0	1	0	0	0	0	0	0	0	1	4
40-50	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2
50-60	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
60-70	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	3
70-80	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	3
80-90	0	0	6	3	1	0	0	0	0	0	0	0	0	0	0	10
90-100	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
100-110	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	2
110-120	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
120-130	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2
130-140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
140-150	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
150-160	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	2
160-170	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	4
170-180	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	2
180-190	0	0	0	2	1	1	0	1	1	0	0	0	0	0	0	6
190-200	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	2
200-210	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	3
210-220	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	3
220-230	1	0	0	0	1	0	0	1	0	0	0	0	1	0	0	4
230-240	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	3
240-250	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
250-260	1	1	10	1	2	0	1	0	0	2	0	0	0	2	0	20
260-270	0	1	2	1	1	0	0	0	1	1	0	0	0	1	1	9
270-280	0	0	2	0	1	0	0	0	1	0	0	0	0	1	0	5
280-290	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
290-300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
300-310	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
310-320	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
320-330	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
330-340	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:	9	2	38	12	17	1	5	3	3	4	1	0	1	4	7	107

Key:

CR = Crescent (Segment)
BB = Backed Blade(let)
BL = Blade(let)
ES = End Scraper
SS = Side Scraper
PT = Point
DR = Drill
CT = Combination Tool
BU = Burin
AL = Awl
NO = Notch
BE = Bec
DE = Denticulate
BP = Backed Point
MR = Misc. Retouch

Table 52 Square 20 Tool Totals By Depth

Depth in cm	CR	BB	BL	ES	SS	PT	DR	CT	BU	AL	NO	BE	DE	BP	MR	Totals
0-10	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
10-20	0	0	1	0	0	0	0	0	3	1	0	0	0	0	0	5
20-30	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	4
30-40	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
40-50	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	3
50-60	1	0	3	0	2	0	0	0	0	1	0	0	0	0	0	7
60-70	0	0	0	0	1	0	0	0	3	2	0	0	0	0	0	6
70-80	1	0	3	0	0	0	0	0	0	2	0	0	0	0	1	7
80-90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90-100	0	0	2	0	0	0	0	0	0	2	1	0	0	0	0	5
100-110	0	0	3	1	1	0	0	0	1	0	0	0	0	0	0	6
110-120	0	0	2	0	0	0	0	0	4	2	0	0	0	0	0	8
120-130	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	4
130-140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
140-150	0	0	3	0	0	0	0	0	1	0	0	0	0	0	0	4
150-160	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	2
160-170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
170-180	0	0	6	0	0	0	0	0	0	0	1	0	0	0	1	8
180-190	0	0	1	0	2	0	0	0	0	2	0	0	0	0	0	5
190-200	0	0	2	0	0	0	0	1	0	2	0	0	0	0	0	5
200-210	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
210-220	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
220-230	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	3
230-240	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
240-250	0	2	13	0	1	0	0	0	2	4	0	0	0	1	2	25
250-260	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	3
260-270	0	0	5	0	0	0	0	0	1	1	0	0	0	0	0	7
270-280	0	0	3	0	0	0	0	0	0	1	0	0	0	0	0	4
280-290	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
290-300	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
300-310	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
310-320	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
320-330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
330-340	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
340-350	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
350-360	0	0	1	0	0	0	0	0	3	0	0	0	0	0	0	4
360-370	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	3
370-380	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
380-390	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
390-400	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
400-410	0	0	3	0	0	0	0	0	2	0	0	0	0	0	0	5
410-420	0	0	3	0	0	1	0	0	1	1	0	0	0	0	0	6
420-430	1	0	2	1	0	0	0	0	2	0	0	0	0	0	0	6
430-440	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	3
Totals:	5	7	78	3	10	1	0	1	30	23	2	0	0	2	4	166

Table 52 cont. Square 20 Tool Totals By Depth

Key:
CR = Crescent (Segment)
BB = Backed Blade(let)
BL = Blade(let)
ES = End Scraper
SS = Side Scraper
PT = Point
DR = Drill
CT = Combination Tool
BU = Burin
AL = Awl
NO = Notch
BE = Bec
DE = Denticulate
BP = Backed Point
MR = Misc. Retouch

Table 53 Square 21 Tool Totals By Depth

Depth in cm	CR	BB	BL	ES	SS	PT	DR	CT	BU	AL	NO	BE	DE	BP	MR	Total
0-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10-20	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
20-30	2	0	1	0	1	0	0	0	1	0	0	0	0	0	2	7
30-40	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	3
40-50	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
50-60	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
60-70	1	0	0	1	1	0	0	0	0	1	0	0	0	0	0	4
70-80	0	0	4	0	1	0	0	0	1	0	1	0	0	0	0	7
80-90	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	3
90-100	1	0	3	0	1	0	0	0	0	0	0	0	0	0	1	6
100-110	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	2
110-120	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	2
120-130	0	0	6	0	1	0	0	0	0	0	0	0	0	0	0	7
130-140	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
140-150	0	0	1	0	1	0	0	0	1	0	0	0	0	0	2	5
150-160	0	0	7	1	1	0	0	0	0	0	0	0	1	0	0	10
160-170	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
170-180	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	3
180-190	0	0	5	2	2	0	0	0	2	3	1	0	0	0	0	15
190-200	0	0	2	0	1	0	0	0	3	3	0	0	0	0	0	9
200-210	0	0	3	0	0	0	0	0	0	1	0	0	0	0	0	4
210-220	0	1	2	0	0	0	0	0	1	1	0	0	0	0	0	5
220-230	1	0	4	0	0	0	0	0	1	4	0	0	0	0	1	11
230-240	0	0	9	0	0	0	1	1	2	3	0	0	0	0	0	16
240-250	0	1	11	0	4	0	0	3	7	11	0	0	0	0	0	37
250-260	1	0	9	0	1	0	0	1	3	10	0	0	0	3	0	28
260-270	0	0	8	0	0	0	0	0	10	8	0	0	0	1	0	27
270-280	0	0	4	0	0	0	0	1	4	4	0	0	0	0	0	13
280-290	0	0	4	0	3	0	0	0	1	5	0	0	0	1	0	14
290-300	0	0	3	0	0	0	0	0	3	7	0	0	0	0	0	13
300-310	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	3
310-320	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
320-330	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	4
330-340	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
340-350	1	0	3	0	0	0	0	0	0	2	0	0	0	0	0	6
350-360	1	0	1	0	0	0	0	0	1	4	0	0	0	0	0	7
360-370	0	0	1	1	2	0	0	0	2	0	0	0	0	0	0	6
370-380	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	2
380-390	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
390-400	0	0	0	0	2	0	0	0	0	3	0	0	0	0	2	7
400-410	0	0	6	0	2	0	0	0	6	6	0	0	0	0	0	20
410-420	0	0	6	1	4	0	0	0	8	17	0	0	1	0	0	37
420-430	0	0	1	1	0	0	0	0	4	6	0	0	0	0	0	12
430-440	0	0	4	0	0	1	0	0	5	3	0	0	0	0	0	13
440-450	0	0	5	2	3	1	0	0	3	7	0	0	0	0	0	21
450-460	0	0	5	0	0	1	0	0	5	4	0	0	1	0	0	16
460-470	0	0	4	0	1	3	0	0	3	2	0	0	0	0	0	13
470-480	0	0	3	0	2	1	0	0	2	0	0	0	0	0	1	9
480-490	0	0	5	1	2	2	0	0	5	9	1	0	0	0	0	25
490-500	0	0	1	2	2	1	0	0	1	1	0	0	0	0	0	8

Table 53 cont. Square 21 Tool Totals By Depth

Depth in cm	CR	BB	BL	ES	SS	PT	DR	CT	BU	AL	NO	BE	DE	BP	MR	Total
500-510	0	0	5	0	0	1	0	0	4	1	0	0	0	0	1	12
510-520	0	0	3	0	1	1	0	1	1	1	0	0	0	0	0	8
520-530	0	0	3	0	1	1	0	0	2	0	0	0	0	0	0	7
530-540	0	0	1	0	0	1	0	1	0	2	0	0	0	0	1	6
540-550	0	0	6	0	0	2	0	0	2	2	0	0	0	0	0	12
550-560	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	3
560-570	0	0	0	0	0	2	0	0	1	0	0	0	1	0	0	4
570-580	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
580-590	0	0	3	0	1	0	0	0	1	0	0	0	0	0	0	5
590-600	0	0	0	0	0	1	0	0	3	1	0	0	0	0	0	5
600-610	0	0	1	0	0	0	0	0	2	0	1	0	0	0	0	4
610-620	0	0	0	1	0	1	0	0	1	1	0	0	0	0	0	4
Totals:	9	2	164	14	47	20	2	8	111	137	6	0	4	6	44	541

Key:
CR = Crescent (Segment)
BB = Backed Blade(let)
BL = Blade(let)
ES = End Scraper
SS = Side Scraper
PT = Point
DR = Drill
CT = Combination Tool
BU = Burin
AL = Awl
NO = Notch
BE = Bec
DE = Denticulate
BP = Backed Point
MR = Misc. Retouch

Table 54 Square 22 Tool Totals By Depth

Depth in cm	CR	BB	BL	ES	SS	PT	DR	CT	BU	AL	NO	BE	DE	BP	MR	Total
0-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10-20	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	2
20-30	2	1	1	0	1	0	0	0	0	0	0	0	0	0	0	5
30-40	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
40-50	0	0	3	1	2	0	1	2	0	0	0	0	0	0	2	11
50-60	1	1	3	0	2	0	1	1	0	0	0	0	0	0	1	10
60-70	0	0	4	0	4	0	0	0	0	0	0	0	0	0	0	8
70-80	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
80-90	0	1	3	0	0	0	0	1	0	0	0	0	0	0	0	5
90-100	0	1	0	1	3	0	0	0	0	0	0	0	0	0	2	7
100-110	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	3
110-120	1	0	2	0	3	0	1	1	0	0	0	0	0	0	0	8
120-130	0	1	3	0	2	0	1	0	0	0	0	0	0	0	0	7
130-140	0	1	3	0	1	0	0	0	0	0	0	0	0	0	1	6
140-150	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0	5
150-160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
160-170	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
170-180	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
180-190	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4
190-200	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4
200-210	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
210-220	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
220-230	1	0	5	0	1	0	0	0	0	0	0	0	0	0	0	7
230-240	2	1	21	0	1	1	0	0	0	0	0	0	0	0	2	28
240-250	0	0	16	2	1	0	0	1	0	0	0	0	0	0	0	20
250-260	0	0	9	0	0	0	0	1	15	0	0	0	0	0	0	25
260-270	0	2	1	1	1	0	0	0	5	0	0	0	0	0	1	11
270-280	2	1	5	1	0	0	0	1	10	0	0	0	0	0	0	20
280-290	0	0	3	2	0	0	0	0	2	3	0	0	0	0	2	12
290-300	0	0	2	0	0	0	0	0	6	3	0	1	0	0	0	12
300-310	0	0	0	1	0	0	0	0	5	1	0	0	0	0	0	7
310-320	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
320-330	0	0	1	1	2	0	0	0	2	0	0	0	0	0	1	7
330-340	0	0	2	1	0	0	0	0	3	2	0	0	0	0	1	9
340-350	0	0	3	2	0	0	0	2	5	4	0	0	0	0	0	16
350-360	0	0	5	0	0	0	0	0	6	2	1	0	0	0	0	14
360-370	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
370-380	0	0	1	0	0	0	0	0	8	2	0	0	0	0	0	11
380-390	1	0	4	1	0	0	0	0	2	1	0	0	0	0	2	11
390-400	0	0	8	0	0	0	0	2	3	1	0	0	0	0	1	15
400-410	0	0	6	0	2	0	0	0	0	0	0	0	0	0	2	10
410-420	0	0	4	0	0	0	0	1	4	1	0	0	0	0	0	10
420-430	0	0	4	0	0	1	0	2	9	0	1	0	0	0	1	18
430-440	0	0	5	1	0	4	0	0	3	0	0	0	0	0	1	14
440-450	0	0	4	1	1	2	0	2	1	1	1	0	0	0	1	14
450-460	0	0	1	1	1	0	0	0	3	0	0	0	1	0	1	8
460-470	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	2
470-480	0	0	0	0	0	1	0	3	0	0	0	0	0	0	0	4
480-490	0	0	1	2	0	1	0	0	1	3	0	0	0	0	1	9
490-500	0	0	0	2	3	0	0	0	1	1	0	0	0	0	2	9

Table 54 cont. Square 22 Tool Totals By Depth

Depth in cm	CR	BB	BL	ES	SS	PT	DR	CT	BU	AL	NO	BE	DE	BP	MR	Total
500-510	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	3
510-520	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	2
520-530	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	2
530-540	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	2
540-550	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
550-560	0	0	0	0	0	0	0	1	4	0	0	0	0	0	1	6
560-570	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
570-580	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
580-590	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
590-600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
600-610	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2
610-620	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Totals:	11	15	155	23	34	12	3	23	101	28	3	1	1	0	30	440

Key:
CR = Crescent (Segment)
BB = Backed Blade(let)
BL = Blade(let)
ES = End Scraper
SS = Side Scraper
PT = Point
DR = Drill
CT = Combination Tool
BU = Burin
AL = Awl
NO = Notch
BE = Bec
DE = Denticulate
BP = Backed Point
MR = Misc. Retouch

Table 55 Square 23 Tool Totals By Depth

Depth in cm	CR	BB	BL	ES	SS	PT	DR	CT	BU	AL	NO	BE	DE	BP	MR	Total
0-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10-20	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
20-30	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
30-40	0	0	2	1	0	0	0	1	0	0	0	0	0	0	0	4
40-50	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	4
50-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60-70	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
70-80	0	1	1	1	2	0	0	0	0	0	0	0	0	0	0	5
80-90	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
90-100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100-110	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
110-120	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	4
120-130	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3
130-140	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
140-150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
150-160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
160-170	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
170-180	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
180-190	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
190-200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
200-210	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
210-220	0	0	2	2	1	0	0	0	0	0	0	0	0	0	0	5
220-230	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
230-240	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
240-250	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
250-260	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	4
260-270	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	2
270-280	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
280-290	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
290-300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
300-310	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
310-320	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
320-330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
330-340	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
340-350	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
350-360	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
360-370	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
370-380	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
380-390	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
390-400	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
400-410	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
410-420	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
420-430	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4
430-440	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	2
440-450	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
450-460	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
460-470	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	3
470-480	0	0	4	0	0	1	0	0	0	0	0	0	0	0	0	5
480-490	0	0	0	0	1	2	0	0	0	0	0	0	0	0	1	4
490-500	0	0	3	1	0	4	0	0	1	0	0	0	0	0	1	10

Table 55 cont. Square 23 Tool Totals By Depth

Depth in cm	CR	BB	BL	ES	SS	PT	DR	CT	BU	AL	NO	BE	DE	BP	MR	Total
500-510	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	3
510-520	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
520-530	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	4
530-540	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	2
540-550	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
550-560	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
560-570	0	0	2	0	3	1	0	0	0	0	0	0	0	0	0	6
570-580	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
580-590	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
590-600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
600-610	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
610-620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
620-630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
630-640	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
640-650	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
650-660	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	3
660-670	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
670-680	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	3
680-690	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
690-700	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Totals:	6	3	45	7	20	19	0	5	1	1	1	0	1	0	6	115

Key:
CR = Crescent (Segment)
BB = Backed Blade(let)
BL = Blade(let)
ES = End Scraper
SS = Side Scraper
PT = Point
DR = Drill
CT = Combination Tool
BU = Burin
AL = Awl
NO = Notch
BE = Bec
DE = Denticulate
BP = Backed Point
MR = Misc. Retouch

Table 56 Square 24 Tool Totals By Depth

Depth in cm	CR	BB	BL	ES	SS	PT	DR	CT	BU	AL	NO	BE	DE	BP	MR	Totals
0-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20-30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30-40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40-50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60-70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70-80	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
80-90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90-100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100-110	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
110-120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
120-130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
130-140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
140-150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	4

Table 57 Square 25 Tool Totals By Depth

Depth in cm	CR	BB	BL	ES	SS	PT	DR	CT	BU	AL	NO	BE	DE	BP	MR	Totals
0-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20-30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
30-40	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	2
40-50	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
50-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60-70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70-80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80-90	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
90-100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100-110	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
110-120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
120-130	0	1	2	0	1	0	0	0	0	0	0	0	0	0	0	4
130-140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
140-150	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
Totals:	1	1	7	0	2	0	0	0	0	0	0	1	0	0	1	13

Key:
CR = Crescent (Segment)
BB = Backed Blade(let)
BL = Blade(let)
ES = End Scraper
SS = Side Scraper
PT = Point
DR = Drill
CT = Combination Tool
BU = Burin
AL = Awl
NO = Notch
BE = Bec
DE = Denticulate
BP = Backed Point
MR = Misc. Retouch

Table 58 Square 26 Tool Totals By Depth

Depth in cm	CR	BB	BL	ES	SS	PT	DR	CT	BU	AL	NO	BE	DE	BP	MR	Totals
0-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10-20	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
20-30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30-40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40-50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60-70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70-80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80-90	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
90-100	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
100-110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
110-120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
120-130	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
130-140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
140-150	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Totals:	0	1	1	1	2	0	0	0	0	0	0	0	0	0	0	5

Table 59 Square 27 Tool Totals By Depth

Depth in cm	CR	BB	BL	ES	SS	PT	DR	CT	BU	AL	NO	BE	DE	BP	MR	Totals
0-10	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
10-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20-30	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
30-40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40-50	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
50-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60-70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70-80	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
80-90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90-100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100-110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
110-120	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
120-130	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
130-140	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
140-150	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Totals:	0	1	4	0	3	0	0	0	0	0	0	0	0	0	0	8

Key:

CR = Crescent (Segment)
BB = Backed Blade(let)
BL = Blade(let)
ES = End Scraper
SS = Side Scraper
PT = Point
DR = Drill
CT = Combination Tool
BU = Burin
AL = Awl
NO = Notch
BE = Bec
DE = Denticulate
BP = Backed Point
MR = Misc. Retouch

Table 60 Square 28 Tool Totals By Depth

Depth in cm	CR	BB	BL	ES	SS	PT	DR	CT	BU	AL	NO	BE	DE	BP	MR	Totals
0-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20-30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30-40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40-50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50-60	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
60-70	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
70-80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80-90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90-100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100-110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
110-120	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	2
120-130	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	2
130-140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
140-150	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals:	1	1	2	1	1	0	0	0	0	0	0	0	0	0	0	6

Table 61 Square 29 Tool Totals By Depth

Depth in cm	CR	BB	BL	ES	SS	PT	DR	CT	BU	AL	NO	BE	DE	BP	MR	Totals
0-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20-30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30-40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40-50	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
50-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60-70	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
70-80	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
80-90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90-100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100-110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
110-120	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
120-130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
130-140	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	3
140-150	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Totals:	3	0	3	1	2	0	0	0	0	0	0	0	0	0	0	9

Key:
CR = Crescent (Segment)
BB = Backed Blade(let)
BL = Blade(let)
ES = End Scraper
SS = Side Scraper
PT = Point
DR = Drill
CT = Combination Tool
BU = Burin
AL = Awl
NO = Notch
BE = Bec
DE = Denticulate
BP = Backed Point
MR = Misc. Retouch

Table 62 Square 30 Tool Totals By Depth

Depth in cm	CR	BB	BL	ES	SS	PT	DR	CT	BU	AL	NO	BE	DE	BP	MR	Totals
0-10	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
10-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20-30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30-40	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
40-50	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
50-60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60-70	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
70-80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80-90	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
90-100	0	1	3	0	0	0	0	0	0	0	0	0	0	1	0	5
100-110	1	0	3	0	0	0	0	0	0	0	0	0	0	0	1	5
110-120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
120-130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
130-140	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	2
140-150	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	3
Totals:	3	2	12	0	0	0	2	0	0	0	0	0	0	2	1	22

Table 63 Square 31 Tool Totals By Depth

Depth in cm	CR	BB	BL	ES	SS	PT	DR	CT	BU	AL	NO	BE	DE	BP	MR	Totals
0-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10-20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20-30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30-40	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
40-50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
50-60	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
60-70	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
70-80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80-90	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
90-100	1	0	5	0	1	0	0	0	0	0	0	0	0	0	0	7
100-110	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
110-120	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
120-130	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	3
130-140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
140-150	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Totals:	5	0	8	0	4	0	1	0	0	0	0	0	0	0	1	19

Key:

CR = Crescent (Segment)
BB = Backed Blade(let)
BL = Blade(let)
ES = End Scraper
SS = Side Scraper
PT = Point
DR = Drill
CT = Combination Tool
BU = Burin
AL = Awl
NO = Notch
BE = Bec
DE = Denticulate
BP = Backed Point
MR = Misc. Retouch

APPENDIX B

DEBITAGE

Table 64 Square 10 Debitage & Raw Material Totals By Depth

Depth in cm	QD	BCD	CHD	JAD	TBF	BLD	SD	MCD	OFGD	Totals	%QTZ
0-10	30	0	0	1	0	0	1	0	2	34	88.2
10-20	16	1	1	0	0	0	0	1	2	21	76.2
20-30	26	1	0	1	0	0	0	2	4	34	76.5
30-40	37	0	1	0	0	0	1	0	4	43	86
40-50	12	0	0	0	0	0	0	0	1	13	92.3
50-60	41	1	2	1	0	0	0	0	4	49	83.7
60-70	39	2	0	4	1	0	0	0	1	47	83
70-80	17	1	1	0	0	1	1	1	0	22	77.3
80-90	26	3	0	0	0	0	2	4	3	38	68.4
90-100	11	4	1	4	0	0	2	5	8	35	31.4
100-110	25	5	2	3	0	1	13	10	7	66	37.9
110-120	22	5	0	2	1	1	5	2	9	47	46.8
120-130	15	0	0	0	0	0	1	5	2	23	65.2
130-140	21	1	0	4	0	0	4	4	7	41	51.2
140-150	4	0	0	0	0	0	0	0	1	5	80
150-160	3	0	0	0	0	0	2	1	0	6	50
160-170	6	1	1	0	0	0	1	1	2	12	50
170-180	7	3	1	0	0	0	5	5	1	22	31.8
180-190	9	3	0	0	0	0	7	0	1	20	45
190-200	7	2	1	0	0	0	3	1	2	16	43.8
200-210	9	0	0	0	0	0	2	2	1	14	64.3
210-220	13	0	0	0	0	0	5	2	1	21	61.9
220-230	14	1	1	0	1	0	2	2	0	21	66.7
230-240	32	0	0	2	0	0	3	1	1	39	82.1
240-250	27	1	0	0	0	0	1	0	1	30	90
250-260	23	1	0	0	0	0	2	0	4	30	76.7
Totals:	492	36	12	22	3	3	63	49	69	749	

Key:
QD = Quartz Debitage
BCD = Brown Chert Debitage
CHD = Chalcedony Debitage
JAD = Jasper Debitage
TBF = Transparent w/ black flecks Debitage
BCD = Black Chert Debitage
SD = Silcrete Debitage
MCD = Multi-Color Chert Debitage
OFGD = Other Fine Grained Debitage

Table 65 Square 11 Debitage & Raw Material Totals By Depth

Depth in cm	QD	BCD	CHD	JAD	TBF	BLD	SD	MCD	OFGD	Totals	%QTZ
0-10	11	0	1	0	0	0	0	0	0	12	91.7
10-20	3	0	0	0	0	0	1	0	0	4	75
20-30	9	1	0	4	0	0	1	1	0	16	56.3
30-40	26	0	0	0	0	0	0	1	2	29	89.7
40-50	11	1	1	1	0	0	0	0	4	18	61.1
50-60	8	1	1	0	0	0	0	0	2	12	66.7
60-70	60	1	1	0	1	0	1	0	4	68	88.2
70-80	53	5	1	0	0	1	1	5	6	72	73.6
80-90	18	0	0	0	0	0	0	0	4	22	81.8
90-100	29	1	1	0	0	0	2	7	7	47	61.7
100-110	27	3	1	1	0	0	11	12	17	72	37.5
110-120	18	5	1	1	0	0	12	7	23	67	26.9
120-130	17	0	0	2	0	0	1	6	8	34	50
130-140	0	0	0	0	0	0	0	0	0	0	0
140-150	13	2	1	0	0	0	2	4	2	24	54.2
150-160	10	2	1	1	1	0	1	1	1	18	55.6
160-170	3	2	0	0	0	0	2	0	0	7	42.9
170-180	30	7	4	3	0	0	10	11	1	66	45.5
180-190	14	3	2	1	0	0	20	8	5	53	26.4
190-200	8	1	0	1	0	0	3	2	1	16	50
200-210	7	0	0	2	0	0	4	1	1	15	46.7
210-220	19	1	0	0	0	0	10	3	1	34	55.9
220-230	22	1	0	0	0	0	3	2	1	29	75.9
230-240	79	0	3	2	0	0	2	5	2	93	84.9
240-250	45	0	0	0	0	0	0	1	2	48	93.8
250-260	157	1	3	2	1	0	9	6	4	183	85.8
260-270	55	1	0	2	1	0	2	5	2	68	80.9
270-280	21	0	1	2	0	0	2	0	5	31	67.7
280-290	27	0	1	0	0	0	0	0	1	29	93.1
290-300	22	1	0	0	0	0	0	0	1	24	91.7
300-310	2	0	0	0	0	0	0	1	0	3	66.7
310-320	8	1	0	0	0	0	0	1	1	11	72.7
320-330	0	0	0	0	0	0	0	0	0	0	0
330-340	38	2	0	0	0	0	6	0	3	49	77.6
340-350	7	0	0	0	0	0	2	0	0	9	77.8
350-360	3	0	0	2	0	0	2	0	0	7	42.9
360-370	12	0	0	0	0	0	3	1	0	16	75
370-380	6	0	0	0	0	0	1	0	0	7	85.7
380-390	5	0	0	0	0	0	0	0	1	6	83.3
390-400	4	0	0	0	0	0	0	1	3	8	50
Totals:	907	43	24	27	4	1	114	92	115	1327	

Key:
QD = Quartz Debitage
BCD = Brown Chert Debitage
CHD = Chalcedony Debitage
JAD = Jasper Debitage
TBF = Transparent w/ black flecks Debitage
BCD = Black Chert Debitage
SD = Silcrete Debitage
MCD = Multi-Color Chert Debitage
OFGD = Other Fine Grained Debitage

Table 66 Square 12 Debitage & Raw Material Totals By Depth

Depth in cm	QD	BCD	CHD	JAD	TBF	BLD	SD	MCD	OFGD	Totals	%QTZ
0-10	31	3	2	1	0	0	0	0	3	40	77.5
10-20	10	0	0	0	0	0	0	0	1	11	90.9
20-30	12	0	0	0	0	0	1	0	1	14	85.7
30-40	3	0	0	0	0	0	0	1	1	5	60
40-50	23	1	1	1	0	1	1	0	5	33	69.7
50-60	7	1	1	0	0	0	0	0	0	9	77.8
60-70	21	0	1	3	0	0	2	0	4	31	67.7
70-80	19	1	0	1	0	0	2	1	3	27	70.4
80-90	22	1	0	0	0	0	2	1	4	30	73.3
90-100	31	4	0	0	0	0	4	4	7	50	62
100-110	68	6	3	2	1	0	18	8	22	128	53.1
110-120	25	3	0	3	0	0	8	3	6	48	52.1
120-130	22	1	2	4	0	0	10	8	11	58	37.9
130-140	12	3	0	0	0	0	6	2	7	30	40
140-150	8	2	0	1	0	0	4	1	4	20	40
150-160	7	2	0	1	0	0	1	1	2	14	50
160-170	18	3	1	2	0	0	7	1	1	33	54.5
170-180	32	1	1	0	1	0	7	3	11	56	57.1
180-190	8	1	0	0	0	0	4	1	3	17	47.1
190-200	29	1	0	1	1	0	11	1	5	49	59.2
200-210	17	2	2	1	0	0	4	1	4	31	54.8
210-220	4	1	0	0	0	0	2	0	0	7	57.1
220-230	19	2	0	0	0	0	3	3	1	28	67.9
230-240	20	0	1	0	0	0	2	2	1	26	76.9
240-250	54	4	0	1	0	0	4	4	2	69	78.3
250-260	51	1	1	0	0	0	3	3	6	65	78.5
260-270	64	3	3	0	0	0	7	10	1	88	72.7
270-280	14	1	0	0	0	0	1	5	6	27	51.9
280-290	13	2	2	0	0	0	1	1	3	22	59.1
290-300	24	1	1	0	0	0	2	3	1	32	75
300-310	9	0	0	0	0	0	0	1	0	10	90
310-320	3	0	0	0	0	0	0	0	1	4	75
320-330	21	0	0	0	0	0	0	0	1	22	95.5
330-340	24	0	1	0	0	0	0	1	1	27	88.9
340-350	25	3	0	0	0	0	0	1	0	29	86.2
350-360	16	0	0	0	0	0	1	1	1	19	84.2
360-370	7	0	0	0	0	0	0	0	4	11	63.6
370-380	18	0	1	1	0	0	0	3	1	24	75
380-390	8	1	0	0	0	0	1	1	2	13	61.5
390-400	14	3	0	0	0	0	1	5	3	26	53.8
400-410	21	1	1	0	0	0	4	1	5	33	63.6
410-420	29	0	1	2	1	0	11	5	4	53	54.7
420-430	15	4	2	3	0	0	15	5	3	47	31.9
430-440	13	0	0	0	0	0	5	5	1	24	54.2
440-450	63	1	1	5	1	0	21	5	9	106	59.4
450-460	46	4	3	4	0	1	22	10	16	106	43.4
460-470	78	4	0	3	0	0	28	13	11	137	56.9
470-480	114	3	8	6	1	0	34	19	23	208	54.8
480-490	34	0	4	2	0	0	19	15	6	80	42.5
490-500	9	0	3	0	1	0	12	1	6	32	28.1

Table 66 cont. Square 12 Debitage & R.M. Totals By Depth

Depth in cm	QD	BCD	CHD	JAD	TBF	BLD	SD	MCD	OFGD	Totals	%QTZ
500-510	21	4	5	1	0	2	19	8	12	72	29.2
510-520	9	1	6	1	2	0	12	5	15	51	17.6
520-530	23	1	10	2	0	0	42	7	19	104	22.1
530-540	13	7	16	4	6	0	54	17	21	138	9.4
540-550	29	11	20	8	6	0	49	20	35	178	16.3
550-560	16	10	10	6	3	0	40	18	15	118	13.6
560-570	21	13	6	5	2	0	44	13	29	133	15.8
570-580	11	6	0	6	3	0	37	10	18	91	12.1
580-590	16	6	1	4	0	0	19	7	12	65	24.6
590-600	17	6	1	3	1	0	26	3	5	62	27.4
600-610	10	0	0	2	0	0	6	0	5	23	43.5
610-620	11	2	1	2	0	0	4	1	10	31	35.5
620-630	10	0	0	0	1	0	5	3	1	20	50
630-640	3	0	1	1	1	0	4	0	0	10	30
640-650	4	0	0	0	0	0	0	0	1	5	80
650-660	11	0	1	0	0	0	5	1	0	18	61.1
660-670	5	1	1	0	0	0	4	0	1	12	41.7
670-680	11	0	0	2	0	0	1	1	0	15	73.3
Totals:	1496	143	126	107	32	4	662	274	423	3255	

Key:
QD = Quartz Debitage
BCD = Brown Chert Debitage
CHD = Chalcedony Debitage
JAD = Jasper Debitagee
TBF = Transparent w/ black flecks Debitage
BCD = Black Chert Debitage
SD = Silcrete Debitage
MCD = Multi-Color Chert Debitage
OFGD = Other Fine Grained Debitage

Table 67 Square 13 Debitage & Raw Material Totals By Depth

Depth in cm	QD	BCD	CHD	JAD	TBF	BLD	SD	MCD	OFGD	Totals	%QTZ
0-10	6	0	0	0	0	0	0	0	0	6	100
10-20	4	0	0	1	0	0	0	0	0	5	80
20-30	7	0	0	2	0	0	0	1	0	10	70
30-40	7	0	0	2	1	0	0	0	0	10	70
40-50	12	0	0	0	0	0	0	1	3	16	75
50-60	20	0	0	0	0	0	1	0	0	21	95.2
60-70	28	2	0	1	0	0	0	1	4	36	77.8
70-80	27	1	0	3	0	0	1	0	2	34	79.4
80-90	9	4	0	1	0	0	0	2	3	19	47.4
90-100	0	0	0	0	0	0	0	0	0	0	0
100-110	15	4	0	0	0	0	4	2	7	32	46.9
110-120	20	8	3	5	0	0	12	12	21	81	24.7
120-130	25	8	10	2	0	0	8	6	18	77	32.5
130-140	12	1	1	0	0	0	7	6	3	30	40
140-150	4	1	0	0	0	0	2	1	0	8	50
150-160	2	0	0	0	0	0	0	1	2	5	40
160-170	3	0	0	0	0	0	1	0	2	6	37.5
170-180	7	6	0	0	0	0	4	1	1	19	36.8
180-190	6	1	1	0	0	0	8	0	1	17	35.3
Totals:	214	36	15	17	1	0	48	34	67	432	

Table 68 Square 14 Debitage & Raw Material Totals By Depth

Depth in cm	QD	BCD	CHD	JAD	TBF	BLD	SD	MCD	OFGD	Totals	%QTZ
0-10	5	0	0	1	0	0	0	3	0	9	55.6
10-20	14	0	0	1	0	0	1	1	0	17	82.4
20-30	15	0	0	1	0	0	3	3	3	25	60
30-40	10	0	0	1	0	0	0	0	0	11	90.9
40-50	10	0	0	2	0	0	0	2	2	16	62.5
50-60	22	2	1	1	0	0	1	0	3	30	73.3
60-70	25	3	0	3	0	0	0	2	3	36	69.4
70-80	34	0	1	1	0	0	4	0	2	42	81
80-90	25	1	0	0	0	0	1	0	0	27	92.6
90-100	26	0	0	1	0	0	3	0	1	31	83.9
100-110	48	9	7	2	0	0	16	4	10	96	50
110-120	27	6	6	7	0	0	16	11	11	84	32.1
120-130	22	2	4	5	0	0	16	16	19	84	26.2
Totals:	283	23	19	26	0	0	61	42	54	508	

Key:
QD = Quartz Debitage
BCD = Brown Chert Debitage
CHD = Chalcedony Debitage
JAD = Jasper Debitage
TBF = Transparent w/ black flecks Debitage
BCD = Black Chert Debitage
SD = Silcrete Debitage
MCD = Multi-Color Chert Debitage
OFGD = Other Fine Grained Debitage

Table 69 Square 15 Debitage & Raw Material Totals By Depth

Depth in cm	QD	BCD	CHD	JAD	TBF	BLD	SD	MCD	OFGD	Totals	%QTZ
0-10	6	0	1	1	0	0	0	1	0	9	66.7
10-20	9	0	0	1	0	0	2	0	4	16	64.3
20-30	7	0	0	0	0	0	1	1	2	11	63.6
30-40	14	0	0	0	0	0	1	0	1	16	87.5
40-50	5	0	0	0	0	0	2	1	0	8	62.5
50-60	21	0	0	2	0	0	2	0	3	28	75
60-70	29	0	1	1	0	0	4	0	2	37	78.4
70-80	36	3	3	3	0	0	2	2	4	53	67.9
80-90	32	2	0	0	0	0	0	0	5	39	82.1
90-100	11	1	0	1	0	0	2	1	2	18	61.1
100-110	28	3	0	2	0	0	9	6	5	53	52.8
110-120	47	2	0	4	0	0	20	14	21	108	43.5
120-130	18	3	5	4	0	0	17	12	15	74	24.3
Totals:	263	14	10	19	0	0	62	38	64	470	

Table 70 Square 16 Debitage & Raw Material Totals By Depth

Depth in cm	QD	BCD	CHD	JAD	TBF	BLD	SD	MCD	OFGD	Totals	%QTZ
0-10	2	0	0	0	0	0	0	0	0	2	100
10-20	4	0	0	0	0	0	0	0	0	4	100
20-30	10	0	1	2	0	0	1	0	1	15	66.7
30-40	12	0	0	1	0	0	1	0	1	15	80
40-50	16	0	0	0	0	0	0	1	2	19	84.2
50-60	15	1	1	0	0	0	2	1	0	20	75
60-70	25	0	0	0	0	0	1	2	1	29	86.2
70-80	20	1	3	3	0	0	1	2	3	33	60.1
80-90	19	0	0	0	0	0	0	1	1	21	90.5
90-100	10	1	0	0	0	0	1	0	2	14	71.4
100-110	9	1	0	0	0	0	2	0	1	13	69.2
110-120	2	0	0	0	0	0	3	0	5	10	20
120-130	24	7	0	1	1	0	12	6	18	69	34.8
Totals:	168	11	5	7	1	0	24	13	35	264	

Key:
QD = Quartz Debitage
BCD = Brown Chert Debitage
CHD = Chalcedony Debitage
JAD = Jasper Debitage
TBF = Transparent w/ black flecks Debitage
BCD = Black Chert Debitage
SD = Silcrete Debitage
MCD = Multi-Color Chert Debitage
OFGD = Other Fine Grained Debitage

Table 71 Square 17 Debitage & Raw Material Totals By Depth

Depth in cm	QD	BCD	CHD	JAD	TBF	BLD	SD	MCD	OFGD	Totals	%QTZ
0-10	1	0	1	0	0	0	0	0	0	2	50
10-20	12	0	0	0	0	0	0	0	1	13	92.3
20-30	7	0	0	0	0	0	0	0	0	7	100
30-40	3	0	0	0	0	0	0	0	2	5	60
40-50	20	0	0	1	0	0	2	0	1	24	83.3
50-60	23	2	0	0	0	0	1	0	0	26	88.5
60-70	19	0	0	0	0	0	1	2	1	23	82.6
70-80	59	3	0	2	1	0	2	4	4	75	78.7
80-90	16	0	0	0	0	0	1	2	0	19	84.2
90-100	20	0	0	0	0	0	0	1	1	22	90.9
100-110	11	0	0	0	0	0	1	1	3	16	68.8
110-120	21	6	3	4	0	1	4	5	8	52	40.4
120-130	31	5	3	3	0	0	11	13	12	78	39.7
Totals:	243	16	7	10	1	1	23	28	33	362	

Table 72 Square 18 Debitage & Raw Material Totals By Depth

Depth in cm	QD	BCD	CHD	JAD	TBF	BLD	SD	MCD	OFGD	Totals	%QTZ
0-10	6	1	0	0	0	0	0	0	0	7	85.7
10-20	4	0	0	0	0	0	1	0	0	5	80
20-30	4	0	0	1	0	0	1	0	3	9	44.4
30-40	5	0	0	0	0	0	0	0	0	5	100
40-50	5	0	0	0	0	0	0	0	0	5	100
50-60	32	2	0	1	0	0	1	1	5	42	76.2
60-70	9	0	0	1	0	0	0	1	2	13	69.2
70-80	50	2	2	2	1	0	4	3	9	73	68.5
80-90	16	1	0	1	0	0	0	1	2	21	76.2
90-100	8	0	0	1	0	0	1	1	1	12	66.7
100-110	41	2	4	1	0	0	5	1	11	65	63.1
110-120	17	2	1	5	0	0	0	0	1	26	65.4
120-130	41	7	4	9	0	0	16	4	12	93	44.1
130-140	29	0	0	0	0	0	0	3	4	36	80.6
Totals:	267	17	11	22	1	0	29	15	50	412	

Key:
QD = Quartz Debitage
BCD = Brown Chert Debitage
CHD = Chalcedony Debitage
JAD = Jasper Debitage
TBF = Transparent w/ black flecks Debitage
BCD = Black Chert Debitage
SD = Silcrete Debitage
MCD = Multi-Color Chert Debitage
OFGD = Other Fine Grained Debitage

Table 73 Square 19 Debitage & Raw Material Totals By Depth

Depth in cm	QD	BCD	CHD	JAD	TBF	BLD	SD	MCD	OFGD	Totals	%QTZ
0-10	19	5	2	0	0	0	0	0	0	26	73.1
10-20	30	0	0	1	0	0	0	1	1	33	90.9
20-30	39	1	1	1	0	0	0	6	0	48	81.3
30-40	52	3	2	2	0	0	0	2	5	66	78.8
40-50	55	0	1	4	0	0	0	3	0	63	87.3
50-60	44	0	2	2	0	0	0	4	1	53	83
60-70	49	4	1	5	0	0	0	1	0	60	81.7
70-80	27	2	0	4	1	0	3	0	0	37	73
80-90	94	7	3	8	0	0	10	17	0	139	67.6
90-100	47	5	1	4	0	0	3	6	3	69	68.1
100-110	25	2	0	5	0	0	0	1	4	37	67.6
110-120	35	3	2	1	1	0	1	4	2	49	71.4
120-130	27	6	1	1	0	0	2	2	0	39	69.2
130-140	17	1	0	0	0	0	1	1	1	21	81
140-150	17	0	0	0	0	0	2	2	1	22	77.3
150-160	6	1	0	0	0	0	0	1	1	9	66.7
160-170	16	3	0	1	0	0	5	2	1	28	57.1
170-180	14	0	0	1	0	0	5	2	1	23	60.9
180-190	27	1	0	0	0	0	25	0	4	57	47.4
190-200	17	2	1	0	0	0	1	3	0	24	70.8
200-210	27	3	0	0	0	0	1	0	3	34	79.4
210-220	23	0	0	0	0	0	1	4	1	29	59
220-230	33	0	0	0	0	0	2	3	2	40	82.5
230-240	66	1	0	0	0	0	0	3	0	70	94.3
240-250	47	1	1	1	0	0	1	2	0	53	88.7
250-260	225	4	3	3	0	2	0	15	5	257	87.5
260-270	56	0	1	0	0	0	1	3	0	61	91.8
270-280	50	0	0	1	0	0	1	12	0	64	78.1
280-290	19	0	1	1	0	0	0	3	0	24	79.2
290-300	4	1	0	0	0	0	0	0	0	5	80
300-310	6	0	0	0	0	0	1	1	0	8	75
310-320	5	1	0	0	0	0	1	0	0	7	71.4
320-330	2	0	0	0	0	0	0	0	0	2	100
330-340	6	1	0	0	0	0	0	1	0	8	48
Totals:	1226	58	23	46	2	2	67	105	36	1565	

Key:
QD = Quartz Debitage
BCD = Brown Chert Debitage
CHD = Chalcedony Debitage
JAD = Jasper Debitagee
TBF = Transparent w/ black flecks Debitage
BCD = Black Chert Debitage
SD = Silcrete Debitage
MCD = Multi-Color Chert Debitage
OFGD = Other Fine Grained Debitage

Table 74 Square 20 Debitage & Raw Material Totals By Depth

Depth in cm	QD	BCD	CHD	JAD	TBF	BLD	SD	MCD	OFGD	Totals	%QTZ
0-10	7	0	0	1	0	0	0	0	1	9	77.8
10-20	5	0	0	1	0	0	0	0	1	7	71.4
20-30	44	1	0	6	0	0	0	0	4	55	80
30-40	50	0	0	0	0	0	0	1	0	51	98
40-50	28	0	0	2	0	0	2	0	6	38	73.7
50-60	32	3	2	1	0	0	1	2	4	45	71.1
60-70	42	4	0	3	0	1	0	2	4	56	75
70-80	67	5	1	2	0	0	3	2	6	86	77.9
80-90	0	0	0	0	0	0	0	0	0	0	0
90-100	46	4	0	2	0	0	3	4	6	65	70.8
100-110	19	2	0	1	0	1	0	1	7	31	61.3
110-120	51	2	0	0	1	0	5	5	9	73	69.9
120-130	20	2	0	1	0	0	4	1	2	30	66.7
130-140	29	0	0	0	0	0	0	3	4	36	80.6
140-150	13	1	0	1	0	0	2	1	0	18	72.2
150-160	12	1	0	1	0	0	2	2	2	20	60
160-170	15	1	0	0	0	0	1	0	4	21	71.4
170-180	29	2	0	1	1	0	4	5	1	43	67.4
180-190	8	1	0	2	0	0	0	3	1	15	53.3
190-200	13	2	0	0	0	0	4	0	3	22	59.1
200-210	13	0	0	1	0	0	8	1	0	23	56.5
210-220	14	2	0	0	0	0	1	1	2	20	70
220-230	28	2	0	0	0	0	2	1	3	36	63.9
230-240	54	1	0	0	0	0	2	0	1	58	93.1
240-250	152	5	8	5	0	0	10	7	7	194	78.4
250-260	82	5	2	1	0	0	3	10	9	112	73.2
260-270	32	1	0	1	0	0	0	8	3	45	71.1
270-280	23	0	0	2	0	0	1	1	3	30	76.7
280-290	8	0	0	0	0	0	1	2	2	13	61.5
290-300	14	0	3	0	0	0	1	5	0	23	60.9
300-310	5	0	1	0	0	0	0	1	0	7	71.4
310-320	1	1	0	0	0	0	0	0	1	3	33.3
320-330	13	1	1	1	0	0	0	0	0	16	81.3
330-340	12	0	0	0	0	0	0	0	0	12	100
340-350	35	0	0	0	0	0	1	0	0	36	97.2
350-360	19	0	1	0	0	0	0	1	1	22	86.4
360-370	14	0	1	0	0	0	1	0	0	16	87.5
370-380	13	0	0	0	0	0	1	0	0	14	92.9
380-390	9	0	0	0	0	0	0	4	0	13	69.2
390-400	12	0	0	0	0	0	2	2	2	18	66.7
400-410	13	0	0	0	1	0	1	1	0	16	81.3
410-420	14	1	0	0	0	0	8	4	3	30	46.7
420-430	29	1	0	1	0	0	22	3	2	58	50
Totals:	1139	51	20	37	3	2	96	84	104	1536	

Key:

QD = Quartz Debitage

BCD = Brown Chert Debitage

CHD = Chalcedony Debitage

JAD = Jasper Debitage

TBF = Transparent w/ black flecks Debitage

BCD = Black Chert Debitage

SD = Silcrete Debitage

MCD = Multi-Color Chert Debitage

OFGD = Other Fine Grained Debitage

Table 75 Square 21 Debitage & Raw Material Totals By Depth

Depth in cm	QD	BCD	CHD	JAD	TBF	BLD	SD	MCD	OFGD	Totals	%QTZ
0-10	5	0	0	0	0	0	0	0	1	6	8.3
10-20	9	0	0	0	0	0	0	0	0	9	100
20-30	73	0	0	7	0	0	0	0	4	84	86.9
30-40	68	0	0	1	0	0	0	5	3	77	88.3
40-50	46	0	0	1	0	0	0	3	5	55	83.6
50-60	32	1	1	2	0	0	2	3	6	47	68
60-70	41	0	2	0	0	0	1	1	4	49	83.7
70-80	39	1	1	2	0	1	0	4	3	51	76.5
80-90	53	2	1	3	0	0	2	4	4	69	76.8
90-100	35	0	0	2	0	1	1	3	4	46	76
100-110	47	1	2	0	0	0	1	7	4	62	75.8
110-120	39	2	0	2	1	0	2	6	3	55	70.9
120-130	49	1	1	3	0	1	7	7	7	76	64.5
130-140	31	0	0	2	0	1	6	3	3	46	67.4
140-150	24	1	0	2	0	0	0	0	1	28	85.7
150-160	10	1	0	1	0	0	1	3	7	23	43.5
160-170	23	0	1	0	0	0	1	1	13	39	59
170-180	29	0	1	1	0	0	3	2	5	41	70.7
180-190	28	1	1	2	0	0	4	2	7	45	62.2
190-200	24	1	3	0	1	0	3	2	1	35	68.6
200-210	23	0	0	0	0	0	2	1	1	27	85.2
210-220	27	1	1	0	1	0	1	4	1	36	75
220-230	53	0	0	0	0	0	2	2	3	60	88.3
230-240	81	0	4	0	2	0	8	8	2	105	77.1
240-250	174	2	2	0	2	0	5	8	3	196	88.8
250-260	132	0	5	2	2	0	2	5	9	157	84.1
260-270	19	0	0	0	0	0	1	4	1	25	76
270-280	38	0	1	0	0	0	1	7	2	49	77.6
280-290	21	0	0	0	0	0	1	5	3	30	70
290-300	14	1	0	0	0	0	1	1	2	19	73.7
300-310	13	0	0	0	0	0	0	1	0	14	92.9
310-320	11	0	0	0	0	0	2	0	1	14	78.6
320-330	13	0	0	0	0	0	1	0	1	15	86.7
330-340	8	2	0	0	0	0	1	1	0	12	66.7
340-350	11	0	0	0	0	0	1	0	0	12	91.7
350-360	14	0	0	0	0	0	0	1	0	15	93.3
360-370	10	1	1	1	0	0	1	0	0	14	71.4
370-380	8	2	1	0	0	1	3	1	2	18	44.4
380-390	0	0	0	0	0	0	0	0	0	0	0
390-400	15	3	0	0	1	0	7	6	1	33	45.5
400-410	31	1	1	1	0	0	10	1	1	46	67.4
410-420	71	2	5	7	1	1	15	9	8	119	59.7
420-430	18	2	1	2	0	0	6	4	3	36	50
430-440	22	1	1	2	0	0	2	6	1	35	62.9
440-450	42	5	3	5	1	0	13	4	8	81	51.9
450-460	48	3	2	2	3	0	15	11	10	94	51.1
460-470	21	4	0	5	4	0	23	7	17	81	25.9
470-480	14	0	10	6	4	0	18	12	15	79	17.7
480-490	16	6	7	10	4	0	28	7	5	83	19.3
490-500	10	2	5	1	0	0	18	3	7	46	21.7

Table 75 cont. Square 21 Debitage & R.M. Totals By Depth

Depth in cm	QD	BCD	CHD	JAD	TBF	BLD	SD	MCD	OFGD	Totals	%QTZ
500-510	14	1	3	5	1	0	10	6	0	40	35
510-520	4	1	2	4	0	0	10	6	6	33	12.1
520-530	8	3	0	7	0	0	9	3	9	39	20.5
530-540	10	1	0	2	0	0	5	4	9	31	32.3
540-550	20	3	1	5	0	0	11	5	3	48	41.7
550-560	12	0	1	0	0	0	2	3	5	23	52.2
560-570	27	3	0	4	0	0	9	3	9	55	49.1
570-580	15	0	0	1	0	0	2	1	4	23	65.2
580-590	19	1	0	0	0	0	4	0	2	26	73.1
590-600	12	1	0	1	0	0	3	0	2	19	63.2
600-610	21	1	1	1	0	0	3	0	1	28	75
610-620	18	1	0	0	0	0	6	1	4	30	60
Totals:	1863	66	72	105	28	6	296	207	246	2889	

Key:
QD = Quartz Debitage
BCD = Brown Chert Debitage
CHD = Chalcedony Debitage
JAD = Jasper Debitagee
TBF = Transparent w/ black flecks Debitage
BCD = Black Chert Debitage
SD = Silcrete Debitage
MCD = Multi-Color Chert Debitage
OFGD = Other Fine Grained Debitage

Table 76 Square 22 Debitage & Raw Material Totals By Depth

Depth in cm	QD	BCD	CHD	JAD	TBF	BLD	SD	MCD	OFGD	Totals	%QTZ
0-10	10	1	0	0	0	0	0	0	0	11	90.9
10-20	22	0	0	2	0	0	1	2	1	28	78.6
20-30	57	0	2	0	0	0	2	5	2	68	83.8
30-40	102	0	1	3	0	1	1	4	5	117	87.2
40-50	121	1	3	2	0	0	5	9	8	149	81.2
50-60	91	4	0	4	1	0	3	9	2	114	79.8
60-70	78	5	3	7	0	0	4	6	1	104	75
70-80	79	4	3	2	0	0	2	8	1	99	79.8
80-90	58	5	2	3	1	0	4	9	0	82	70.7
90-100	46	1	2	4	0	0	0	0	0	53	86.8
100-110	40	3	2	2	0	1	3	0	0	51	78.4
110-120	59	0	1	4	0	0	5	11	0	80	73.8
120-130	31	1	2	0	1	0	4	5	3	47	66
130-140	25	2	2	0	1	0	2	2	0	34	73.5
140-150	28	5	0	3	2	0	2	1	0	41	68.3
150-160	29	0	0	6	0	1	4	7	7	54	53.7
160-170	32	0	1	2	0	0	8	4	0	47	68.1
170-180	26	2	5	4	0	0	3	5	0	45	57.8
180-190	39	3	0	4	1	0	4	2	2	55	70.9
190-200	38	1	0	3	1	0	3	3	0	49	77.6
200-210	24	0	0	0	0	0	4	5	1	34	70.6
210-220	58	1	0	0	0	0	3	10	0	72	80.6
220-230	42	0	0	1	0	0	0	1	1	45	93.3
230-240	144	1	2	2	0	0	7	6	1	163	88.3
240-250	193	5	7	2	3	0	5	14	2	231	83.5
250-260	36	3	2	1	0	2	0	15	2	61	59
260-270	24	0	2	1	0	0	1	6	1	35	68.6
270-280	45	0	2	1	0	1	1	7	0	57	78.9
280-290	42	0	1	2	1	0	0	3	1	50	84
290-300	31	0	0	0	0	1	0	3	0	35	88.6
300-310	7	0	0	0	0	0	1	0	0	8	87.5
310-320	5	0	0	0	0	0	1	0	0	6	83.3
320-330	3	0	0	0	0	0	0	0	0	3	100
330-340	6	0	0	0	0	0	0	0	0	6	100
340-350	23	0	0	0	0	0	0	0	2	25	92
350-360	42	1	0	0	0	0	3	4	2	52	80.8
360-370	7	0	1	0	0	0	1	5	0	14	50
370-380	10	3	0	1	0	0	7	4	0	25	40
380-390	52	2	0	1	3	0	9	21	6	94	55.3
390-400	81	0	4	5	0	2	15	10	0	117	69.2
400-410	96	1	0	2	1	0	19	7	4	130	73.8
410-420	42	1	2	4	0	0	19	16	9	93	45.2
420-430	21	0	2	4	0	0	17	15	3	62	33.9
430-440	22	6	0	2	0	0	15	24	4	73	30.1
440-450	44	2	6	8	3	0	28	25	5	121	36.4
450-460	33	7	1	3	1	0	14	12	7	78	42.3
460-470	5	3	1	2	1	0	0	8	7	27	18.5
470-480	8	1	1	1	0	0	6	1	2	20	40
480-490	39	4	2	7	0	0	10	29	7	98	39.8
490-500	31	0	0	0	0	0	3	10	12	56	55.4

Table 76 cont. Square 22 Debitage & R.M. Totals By Depth

Depth in cm	QD	BCD	CHD	JAD	TBF	BLD	SD	MCD	OFGD	Totals	%QTZ
500-510	16	1	0	0	0	0	7	2	6	32	50
510-520	16	0	0	0	0	0	3	1	1	21	76.2
520-530	15	0	0	0	0	0	3	3	0	21	71.4
530-540	32	1	0	1	0	0	0	3	5	42	76.2
540-550	2	0	0	1	0	0	0	3	2	8	25
550-560	4	2	0	0	0	0	0	4	0	10	40
560-570	10	2	0	2	0	0	1	3	2	20	50
570-580	6	0	0	0	0	0	0	0	0	6	100
580-590	13	0	0	1	0	0	0	0	0	14	92.9
590-600	7	2	0	0	0	0	0	2	0	11	63.6
600-610	8	2	0	1	0	0	1	0	3	15	53.3
610-620	3	0	1	0	0	0	3	5	3	15	20
Totals:	2359	89	66	111	21	9	267	379	133	3434	

Key:
QD = Quartz Debitage
BCD = Brown Chert Debitage
CHD = Chalcedony Debitage
JAD = Jasper Debitagee
TBF = Transparent w/ black flecks Debitage
BCD = Black Chert Debitage
SD = Silcrete Debitage
MCD = Multi-Color Chert Debitage
OFGD = Other Fine Grained Debitage

Table 77 Square 23 Debitage & Raw Material Totals By Depth

Depth in cm	QD	BCD	CHD	JAD	TBF	BLD	SD	MCD	OFGD	Totals	%QTZ
0-10	20	1	2	1	1	0	1	1	0	27	74.1
10-20	21	0	0	1	0	0	3	4	1	30	70
20-30	29	0	0	1	0	0	0	0	0	30	96.7
30-40	107	3	2	6	0	0	2	1	0	121	88.4
40-50	125	2	0	6	0	0	1	9	0	143	87.4
50-60	85	5	3	3	0	0	1	8	1	106	80.2
60-70	67	9	2	6	0	0	9	0	5	98	68.4
70-80	126	3	7	2	1	0	0	11	3	153	82.4
80-90	65	6	4	3	0	0	2	3	2	85	76.5
90-100	70	6	1	7	2	0	4	3	0	93	75.3
100-110	32	2	1	5	0	0	3	6	5	54	59.3
110-120	66	12	10	4	4	0	9	6	4	115	57.4
120-130	47	6	0	2	0	1	3	6	5	70	67.1
130-140	12	2	0	4	0	0	3	4	2	27	44.4
140-150	35	0	2	2	5	0	4	7	2	57	61.4
150-160	31	7	4	4	0	0	10	4	4	64	48.4
160-170	10	0	1	2	0	0	2	3	1	19	52.6
170-180	38	4	2	2	2	0	22	6	0	76	50
180-190	36	2	2	0	0	4	22	3	0	69	52.2
190-200	30	2	1	1	1	0	18	0	0	53	56.6
200-210	22	2	0	0	0	0	1	1	0	26	84.6
210-220	99	4	1	6	0	0	7	2	9	128	77.3
220-230	53	0	2	1	0	0	2	2	12	72	73.6
230-240	120	1	3	1	3	0	4	5	0	137	87.6
240-250	66	0	1	0	0	0	1	6	2	76	86.8
250-260	56	0	1	1	1	2	13	0	3	77	72.7
260-270	49	2	3	6	3	2	0	2	2	69	71
270-280	25	2	0	2	1	0	0	1	1	32	78.1
280-290	22	0	1	0	0	0	0	3	1	27	81.5
290-300	21	0	0	0	0	0	1	0	0	22	95.5
300-310	15	0	0	0	1	0	1	1	1	19	78.9
310-320	8	0	0	0	0	0	0	0	0	8	100
320-330	12	0	0	0	0	0	0	0	0	12	100
330-340	6	0	0	0	0	0	2	0	0	8	75
340-350	18	0	0	0	0	0	1	0	1	20	90
350-360	26	2	0	0	1	0	0	0	1	30	86.7
360-370	6	0	1	0	0	0	1	2	1	11	54.5
370-380	22	0	3	2	0	0	0	1	8	36	61.1
380-390	18	2	0	0	0	0	0	5	0	25	72
390-400	16	1	1	1	0	0	1	2	1	23	69.6
400-410	28	2	0	1	0	0	8	18	0	57	49.1
410-420	17	6	0	4	0	0	5	3	0	35	48.6
420-430	48	1	0	1	2	0	12	8	0	72	66.7
430-440	71	5	1	3	6	0	0	15	1	102	69.6
440-450	92	5	4	9	5	0	1	21	7	144	61.7
450-460	12	1	0	0	2	0	1	4	1	21	57.1
460-470	33	2	5	0	2	0	11	23	6	82	40.2
470-480	24	3	0	2	2	0	25	25	4	85	28.2
480-490	23	3	7	12	4	0	27	24	9	109	21.1
490-500	45	6	5	8	3	0	22	28	11	128	35.2

Table 77 cont. Square 23 Debitage & R.M. Totals By Depth

Depth in cm	QD	BCD	CHD	JAD	TBF	BLD	SD	MCD	OFGD	Totals	%QTZ
500-510	19	0	4	0	0	0	17	16	8	64	29.7
510-520	17	2	0	2	0	0	12	13	6	52	32.7
520-530	25	3	12	8	8	0	26	16	2	100	25
530-540	21	2	2	5	2	0	12	11	0	55	38.2
540-550	7	3	6	2	1	3	20	6	6	54	13
550-560	11	4	2	2	0	0	5	10	0	34	32.4
560-570	29	0	3	7	1	0	10	11	1	62	46.8
570-580	18	0	0	2	0	0	2	4	2	28	64.3
580-590	37	0	1	0	0	0	3	3	1	45	82.2
590-600	13	0	0	0	0	0	1	0	0	14	92.9
600-610	7	0	0	0	0	0	0	0	1	8	87.5
610-620	23	0	1	1	0	0	3	0	9	37	62.2
620-630	12	1	0	2	2	0	2	3	6	28	42.9
630-640	24	2	0	0	0	0	2	5	4	37	64.9
640-650	18	0	0	0	0	0	1	4	3	26	69.2
650-660	32	4	0	4	0	0	3	3	9	55	58.2
660-670	28	1	1	3	0	0	8	4	6	51	54.9
670-680	24	3	0	4	3	0	7	11	1	53	45.3
680-690	12	0	0	8	0	0	10	4	12	46	26.1
690-700	9	1	5	2	0	0	3	16	0	36	25
Totals:	2511	148	120	174	69	12	413	427	194	4068	

Key:
QD = Quartz Debitage
BCD = Brown Chert Debitage
CHD = Chalcedony Debitage
JAD = Jasper Debitagee
TBF = Transparent w/ black flecks Debitage
BCD = Black Chert Debitage
SD = Silcrete Debitage
MCD = Multi-Color Chert Debitage
OFGD = Other Fine Grained Debitage

Table 78 Square 24 Debitage & Raw Material Totals By Depth

Depth in cm	QD	BCD	CHD	JAD	TBF	BLD	SD	MCD	OFGD	Totals	%QTZ
0-10	4	0	0	0	0	0	0	0	1	5	80
10-20	4	0	0	0	0	0	0	0	0	4	100
20-30	7	0	0	0	0	0	0	0	0	7	100
30-40	15	0	0	0	0	0	1	1	0	17	88.2
40-50	23	1	0	0	0	0	0	0	0	24	95.8
50-60	10	2	0	1	0	0	0	0	0	13	76.9
60-70	13	1	1	0	0	0	1	0	0	16	81.3
70-80	14	0	0	1	0	0	0	0	0	15	93.3
80-90	10	0	0	0	0	0	0	1	0	11	90.9
90-100	8	1	0	0	0	0	1	1	1	12	66.7
100-110	13	1	0	1	0	0	3	5	0	23	56.5
110-120	15	2	0	2	0	0	4	5	1	29	51.7
120-130	8	2	0	5	0	0	0	2	0	17	47.1
130-140	9	0	0	1	0	0	0	3	0	13	69.2
140-150	7	1	0	1	0	0	0	1	0	10	70
Totals:	160	11	1	12	0	0	10	19	3	216	

Table 79 Square 25 Debitage & Raw Material Totals By Depth

Depth in cm	QD	BCD	CHD	JAD	TBF	BLD	SD	MCD	OFGD	Totals	%QTZ
0-10	6	0	0	0	1	0	0	0	0	7	85.7
10-20	4	0	0	0	0	0	0	0	0	4	100
20-30	18	0	0	0	0	0	0	0	0	18	100
30-40	17	0	0	1	0	0	2	0	0	20	85
40-50	27	0	0	0	0	0	1	1	0	29	93.1
50-60	35	2	1	1	0	0	0	0	1	40	87.5
60-70	17	1	1	0	0	0	1	0	1	21	81
70-80	25	2	1	0	0	0	0	2	0	30	83.3
80-90	44	3	3	4	0	0	0	4	0	58	75.9
90-100	21	1	1	0	1	0	0	1	0	25	84
100-110	38	2	2	2	0	0	0	4	1	49	77.6
110-120	51	0	0	1	0	0	1	11	1	65	78.5
120-130	36	0	1	0	1	0	0	2	2	42	85.7
130-140	19	0	0	1	0	0	2	1	2	25	76
140-150	22	0	1	0	0	0	3	0	1	27	81.5
Totals:	380	11	11	10	3	0	10	26	9	460	

Key:
QD = Quartz Debitage
BCD = Brown Chert Debitage
CHD = Chalcedony Debitage
JAD = Jasper Debitage
TBF = Transparent w/ black flecks Debitage
BCD = Black Chert Debitage
SD = Silcrete Debitage
MCD = Multi-Color Chert Debitage
OFGD = Other Fine Grained Debitage

Table 80 Square 26 Debitage & Raw Material Totals By Depth

Depth in cm	QD	BCD	CHD	JAD	TBF	BLD	SD	MCD	OFGD	Totals	%QTZ
0-10	5	0	0	0	0	0	0	0	0	5	100
10-20	2	0	0	0	0	0	0	0	0	2	100
20-30	6	0	0	0	0	0	0	0	0	6	100
30-40	7	0	0	1	0	0	1	0	0	9	77.8
40-50	6	1	0	0	0	0	1	0	0	8	75
50-60	5	1	1	0	0	0	1	1	1	10	50
60-70	11	0	0	0	0	0	0	2	0	13	84.6
70-80	30	1	3	1	0	0	0	1	0	36	83.3
80-90	18	0	1	0	0	0	1	1	0	21	85.7
90-100	13	0	0	0	0	0	0	3	0	16	81.3
100-110	12	0	1	0	1	0	0	0	0	14	85.7
110-120	12	1	0	0	0	0	1	0	0	14	85.7
120-130	21	1	1	1	0	0	1	4	1	30	70
130-140	20	0	0	1	0	0	1	0	0	22	90.9
140-150	16	1	0	0	0	0	3	0	1	21	76.2
Totals:	184	6	7	4	1	0	10	12	3	227	

Table 81 Square 27 Debitage & Raw Material Totals By Depth

Depth in cm	QD	BCD	CHD	JAD	TBF	BLD	SD	MCD	OFGD	Totals	%QTZ
0-10	3	0	0	0	0	0	0	0	0	3	100
10-20	3	0	0	1	0	0	0	0	0	4	75
20-30	8	0	0	0	0	0	0	0	0	8	100
30-40	19	1	1	0	0	0	0	0	0	21	90.5
40-50	16	0	0	2	0	0	1	0	0	19	84.2
50-60	19	0	1	0	0	0	0	0	0	20	95
60-70	1	0	0	0	0	0	0	0	0	1	100
70-80	8	1	3	0	1	0	1	0	3	17	47.1
80-90	10	0	0	0	0	0	1	0	0	11	90.9
90-100	14	0	1	1	0	0	2	0	1	19	73.7
100-110	17	3	1	0	0	0	0	0	0	21	81
110-120	3	2	2	2	0	0	1	7	0	17	17.6
120-130	29	2	1	1	0	0	0	9	2	44	65.9
130-140	18	1	0	1	0	0	2	7	0	29	62.1
140-150	12	0	0	1	0	0	1	0	1	15	80
Totals:	180	10	10	9	1	0	9	23	7	249	

Key:
QD = Quartz Debitage
BCD = Brown Chert Debitage
CHD = Chalcedony Debitage
JAD = Jasper Debitage
TBF = Transparent w/ black flecks Debitage
BCD = Black Chert Debitage
SD = Silcrete Debitage
MCD = Multi-Color Chert Debitage
OFGD = Other Fine Grained Debitage

Table 82 Square 28 Debitage & Raw Material Totals By Depth

Depth in cm	QD	BCD	CHD	JAD	TBF	BLD	SD	MCD	OFGD	Totals	%QTZ
0-10	2	0	0	0	0	0	0	0	0	2	100
10-20	1	0	0	0	0	0	0	0	0	1	100
20-30	15	0	0	0	0	0	0	0	0	15	100
30-40	14	0	0	0	0	0	0	0	0	14	100
40-50	27	0	0	1	0	0	0	0	0	28	96.4
50-60	5	0	0	0	0	0	0	0	0	5	100
60-70	9	1	0	0	0	0	1	0	0	11	81.8
70-80	8	1	0	0	0	0	0	0	0	9	88.9
80-90	9	1	0	1	0	0	1	1	1	14	64.3
90-100	0	0	4	0	0	0	0	0	0	4	0
100-110	20	1	0	2	1	0	0	0	0	24	83.3
110-120	11	0	0	1	0	0	1	0	3	16	68.8
120-130	27	3	1	1	0	0	0	0	0	32	84.4
130-140	33	3	1	3	0	0	0	2	0	42	78.6
140-150	18	0	0	0	0	0	3	0	0	21	85.7
Totals:	199	10	6	9	1	0	6	3	4	238	

Table 83 Square 29 Debitage & Raw Material Totals By Depth

Depth in cm	QD	BCD	CHD	JAD	TBF	BLD	SD	MCD	OFGD	Totals	%QTZ
0-10	5	0	0	0	0	0	0	0	0	5	100
10-20	1	0	0	1	1	0	0	0	0	3	33.3
20-30	17	0	0	0	0	0	0	0	0	17	100
30-40	26	1	1	3	1	0	0	0	11	43	60.5
40-50	34	4	0	1	0	0	0	0	2	41	82.9
50-60	30	4	0	0	0	0	1	2	0	37	81.1
60-70	11	1	2	0	1	0	0	0	0	15	73.3
70-80	26	2	1	1	1	0	0	0	0	31	83.9
80-90	23	0	2	0	2	0	1	0	1	29	79.3
90-100	45	2	4	1	1	0	0	0	0	53	84.9
100-110	33	2	3	0	4	0	0	0	1	43	76.7
110-120	32	0	3	3	0	2	1	0	2	43	74.4
120-130	50	2	1	0	2	0	0	0	4	59	84.7
130-140	58	0	1	0	1	0	1	2	7	70	82.9
140-150	59	2	0	1	0	0	0	0	1	63	93.7
Totals:	450	20	18	11	14	2	4	4	29	552	

Key:
QD = Quartz Debitage
BCD = Brown Chert Debitage
CHD = Chalcedony Debitage
JAD = Jasper Debitage
TBF = Transparent w/ black flecks Debitage
BCD = Black Chert Debitage
SD = Silcrete Debitage
MCD = Multi-Color Chert Debitage
OFGD = Other Fine Grained Debitage

Table 84 Square 30 Debitage & Raw Material Totals By Depth

Depth in cm	QD	BCD	CHD	JAD	TBF	BLD	SD	MCD	OFGD	Totals	%QTZ
0-10	18	0	0	1	0	0	0	0	1	20	90
10-20	27	0	0	1	0	0	0	0	0	28	96.6
20-30	33	1	0	0	1	0	0	1	1	37	89.2
30-40	28	1	0	0	0	0	0	0	0	29	96.6
40-50	19	0	1	0	0	0	0	0	1	21	90.5
50-60	35	2	0	1	0	0	1	2	2	43	81.4
60-70	20	1	1	0	0	1	1	0	1	25	80
70-80	43	4	2	0	0	0	0	0	2	51	84.3
80-90	34	0	4	2	1	0	1	2	0	44	77.3
90-100	45	0	7	4	1	0	0	5	3	65	69.2
100-110	61	2	6	5	0	0	0	2	5	81	75.3
110-120	41	0	6	2	0	0	1	3	3	56	73.2
120-130	40	3	1	4	0	0	0	2	2	52	76.9
130-140	10	0	0	6	3	0	0	1	1	21	47.6
140-150	9	0	0	2	0	0	0	0	2	13	69.2
Totals:	463	14	28	28	6	1	4	18	24	586	

Table 85 Square 31 Debitage & Raw Material Totals By Depth

Depth in cm	QD	BCD	CHD	JAD	TBF	BLD	SD	MCD	OFGD	Totals	%QTZ
0-10	8	0	0	0	0	0	0	1	0	9	88.9
10-20	19	0	0	0	0	0	0	2	0	21	90.5
20-30	21	1	0	1	2	0	2	0	0	27	77.8
30-40	13	0	0	1	1	0	0	0	0	15	86.7
40-50	16	0	0	1	0	0	1	0	0	18	88.7
50-60	18	0	1	4	0	0	0	0	2	25	72
60-70	12	0	1	2	0	0	0	2	0	17	70.6
70-80	14	0	0	3	0	0	0	3	0	20	70
80-90	12	0	0	2	1	0	2	3	2	22	54.5
90-100	31	1	0	4	2	0	2	0	14	54	57.4
100-110	21	0	1	1	3	0	0	0	10	36	58.3
110-120	16	1	0	3	7	0	1	3	3	34	47.1
120-130	19	0	0	3	1	0	0	0	2	25	76
130-140	7	0	0	0	2	0	1	1	0	11	63.6
140-150	7	0	0	1	0	0	0	0	1	9	77.8
Totals:	234	3	3	26	19	0	9	15	34	343	

Key:
QD = Quartz Debitage
BCD = Brown Chert Debitage
CHD = Chalcedony Debitage
JAD = Jasper Debitage
TBF = Transparent w/ black flecks Debitage
BCD = Black Chert Debitage
SD = Silcrete Debitage
MCD = Multi-Color Chert Debitage
OFGD = Other Fine Grained Debitage

APPENDIX C

CORES

Table 86 Quartz(ite) Bipolar Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
10	0-10	1	3.5	12	220-230	1	2.3
10	0-10	1	1.3	12	220-230	1	2.1
10	0-10	1	0.6	12	220-230	1	1.7
10	0-10	1	0.6	12	220-230	1	1
11	0-10	1	1.8	12	220-230	1	1
11	0-10	1	0.9	12	220-230	1	0.8
11	0-10	1	0.5	12	220-230	1	2
12	0-10	1	1.3	12	220-230	1	1.7
12	0-10	1	2.2	12	220-230	1	1.6
12	0-10	1	1	12	220-230	1	1.3
12	0-10	1	0.7	12	220-230	1	1
12	0-10	1	0.5	12	220-230	1	0.8
13	0-10	1	0.7	20	220-230	1	3.6
14	0-10	1	0.3	20	220-230	1	1.5
16	0-10	1	6.9	20	220-230	1	0.7
16	0-10	1	0.2	20	220-230	1	0.2
17	0-10	1	2.9	21	220-230	1	4.9
18	0-10	1	0.5	21	220-230	1	1
18	0-10	1	0.1	22	220-230	1	5.5
20	0-10	1	3.5	22	220-230	1	6
20	0-10	1	1.4	22	220-230	1	3.4
10	10-20	1	0.5	22	220-230	1	4.5
10	10-20	1	0.4	22	220-230	1	1.6
12	10-20	1	5	22	220-230	1	1.9
12	10-20	1	0.8	22	220-230	1	0.7
12	10-20	1	0.5	22	220-230	1	0.5
12	10-20	1	0.3	10	230-240	1	2.6
13	10-20	1	1.3	10	230-240	1	2.3
14	10-20	1	1.6	10	230-240	1	2.5
14	10-20	1	0.5	10	230-240	1	1.8
15	10-20	1	1.3	10	230-240	1	1.7
15	10-20	1	0.6	10	230-240	1	1.7
15	10-20	1	0.5	10	230-240	1	0.6
15	10-20	1	0.5	10	230-240	1	0.7
15	10-20	1	0.2	10	230-240	1	0.7
17	10-20	1	0.3	10	230-240	1	0.6
17	10-20	1	0.1	10	230-240	1	0.6
20	10-20	1	0.4	11	230-240	1	10.8
20	10-20	1	0.3	11	230-240	1	3.6
20	10-20	1	0.3	11	230-240	1	3.5
10	20-30	1	2.6	11	230-240	1	3.6
10	20-30	1	1	11	230-240	1	2.1
10	20-30	1	0.2	11	230-240	1	3.1
11	20-30	1	0.8	11	230-240	1	2.5
11	20-30	1	0.6	11	230-240	1	0.6
11	20-30	1	0.6	11	230-240	1	0.9
12	20-30	1	0.2	11	230-240	1	0.6
14	20-30	1	0.6	11	230-240	1	0.5
14	20-30	1	0.2	11	230-240	1	0.5
16	20-30	1	1	11	230-240	1	0.6
17	20-30	1	0.8	11	230-240	1	0.3

Table 86 cont. Quartz(ite) Bipolar Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
20	20-30	1	2.1	12	230-240	1	8.9
20	20-30	1	1.5	12	230-240	1	3.8
20	20-30	1	1.4	12	230-240	1	2.4
20	20-30	1	1.8	12	230-240	1	1.1
20	20-30	1	0.9	12	230-240	1	0.4
20	20-30	1	0.7	12	230-240	1	0.1
20	20-30	1	0.7	12	230-240	1	4.2
10	30-40	1	8.4	12	230-240	1	1.4
10	30-40	1	3.7	12	230-240	1	1.7
10	30-40	1	0.9	20	230-240	1	1.8
10	30-40	1	0.7	20	230-240	1	1.6
10	30-40	1	0.4	20	230-240	1	0.8
10	30-40	1	0.2	20	230-240	1	0.8
11	30-40	1	3.7	20	230-240	1	0.6
11	30-40	1	3.1	20	230-240	1	0.6
11	30-40	1	3	20	230-240	1	0.6
11	30-40	1	1.9	20	230-240	1	0.4
11	30-40	1	0.8	22	230-240	1	6.3
11	30-40	1	0.7	22	230-240	1	3.1
12	30-40	1	6.2	22	230-240	1	3.1
12	30-40	1	0.5	22	230-240	1	1.7
13	30-40	1	0.9	22	230-240	1	1.3
13	30-40	1	0.3	22	230-240	1	1.2
14	30-40	1	2	22	230-240	1	1.7
14	30-40	1	1.9	22	230-240	1	1
14	30-40	1	1.1	22	230-240	1	1.4
15	30-40	1	1	22	230-240	1	1
16	30-40	1	1.2	22	230-240	1	0.8
16	30-40	1	1.3	22	230-240	1	0.5
16	30-40	1	0.7	10	240-250	1	4.5
16	30-40	1	0.8	10	240-250	1	1.7
16	30-40	1	0.3	10	240-250	1	1.5
17	30-40	1	2.6	10	240-250	1	1.2
17	30-40	1	0.6	10	240-250	1	0.7
18	30-40	1	2.2	10	240-250	1	0.8
18	30-40	1	1.5	11	240-250	1	4.3
18	30-40	1	0.6	11	240-250	1	3
19	30-40	1	0.3	11	240-250	1	2.1
19	30-40	1	0.3	11	240-250	1	2.5
21	30-40	1	1.4	11	240-250	1	1.1
22	30-40	1	33.2	11	240-250	1	0.5
22	30-40	1	26.3	11	240-250	1	0.5
22	30-40	1	7.3	12	240-250	1	3.6
10	40-50	1	15.2	12	240-250	1	2.2
10	40-50	1	1.1	12	240-250	1	2.2
11	40-50	1	1.5	12	240-250	1	2.7
12	40-50	1	10.6	12	240-250	1	1.2
12	40-50	1	5.3	12	240-250	1	0.8
12	40-50	1	2.4	12	240-250	1	0.8
12	40-50	1	2	12	240-250	1	0.7
12	40-50	1	2	12	240-250	1	0.7

Table 86 cont. Quartz(ite) Bipolar Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
12	40-50	1	1.6	12	240-250	1	0.7
12	40-50	1	1.1	12	240-250	1	3.5
12	40-50	1	0.9	12	240-250	1	2.2
12	40-50	1	0.9	12	240-250	1	1.9
12	40-50	1	1	12	240-250	1	2.1
12	40-50	1	0.6	12	240-250	1	1.4
13	40-50	1	3	12	240-250	1	1.2
13	40-50	1	2.8	12	240-250	1	1
13	40-50	1	0.1	12	240-250	1	1
14	40-50	1	1.8	12	240-250	1	1
15	40-50	1	11.2	12	240-250	1	0.5
16	40-50	1	6.2	11	240-250	1	4.4
16	40-50	1	0.9	11	240-250	1	3.4
16	40-50	1	1.1	11	240-250	1	3
17	40-50	1	3.7	11	240-250	1	1.5
17	40-50	1	0.5	11	240-250	1	1.3
20	40-50	1	2.4	11	240-250	1	1.8
20	40-50	1	2.6	11	240-250	1	0.9
20	40-50	1	0.7	11	240-250	1	1.2
22	40-50	1	0.6	11	240-250	1	0.6
10	50-60	1	7.3	11	240-250	1	0.7
10	50-60	1	5.2	11	240-250	1	0.5
10	50-60	1	2.4	11	240-250	1	0.5
10	50-60	1	1.7	11	240-250	1	0.3
10	50-60	1	0.8	11	240-250	1	0.3
11	50-60	1	1.9	11	240-250	1	0.3
11	50-60	1	1	11	240-250	1	0.3
11	50-60	1	0.8	11	240-250	1	0.3
11	50-60	1	0.2	12	240-250	1	3.6
12	50-60	1	1.7	12	240-250	1	2.8
13	50-60	1	1.3	12	240-250	1	2.1
13	50-60	1	0.3	12	240-250	1	1.6
13	50-60	1	0.3	12	240-250	1	1.6
14	50-60	1	0.8	21	240-250	1	2.8
14	50-60	1	0.5	21	240-250	1	0.8
14	50-60	1	0.3	21	240-250	1	0.8
14	50-60	1	0.1	22	240-250	1	3.8
15	50-60	1	0.8	22	240-250	1	1.6
15	50-60	1	0.8	22	240-250	1	1.2
15	50-60	1	0.5	22	240-250	1	0.8
15	50-60	1	0.3	22	240-250	1	1
16	50-60	1	4.4	22	240-250	1	0.7
16	50-60	1	1.6	22	240-250	1	0.6
16	50-60	1	1.7	22	240-250	1	0.6
16	50-60	1	1.5	10	250-260	1	5
16	50-60	1	1.2	10	250-260	1	2.4
16	50-60	1	1	10	250-260	1	0.7
16	50-60	1	0.5	10	250-260	1	0.4
16	50-60	1	0.3	11	250-260	1	9.1
17	50-60	1	0.3	11	250-260	1	4.5
18	50-60	1	1.6	11	250-260	1	4.4

Table 86 cont. Quartz(ite) Bipolar Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
18	50-60	1	0.9	11	250-260	1	5.3
18	50-60	1	0.6	11	250-260	1	3.6
18	50-60	1	0.6	11	250-260	1	6
18	50-60	1	0.5	11	250-260	1	2.4
20	50-60	1	2.2	11	250-260	1	2.4
22	50-60	1	0.4	11	250-260	1	2
22	50-60	1	1.2	11	250-260	1	1.6
22	50-60	1	0.8	11	250-260	1	0.9
22	50-60	1	0.5	11	250-260	1	1.3
22	50-60	1	0.5	11	250-260	1	1.2
10	60-70	1	2.2	11	250-260	1	0.6
10	60-70	1	1.9	11	250-260	1	1.4
10	60-70	1	1.5	11	250-260	1	0.6
10	60-70	1	1	11	250-260	1	1.1
10	60-70	1	0.7	11	250-260	1	0.6
10	60-70	1	0.9	11	250-260	1	0.9
11	60-70	1	5.7	11	250-260	1	0.9
11	60-70	1	7.7	12	250-260	1	6.9
11	60-70	1	4.5	12	250-260	1	2.9
11	60-70	1	2.7	12	250-260	1	3.1
11	60-70	1	1.3	12	250-260	1	4.7
11	60-70	1	1.3	12	250-260	1	2.7
11	60-70	1	0.9	12	250-260	1	2.4
11	60-70	1	0.5	12	250-260	1	2.1
12	60-70	1	13.4	12	250-260	1	1.2
12	60-70	1	8.4	12	250-260	1	1.7
12	60-70	1	6	12	250-260	1	1
12	60-70	1	5.1	12	250-260	1	1
12	60-70	1	5	12	250-260	1	1
12	60-70	1	3.8	12	250-260	1	1.2
12	60-70	1	2.7	12	250-260	1	0.7
12	60-70	1	0.9	12	250-260	1	1
12	60-70	1	0.4	12	250-260	1	1.1
14	60-70	1	1.3	12	250-260	1	0.9
14	60-70	1	1.3	12	250-260	1	1
14	60-70	1	1.2	12	250-260	1	1.4
14	60-70	1	0.4	12	250-260	1	1.1
14	60-70	1	0.2	12	250-260	1	0.7
15	60-70	1	2.1	12	250-260	1	1
15	60-70	1	2.2	12	250-260	1	0.8
15	60-70	1	2	12	250-260	1	0.7
15	60-70	1	1.6	12	250-260	1	0.7
15	60-70	1	0.7	12	250-260	1	0.8
15	60-70	1	0.5	12	250-260	1	0.5
15	60-70	1	0.5	12	250-260	1	0.5
15	60-70	1	0.4	12	250-260	1	0.5
15	60-70	1	0.3	12	250-260	1	0.5
16	60-70	1	1.6	12	250-260	1	0.8
16	60-70	1	0.7	12	250-260	1	0.5
16	60-70	1	0.4	12	250-260	1	0.6
16	60-70	1	0.4	12	250-260	1	0.6

Table 86 cont. Quartz(ite) Bipolar Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
17	60-70	1	2.5	12	250-260	1	0.5
17	60-70	1	1	12	250-260	1	0.5
18	60-70	1	5.8	12	250-260	1	0.5
18	60-70	1	4.3	12	250-260	1	0.5
18	60-70	1	0.9	12	250-260	1	0.6
18	60-70	1	0.5	12	250-260	1	0.5
18	60-70	1	0.4	12	250-260	1	0.4
20	60-70	1	1.7	12	250-260	1	0.5
20	60-70	1	4.1	12	250-260	1	0.4
20	60-70	1	2	19	250-260	1	5.2
20	60-70	1	1.4	19	250-260	1	4.1
20	60-70	1	0.8	19	250-260	1	4.9
22	60-70	1	0.8	19	250-260	1	3.8
22	60-70	1	0.6	19	250-260	1	5.2
22	60-70	1	1.9	19	250-260	1	3.1
22	60-70	1	1.3	19	250-260	1	2.7
10	70-80	1	2.7	19	250-260	1	3.2
10	70-80	1	1.7	19	250-260	1	2.8
10	70-80	1	1.6	19	250-260	1	3.3
11	70-80	1	13	19	250-260	1	2.4
11	70-80	1	7.7	19	250-260	1	2.6
11	70-80	1	4.2	19	250-260	1	1.6
11	70-80	1	2.2	19	250-260	1	2.2
11	70-80	1	1.9	19	250-260	1	1.1
11	70-80	1	0.8	19	250-260	1	1.5
12	70-80	1	4.1	19	250-260	1	1
12	70-80	1	5.1	19	250-260	1	0.8
12	70-80	1	1.1	19	250-260	1	1.3
12	70-80	1	1.1	19	250-260	1	0.9
12	70-80	1	1	19	250-260	1	0.8
12	70-80	1	0.3	19	250-260	1	0.7
12	70-80	1	0.2	20	250-260	1	5.5
14	70-80	1	0.2	20	250-260	1	1.1
14	70-80	1	0.2	20	250-260	1	1.2
15	70-80	1	1	20	250-260	1	0.5
15	70-80	1	0.4	20	250-260	1	0.5
16	70-80	1	1.9	20	250-260	1	0.4
16	70-80	1	0.7	20	250-260	1	0.3
16	70-80	1	0.9	20	250-260	1	0.4
16	70-80	1	0.2	20	250-260	1	0.3
17	70-80	1	3.4	21	250-260	1	2.8
17	70-80	1	0.6	21	250-260	1	1.6
17	70-80	1	0.5	21	250-260	1	1.3
17	70-80	1	0.6	21	250-260	1	1.3
18	70-80	1	2.5	21	250-260	1	0.7
18	70-80	1	0.8	21	250-260	1	0.5
18	70-80	1	0.4	22	250-260	1	0.5
19	70-80	1	4.5	22	250-260	1	0.5
20	70-80	1	2.6	22	250-260	1	23
20	70-80	1	1.2	22	250-260	1	22
20	70-80	1	0.4	22	250-260	1	8.8

Table 86 cont. Quartz(ite) Bipolar Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
10	80-90	1	4.6	22	250-260	1	3.5
10	80-90	1	1.2	22	250-260	1	1.8
10	80-90	1	1.2	23	250-260	1	8.3
11	80-90	1	0.2	23	250-260	1	8.7
12	80-90	1	14.6	11	260-270	1	4.5
12	80-90	1	7.2	11	260-270	1	4.1
12	80-90	1	4.1	11	260-270	1	3.9
12	80-90	1	3.4	11	260-270	1	3.8
12	80-90	1	2.3	11	260-270	1	6.2
12	80-90	1	0.9	11	260-270	1	2.9
12	80-90	1	0.9	11	260-270	1	2.3
12	80-90	1	0.6	11	260-270	1	2.2
12	80-90	1	0.7	11	260-270	1	2.1
12	80-90	1	0.6	11	260-270	1	2.2
12	80-90	1	0.5	11	260-270	1	2.1
12	80-90	1	0.4	11	260-270	1	1.4
12	80-90	1	0.4	11	260-270	1	1.3
12	80-90	1	0.2	11	260-270	1	1.7
12	80-90	1	0.1	11	260-270	1	1.1
14	80-90	1	2.5	11	260-270	1	1
14	80-90	1	0.2	11	260-270	1	0.9
15	80-90	1	3.2	11	260-270	1	0.6
15	80-90	1	2.7	11	260-270	1	0.5
15	80-90	1	2.2	11	260-270	1	0.7
15	80-90	1	2.3	11	260-270	1	0.8
16	80-90	1	3	11	260-270	1	0.8
17	80-90	1	0.3	11	260-270	1	0.4
17	80-90	1	0.4	12	260-270	1	3.2
18	80-90	1	3.9	12	260-270	1	2.3
18	80-90	1	0.3	12	260-270	1	2.4
22	80-90	1	2.8	12	260-270	1	2.9
22	80-90	1	1.8	12	260-270	1	1
22	80-90	1	1.3	12	260-270	1	1.3
22	80-90	1	0.8	12	260-270	1	1.5
22	80-90	1	0.8	12	260-270	1	0.6
22	80-90	1	0.8	12	260-270	1	0.6
22	80-90	1	0.8	12	260-270	1	0.5
22	80-90	1	0.8	12	260-270	1	0.4
10	90-100	1	1.4	12	260-270	1	0.2
10	90-100	1	0.4	12	260-270	1	0.3
11	90-100	1	0.9	12	260-270	1	0.2
11	90-100	1	1	12	260-270	1	0.1
11	90-100	1	0.4	19	260-270	1	2.4
12	90-100	1	9.7	19	260-270	1	2.6
12	90-100	1	6.3	19	260-270	1	2
12	90-100	1	2	19	260-270	1	1.1
12	90-100	1	1.9	19	260-270	1	1.4
12	90-100	1	1.6	19	260-270	1	1
12	90-100	1	1.1	19	260-270	1	1.1
12	90-100	1	0.4	19	260-270	1	0.5
12	90-100	1	0.4	19	260-270	1	0.9

Table 86 cont. Quartz(ite) Bipolar Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
12	90-100	1	0.2	20	260-270	1	6.2
14	90-100	1	0.6	20	260-270	1	2.6
14	90-100	1	0.2	20	260-270	1	3.3
14	90-100	1	0.2	20	260-270	1	0.9
15	90-100	1	2.4	20	260-270	1	0.6
15	90-100	1	3	20	260-270	1	0.5
15	90-100	1	1.6	20	260-270	1	0.5
15	90-100	1	1.3	20	260-270	1	0.5
15	90-100	1	1.1	22	260-270	1	3.9
15	90-100	1	0.9	22	260-270	1	2.2
15	90-100	1	0.8	22	260-270	1	1.5
15	90-100	1	0.8	22	260-270	1	0.8
16	90-100	1	3.9	22	260-270	1	0.7
17	90-100	1	1.1	11	270-280	1	2.2
17	90-100	1	0.7	11	270-280	1	2.2
17	90-100	1	0.4	11	270-280	1	2.6
20	90-100	1	5.5	11	270-280	1	1.7
20	90-100	1	3.9	11	270-280	1	1.1
20	90-100	1	3.7	11	270-280	1	0.4
20	90-100	1	0.3	11	270-280	1	0.7
22	90-100	1	0.8	11	270-280	1	0.2
22	90-100	1	0.6	12	270-280	1	1.6
22	90-100	1	0.9	12	270-280	1	0.7
10	90-100	1	4.1	12	270-280	1	0.8
10	90-100	1	1.2	12	270-280	1	0.5
11	100-110	1	2.7	12	270-280	1	0.4
11	100-110	1	3.7	20	270-280	1	2.1
11	100-110	1	2.6	20	270-280	1	0.5
11	100-110	1	2.3	22	270-280	1	0.3
11	100-110	1	1.7	22	270-280	1	0.4
11	100-110	1	0.7	22	270-280	1	0.3
11	100-110	1	1.4	11	280-290	1	2.6
11	100-110	1	0.9	11	280-290	1	0.5
11	100-110	1	0.3	11	280-290	1	0.4
11	100-110	1	0.3	11	280-290	1	0.3
11	100-110	1	0.2	12	280-290	1	6
12	100-110	1	7.8	20	280-290	1	6.2
12	100-110	1	2.5	20	280-290	1	3.8
12	100-110	1	2	20	280-290	1	0.9
12	100-110	1	1.7	20	280-290	1	1.1
12	100-110	1	1.2	11	290-300	1	8.6
12	100-110	1	0.8	11	290-300	1	5.1
12	100-110	1	0.8	11	290-300	1	0.9
12	100-110	1	0.6	11	290-300	1	0.6
12	100-110	1	0.6	11	290-300	1	0.4
12	100-110	1	0.5	20	290-300	1	4.1
12	100-110	1	0.3	20	290-300	1	3.7
12	100-110	1	0.3	20	290-300	1	3.6
14	100-110	1	3.2	20	290-300	1	0.6
14	100-110	1	0.3	20	290-300	1	0.8
14	100-110	1	0.2	21	290-300	1	0.7

Table 86 cont. Quartz(ite) Bipolar Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
14	100-110	1	0.2	22	290-300	1	0.1
15	100-110	1	0.3	11	300-310	1	7.5
17	100-110	1	5.2	11	300-310	1	0.8
17	100-110	1	0.3	11	300-310	1	0.4
18	100-110	1	1.9	12	300-310	1	1.3
18	100-110	1	2	12	300-310	1	0.5
18	100-110	1	0.8	12	300-310	1	0.4
18	100-110	1	0.4	20	300-310	1	1.6
20	100-110	1	11.7	11	310-320	1	9.7
20	100-110	1	3.6	11	310-320	1	1.9
20	100-110	1	2.7	11	310-320	1	1.3
20	100-110	1	2.9	11	310-320	1	0.9
20	100-110	1	1.9	11	310-320	1	0.4
20	100-110	1	2.6	12	320-330	1	1
20	100-110	1	1	12	320-330	1	0.5
20	100-110	1	0.6	20	320-330	1	1.6
20	100-110	1	0.6	20	320-330	1	0.6
22	100-110	1	1.9	20	320-330	1	0.5
22	100-110	1	1.1	20	320-330	1	0.4
22	100-110	1	0.8	11	330-340	1	0.8
22	100-110	1	1.2	11	330-340	1	1.2
22	100-110	1	0.5	11	330-340	1	1.3
22	100-110	1	0.4	11	330-340	1	1
10	110-120	1	5.1	11	330-340	1	0.8
10	110-120	1	1.1	11	330-340	1	0.2
10	110-120	1	0.9	12	330-340	1	10.1
11	110-130	1	4.2	12	330-340	1	6.7
11	110-120	1	2.3	12	330-340	1	1.1
11	110-120	1	1.6	12	330-340	1	0.8
11	110-120	1	0.8	12	330-340	1	0.3
11	110-120	1	0.8	12	330-340	1	0.1
11	110-120	1	0.4	20	330-340	1	3.4
12	110-120	1	11	20	330-340	1	2.9
12	110-120	1	10.1	20	330-340	1	0.8
12	110-120	1	6.5	20	330-340	1	0.8
12	110-120	1	3.2	20	330-340	1	0.3
12	110-120	1	2.2	11	340-350	1	1.1
12	110-120	1	1.5	11	340-350	1	0.8
12	110-120	1	1.5	11	340-350	1	0.6
12	110-120	1	1.4	11	340-350	1	0.4
12	110-120	1	1.4	11	340-350	1	0.3
12	110-120	1	1	12	340-350	1	1.3
12	110-120	1	0.9	12	340-350	1	0.9
12	110-120	1	0.7	12	340-350	1	0.5
12	110-120	1	0.7	12	340-350	1	0.5
12	110-120	1	0.5	12	340-350	1	0.4
12	110-120	1	0.4	20	340-350	1	0.4
13	110-120	1	2.4	22	340-350	1	1.7
13	110-120	1	0.5	22	340-350	1	0.6
13	110-120	1	0.4	11	350-360	1	4
13	110-120	1	0.3	11	350-360	1	2.6

Table 86 cont. Quartz(ite) Bipolar Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
13	110-120	1	0.3	11	350-360	1	1
14	110-120	1	0.6	11	350-360	1	0.4
14	110-120	1	0.5	12	350-360	1	0.8
15	110-120	1	1.4	12	350-360	1	0.5
15	110-120	1	0.7	12	350-360	1	0.4
15	110-120	1	0.4	12	350-360	1	0.2
15	110-120	1	0.3	12	350-360	1	0.2
15	110-120	1	0.2	12	350-360	1	0.2
17	110-120	1	0.2	20	350-360	1	6.4
17	110-120	1	0.1	20	350-360	1	2.7
18	110-120	1	0.8	20	350-360	1	2.3
20	110-120	1	5	20	350-360	1	2.3
20	110-120	1	3.6	20	350-360	1	0.9
20	110-120	1	2.5	20	350-360	1	0.7
20	110-120	1	2.2	20	350-360	1	0.1
20	110-120	1	2.2	11	360-370	1	4.1
20	110-120	1	1	11	360-370	1	0.4
20	110-120	1	0.6	11	360-370	1	0.4
20	110-120	1	0.6	12	360-370	1	1.8
22	110-120	1	1.4	12	360-370	1	1.5
22	110-120	1	2.7	12	360-370	1	1
22	110-120	1	1.9	12	360-370	1	0.4
22	110-120	1	1.4	20	360-370	1	0.6
22	110-120	1	0.8	20	360-370	1	0.3
22	110-120	1	1.3	12	370-380	1	8.9
11	110-120	1	0.5	12	370-380	1	1.9
25	110-120	1	1.2	12	370-380	1	1.3
11	120-130	1	2.7	12	370-380	1	0.7
11	120-130	1	2.3	20	370-380	1	1.5
12	120-130	1	3.5	20	370-380	1	1.5
12	120-130	1	3	12	380-390	1	2.3
12	120-130	1	2.6	12	380-390	1	0.7
12	120-130	1	1.7	12	380-390	1	0.7
12	120-130	1	2.1	12	380-390	1	0.5
12	120-130	1	1.2	12	380-390	1	0.4
12	120-130	1	1.3	12	380-390	1	0.4
12	120-130	1	0.8	12	380-390	1	0.4
12	120-130	1	0.6	20	380-390	1	10.5
13	120-130	1	0.4	20	380-390	1	8.6
13	120-130	1	0.2	20	380-390	1	3
14	120-130	1	0.9	11	390-400	1	1
14	120-130	1	0.9	12	390-400	1	1.6
14	120-130	1	0.2	12	390-400	1	1
15	120-130	1	1.3	12	390-400	1	0.4
15	120-130	1	1.2	12	390-400	1	0.3
15	120-130	1	0.7	20	390-400	1	1.6
15	120-130	1	1	20	390-400	1	1.3
15	120-130	1	0.8	20	390-400	1	0.7
16	120-130	1	0.7	11/12	400-410	1	2.8
16	120-130	1	0.6	11/12	400-410	1	2.4
16	120-130	1	0.4	11/12	400-410	1	3

Table 86 cont. Quartz(ite) Bipolar Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
16	120-130	1	0.1	21	400-410	1	1.2
17	120-130	1	0.9	22	400-410	1	2.2
17	120-130	1	0.5	11/12	410-420	1	3.7
17	120-130	1	0.5	11/12	410-420	1	3.5
17	120-130	1	0.4	11/12	410-420	1	0.6
17	120-130	1	0.1	11/12	410-420	1	0.8
18	120-130	1	2.7	11/12	410-420	1	0.5
18	120-130	1	0.5	11/12	410-420	1	0.3
20	120-130	1	1	20	410-420	1	5.9
20	120-130	1	0.9	20	410-420	1	2.9
22	120-130	1	0.6	11/12	420-430	1	3.7
10	130-140	1	2.4	11/12	420-430	1	2.3
12	130-140	1	2.4	11/12	420-430	1	1
12	130-140	1	2.7	11/12	420-430	1	0.6
12	130-140	1	2.6	11/12	420-430	1	1
12	130-140	1	1.2	11/12	420-430	1	0.7
12	130-140	1	0.6	11/12	420-430	1	0.2
13	130-140	1	2.5	20	420-430	1	2.3
13	130-140	1	0.4	20	420-430	1	2.2
13	130-140	1	0.3	20	420-430	1	0.5
22	130-140	1	3.2	21	420-430	1	3.2
22	130-140	1	0.7	21	420-430	1	2
22	130-140	1	1.1	21	420-430	1	1.8
22	130-140	1	0.9	21	420-430	1	0.9
22	130-140	1	1.3	11/12	430-440	1	0.2
22	130-140	1	0.6	11/12	430-440	1	0.5
22	130-140	1	0.5	21	430-440	1	0.9
10	140-150	1	2.9	11/12	440-450	1	8
10	140-150	1	0.7	11/12	440-450	1	6.5
11	140-150	1	1.3	11/12	440-450	1	6.3
11	140-150	1	0.4	11/12	440-450	1	4
12	140-150	1	5.5	11/12	440-450	1	2.6
12	140-150	1	3.7	11/12	440-450	1	2.5
12	140-150	1	0.9	11/12	440-450	1	2
12	140-150	1	0.3	11/12	440-450	1	1.4
19	140-150	1	0.6	11/12	440-450	1	1.3
20	140-150	1	2.1	11/12	440-450	1	0.7
20	140-150	1	1.1	11/12	440-450	1	0.6
20	140-150	1	1	11/12	440-450	1	1.5
22	140-150	1	6.3	11/12	440-450	1	0.7
22	140-150	1	1.3	11/12	440-450	1	0.3
22	140-150	1	0.9	11/12	440-450	1	0.2
22	140-150	1	0.4	11/12	440-450	1	0.2
10	150-160	1	5.8	11/12	440-450	1	0.3
10	150-160	1	3	21	440-450	1	3.7
12	150-160	1	1.5	21	440-450	1	1.7
12	150-160	1	1.8	22	440-450	1	2.5
12	150-160	1	1.3	11/12	450-460	1	5.2
12	150-160	1	0.8	11/12	450-460	1	4.1
12	150-160	1	1	11/12	450-460	1	3.8
12	150-160	1	0.6	11/12	450-460	1	3.6

Table 86 cont. Quartz(ite) Bipolar Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
20	150-160	1	19.1	11/12	450-460	1	3.3
10	160-170	1	18.1	11/12	450-460	1	2.4
10	160-170	1	8.3	11/12	450-460	1	3.4
10	160-170	1	5.2	11/12	450-460	1	3.2
10	160-170	1	0.3	11/12	450-460	1	3
12	160-170	1	5.5	11/12	450-460	1	1.4
12	160-170	1	2.6	11/12	450-460	1	1
12	160-170	1	1.6	11/12	450-460	1	2
12	160-170	1	1	11/12	450-460	1	2.6
12	160-170	1	0.6	11/12	450-460	1	1.1
12	160-170	1	0.5	11/12	450-460	1	1.1
12	160-170	1	0.6	11/12	450-460	1	0.6
12	160-170	1	0.4	11/12	450-460	1	0.7
10	160-170	1	13.3	11/12	450-460	1	0.4
10	160-170	1	2.8	11/12	450-460	1	0.3
11	170-180	1	6.4	21	450-460	1	4.5
11	170-180	1	4.9	21	450-460	1	1.9
11	170-180	1	5.1	21	450-460	1	1.1
11	170-180	1	2	11/12	460-470	1	5
11	170-180	1	2	11/12	460-470	1	3.5
11	170-180	1	1.2	11/12	460-470	1	4.1
11	170-180	1	0.8	11/12	460-470	1	2.7
11	170-180	1	0.7	11/12	460-470	1	2.1
11	170-180	1	0.8	11/12	460-470	1	2
12	170-180	1	7.2	11/12	460-470	1	1.3
12	170-180	1	3.1	11/12	460-470	1	1.1
12	170-180	1	2.7	11/12	460-470	1	1.2
12	170-180	1	1.4	11/12	460-470	1	1.2
12	170-180	1	1	11/12	460-470	1	1.4
12	170-180	1	0.9	11/12	460-470	1	1.1
12	170-180	1	1.4	11/12	460-470	1	0.7
12	170-180	1	0.9	11/12	460-470	1	0.5
12	170-180	1	0.8	11/12	460-470	1	0.4
12	170-180	1	0.6	11/12	460-470	1	0.3
12	170-180	1	0.3	21	460-470	1	0.7
13	170-180	1	0.3	11/12	470-480	1	9.7
13	170-180	1	0.3	11/12	470-480	1	8.1
13	170-180	1	0.3	11/12	470-480	1	5.4
13	170-180	1	0.3	11/12	470-480	1	6
13	170-180	1	0.2	11/12	470-480	1	3.7
20	170-180	1	6.6	11/12	470-480	1	2.5
20	170-180	1	1	11/12	470-480	1	2.4
20	170-180	1	1.3	11/12	470-480	1	2.1
20	170-180	1	0.4	11/12	470-480	1	2.3
22	170-180	1	1.3	11/12	470-480	1	1.4
22	170-180	1	0.5	11/12	470-480	1	0.9
10	180-190	1	4.3	11/12	470-480	1	0.5
10	180-190	1	2.6	11/12	470-480	1	0.2
11	180-190	1	9.5	21	470-480	1	4.9
11	180-190	1	7.8	12	480-490	1	7
11	180-190	1	4.7	12	480-490	1	3.6

Table 86 cont. Quartz(ite) Bipolar Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
11	180-190	1	4.4	12	480-490	1	1.3
11	180-190	1	4.7	12	480-490	1	1.2
11	180-190	1	4	12	480-490	1	0.8
11	180-190	1	3.1	12	480-490	1	0.5
11	180-190	1	3.4	12	480-490	1	0.2
11	180-190	1	2.4	12	480-490	1	0.2
11	180-190	1	0.8	12	480-490	1	0.2
11	180-190	1	0.6	21	480-490	1	5.4
11	180-190	1	0.5	21	480-490	1	6.5
12	180-190	1	7	21	480-490	1	3.5
12	180-190	1	2.5	21	480-490	1	0.6
12	180-190	1	1.4	12	490-500	1	0.6
12	180-190	1	1	12	490-500	1	0.6
12	180-190	1	0.8	21	490-500	1	3.8
13	180-190	1	0.7	12	500-510	1	6.4
20	180-190	1	0.8	12	500-510	1	1.9
22	180-190	1	0.5	12	500-510	1	1.3
22	180-190	1	0.3	12	500-510	1	0.7
22	180-190	1	0.3	12	500-510	1	0.6
22	180-190	1	0.3	21	500-510	1	2.2
10	190-200	1	16.8	12	510-520	1	1.4
11	190-200	1	5.1	12	510-520	1	1.3
11	190-200	1	2.9	12	510-520	1	0.8
11	190-200	1	2.8	12	510-520	1	0.7
11	190-200	1	0.3	21	510-520	1	1.9
12	190-200	1	4.7	12	520-530	1	9.8
12	190-200	1	1.5	12	520-530	1	2.9
12	190-200	1	1.4	12	520-530	1	1.6
12	190-200	1	1.2	12	520-530	1	1.3
12	190-200	1	1.3	12	520-530	1	1
12	190-200	1	0.7	12	520-530	1	0.6
12	190-200	1	0.8	12	520-530	1	0.5
12	190-200	1	0.3	12	520-530	1	0.4
12	190-200	1	0.3	21	520-530	1	0.4
12	190-200	1	0.3	21	520-530	1	2.3
12	190-200	1	0.2	23	520-530	1	10.5
12	190-200	1	0.1	12	530-540	1	9.7
20	190-200	1	2.3	12	530-540	1	2.7
20	190-200	1	1.5	12	530-540	1	1.1
22	190-200	1	2.5	12	530-540	1	0.5
22	190-200	1	1.5	12	530-540	1	0.2
22	190-200	1	2.2	21	530-540	1	1.3
22	190-200	1	0.5	21	530-540	1	0.9
11	200-210	1	2.6	21	530-540	1	0.8
11	200-210	1	1.8	21	530-540	1	0.3
11	200-210	1	2.2	12	540-550	1	6.8
11	200-210	1	0.7	12	540-550	1	1
12	200-210	1	3	12	540-550	1	0.5
12	200-210	1	2.2	12	540-550	1	0.4
12	200-210	1	1.5	12	540-550	1	0.3
12	200-210	1	0.9	12	540-550	1	0.2

Table 86 cont. Quartz(ite) Bipolar Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
12	200-210	1	0.8	21	540-550	1	1.4
20	200-210	1	5	12	550-560	1	1.4
20	200-210	1	3.5	12	550-560	1	1.6
20	200-210	1	1.9	12	550-560	1	0.7
20	200-210	1	1.2	12	550-560	1	0.2
22	200-210	1	1.9	12	560-570	1	3.5
22	200-210	1	1.7	12	560-570	1	1.7
22	200-210	1	1	12	560-570	1	0.8
22	200-210	1	0.6	12	560-570	1	0.5
10	210-220	1	1.1	12	560-570	1	0.4
10	210-220	1	0.5	21	560-570	1	2.2
11	210-220	1	5.9	21	560-570	1	1.7
11	210-220	1	3.2	21	560-570	1	0.6
11	210-220	1	4.4	21	580-590	1	0.6
11	210-220	1	3.6	12	590-600	1	2.8
11	210-220	1	2.2	12	590-600	1	1.8
11	210-220	1	1.1	12	590-600	1	1.3
11	210-220	1	1	12	590-600	1	1
11	210-220	1	0.7	12	590-600	1	0.6
11	210-220	1	1.1	12	590-600	1	0.5
11	210-220	1	1	12	590-600	1	0.5
11	210-220	1	0.4	12	590-600	1	0.2
11	210-220	1	0.3	21	590-600	1	9.3
12	210-220	1	0.4	21	600-610	1	20.7
12	210-220	1	0.3	21	600-610	1	6
22	210-220	1	1.7	21	600-610	1	2.4
22	210-220	1	0.8	21	600-610	1	1.2
22	210-220	1	0.9	21	600-610	1	0.8
22	210-220	1	0.7	21	600-610	1	0.4
10	220-230	1	3.6	21	610-620	1	1.5
10	220-230	1	0.8	21	610-620	1	0.8
11	220-230	1	11.7	21	610-620	1	0.4
11	220-230	1	2.8	12	620-630	1	2
11	220-230	1	1.3	12	620-630	1	0.9
11	220-230	1	1.5	12	620-630	1	0.4
11	220-230	1	0.7	12	620-630	1	0.3
11	220-230	1	0.5	12	620-630	1	0.2
11	220-230	1	0.6	12	620-630	1	0.2
				12	670-680	1	3.7

Totals: 1303 2576 gm Avg. Wt. 1.977 gm

Lower Fish
200-300 cm 405 782.4 gm Avg. Wt. 1.932 gm

Large Blade
300-420 cm 109 187.7 gm Avg. Wt. 1.722 gm

Upper MSA
420-450 cm 39 79.8 gm Avg. Wt. 2.046 gm

Table 87 Quartz(ite) Minimal Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
11	0-10	1	6.3	22	140-150	1	12.3
13	0-10	1	9.4	22	140-150	1	17.9
13	0-10	1	2.3	22	140-150	1	5.9
13	0-10	1	1.7	22	140-150	1	5
24	0-10	1	43.9	22	140-150	1	5
29	0-10	1	4	22	140-150	1	4.1
13	10-20	1	2	22	140-150	1	2.6
21	10-20	1	9.3	25	140-150	1	3.5
22	10-20	1	5.4	26	140-150	1	17
19	20-30	1	40	28	140-150	1	10.7
19	20-30	1	1.8	28	140-150	1	4
19	20-30	1	7.9	29	140-150	1	31.3
19	20-30	1	6.4	19	150-160	1	4.5
19	20-30	1	4.5	21	150-160	1	1.7
19	20-30	1	2.2	21	150-160	1	1.5
20	20-30	1	7.3	22	150-160	1	4.3
20	20-30	1	5.4	23	150-160	1	19.8
21	20-30	1	10.4	11	160-170	1	1.4
21	20-30	1	2.4	19	160-170	1	12.9
23	20-30	1	8.3	19	160-170	1	4.9
23	20-30	1	2.9	19	160-170	1	3.7
10	30-40	1	8.4	19	160-170	1	7.2
11	30-40	1	13	21	160-170	1	1.7
13	30-40	1	4.1	23	160-170	1	2.9
16	30-40	1	1.2	10	170-180	1	3.1
20	30-40	1	1.2	20	170-180	1	4.8
21	30-40	1	7.9	21	180-190	1	29
21	30-40	1	5.7	22	180-190	1	56.8
21	30-40	1	2.1	19	190-200	1	24.8
21	30-40	1	1.8	19	190-200	1	21.7
22	30-40	1	100	21	190-200	1	1.6
23	30-40	1	48.7	22	190-200	1	9.1
23	30-40	1	18.3	19	210-220	1	37.4
23	30-40	1	1.9	20	210-220	1	5.5
27	30-40	1	2	23	210-220	1	4.1
28	30-40	1	9	23	210-220	1	3.7
19	40-50	1	5.9	19	220-230	1	2.5
20	40-50	1	0.4	21	220-230	1	1.1
20	40-50	1	7.5	21	220-230	1	1.8
20	40-50	1	2.2	10	230-240	1	3.7
21	40-50	1	6.7	11	230-240	1	5.3
21	40-50	1	4.4	11	230-240	1	5.2
22	40-50	1	2.5	11	230-240	1	4.3
23	40-50	1	18.1	19	230-240	1	56.3
23	40-50	1	4.2	19	230-240	1	22
23	40-50	1	2.2	20	230-240	1	6.4
23	40-50	1	2.6	21	230-240	1	3.5
23	40-50	1	5.7	23	230-240	1	7.1
23	40-50	1	34.4	23	230-240	1	6.3
23	40-50	1	6.3	19	240-250	1	4
23	40-50	1	5.4	19	240-250	1	1.9

Table 87 cont. Quartz(ite) Minimal Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
23	40-50	1	4.8	22	240-250	1	4.1
23	40-50	1	3.6	22	240-250	1	3.2
23	40-50	1	2.6	22	240-250	1	2.9
25	40-50	1	2.8	22	240-250	1	2.5
28	40-50	1	1.8	22	240-250	1	2
19	50-60	1	6.9	23	240-250	1	3.2
19	50-60	1	4.5	23	240-250	1	3.2
20	50-60	1	8.7	11	250-260	1	3.4
21	50-60	1	8.5	19	250-260	1	11.7
21	50-60	1	3.5	19	250-260	1	7.3
21	50-60	1	5.4	19	250-260	1	6.1
22	50-60	1	10.5	19	250-260	1	5.8
23	50-60	1	10.5	19	250-260	1	7.5
23	50-60	1	10	21	250-260	1	5.1
23	50-60	1	5.2	21	250-260	1	3.8
23	50-60	1	1.5	21	250-260	1	11.7
24	50-60	1	15.8	23	250-260	1	22.8
24	50-60	1	16.8	11	250-260	1	10.6
24	50-60	1	24.5	19	260-270	1	3.5
25	50-60	1	30.5	22	260-270	1	5.5
25	50-60	1	12.9	22	260-270	1	1.5
27	50-60	1	10.6	23	260-270	1	6.7
27	50-60	1	11.2	21	270-280	1	4.4
28	50-60	1	8.5	22	270-280	1	8.3
20	60-70	1	9.8	22	270-280	1	6.5
21	60-70	1	6.3	22	280-290	1	12.3
22	60-70	1	16.9	22	280-290	1	3.8
22	60-70	1	21.2	23	280-290	1	12.3
22	60-70	1	5.3	23	280-290	1	4.8
22	60-70	1	6.1	21	290-300	1	13
23	60-70	1	4.3	21	290-300	1	7.6
23	60-70	1	3.4	22	290-300	1	37.6
24	60-70	1	2.5	22	290-300	1	5.5
19	70-80	1	24.2	22	290-300	1	12.2
19	70-80	1	13.3	22	290-300	1	4.3
20	70-80	1	5.2	23	290-300	1	9.6
20	70-80	1	3.4	23	290-300	1	6.4
21	70-80	1	1.8	22	300-310	1	7.1
22	70-80	1	5.3	11	310-320	1	7.9
23	70-80	1	28.2	11	310-320	1	4.1
23	70-80	1	46.5	21	310-320	1	5
23	70-80	1	8.8	23	310-320	1	18.3
25	70-80	1	32.1	21	320-330	1	3.9
27	70-80	1	10.3	21	320-330	1	3
11	80-90	1	8.9	23	320-330	1	40.8
19	80-90	1	10.8	21	330-340	1	2.4
19	80-90	1	19	22	330-340	1	3.3
19	80-90	1	10.2	22	330-340	1	3.1
19	80-90	1	3.4	22	330-340	1	4
19	80-90	1	4.9	21	340-350	1	4.1
19	80-90	1	2.3	22	340-350	1	42.8

Table 87 cont. Quartz(ite) Minimal Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
21	80-90	1	3.3	21	350-360	1	10.4
21	80-90	1	4.9	22	350-360	1	14.8
22	80-90	1	12.6	21	360-370	1	23.7
22	80-90	1	5.8	21	360-370	1	15.2
23	80-90	1	5.4	22	360-370	1	12.2
25	80-90	1	12.2	22	370-380	1	36.2
25	80-90	1	6	22	370-380	1	6.3
10	90-100	1	53.8	22	370-380	1	3.2
11	90-100	1	152.2	11	380-390	1	12.3
19	90-100	1	28.5	20	380-390	1	3
19	90-100	1	10.9	22	380-390	1	6.5
20	90-100	1	3	22	380-390	1	7.2
21	90-100	1	56.7	22	390-400	1	12.9
21	90-100	1	7.8	22	390-400	1	10.4
21	90-100	1	7.4	22	390-400	1	4.5
21	90-100	1	5.5	23	390-400	1	50.4
22	90-100	1	4.9	22	400-410	1	4.1
22	90-100	1	5.1	22	400-410	1	3.7
22	90-100	1	3.9	22	410-420	1	3.2
22	90-100	1	4.9	23	410-420	1	14.8
20	100-110	1	2.5	21	420-430	1	3.4
21	100-110	1	10.6	23	420-430	1	90.9
21	100-110	1	2.6	23	420-430	1	11.3
21	100-110	1	1.3	22	440-450	1	5.5
23	100-110	1	9	23	440-450	1	8.5
24	100-110	1	59.4	23	440-450	1	5
24	100-110	1	4.7	22	450-460	1	7
21	110-120	1	3.6	22	450-460	1	3
22	110-120	1	3	21	460-470	1	2.6
23	110-120	1	10.6	22	460-470	1	16.5
25	110-120	1	16.2	11/12	470-480	1	2.9
29	110-120	1	18.7	23	470-480	1	31.5
21	120-130	1	3.9	22	480-490	1	72.4
22	120-130	1	34	22	490-500	1	2.4
22	120-130	1	4.4	22	500-510	1	2.7
24	120-130	1	2.3	22	510-520	1	5.4
25	120-130	1	2.2	23	520-530	1	6
10	130-140	1	2.7	23	530-540	1	5.1
19	130-140	1	8.8	23	530-540	1	8.7
19	130-140	1	13.8	23	540-550	1	7.1
20	130-140	1	2.7	12	560-570	1	3.8
21	130-140	1	1.7	23	560-570	1	5.7
22	130-140	1	25.9	23	560-570	1	3.1
22	130-140	1	4.8	21	570-580	1	4.2
22	130-140	1	6	12	580-590	1	12.9
24	130-140	1	6.4	23	650-660	1	17
25	130-140	1	8.7	23	650-660	1	10.5
27	130-140	1	6.1	23	670-680	1	120.8
27	130-140	1	3	23	670-680	1	26.5
20	140-150	1	7.1	23	680-690	1	5.6
20	140-150	1	7.9	23	680-690	1	8

Table 87 cont. Quartz(ite) Minimal Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
20	140-150	1	4.9	23	690-700	1	119.8
22	140-150	1	15.2	23	690-700	1	150.2
				23	690-700	1	42.5

Totals:	311	3797.9 gm	Avg. Wt.	12.21 gm
Early LSA 200-300 cm	56	464.8 gm	Avg. Wt.	8.3 gm
Large Blade 300-420 cm	34	404.8 gm	Avg. Wt.	11.91 gm
Upper MSA 420-450 cm	6	124.6	Avg. Wt.	20.77 gm

Table 88 Quartz(ite) Flat Bladelet Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
12	0-10	1	0.5	11	120-130	1	0.6
12	0-10	1	0.5	11	120-130	1	0.4
14	0-10	1	0.2	12	120-130	1	1.2
17	0-10	1	0.6	12	120-130	1	0.2
12	10-20	1	1	13	120-130	1	0.4
12	10-20	1	1	14	120-130	1	1
12	10-20	1	0.4	14	120-130	1	0.9
12	10-20	1	0.4	14	120-130	1	0.7
15	10-20	1	0.5	14	120-130	1	0.4
15	10-20	1	0.1	14	120-130	1	0.2
16	10-20	1	0.1	15	120-130	1	0.4
17	10-20	1	0.7	16	120-130	1	0.3
12	20-30	1	0.2	17	120-130	1	0.7
15	20-30	1	1	17	120-130	1	0.6
16	20-30	1	0.4	18	120-130	1	1.1
17	20-30	1	0.3	18	120-130	1	0.5
12	30-40	1	0.6	18	120-130	1	0.2
14	30-40	1	0.7	12	130-140	1	0.4
14	30-40	1	0.6	13	130-140	1	2.6
15	30-40	1	0.2	12	140-150	1	0.5
12	40-50	1	0.9	12	140-150	1	0.3
13	40-50	1	1.8	13	140-150	1	3.1
14	40-50	1	0.6	13	150-160	1	1.9
16	40-50	1	0.5	10	160-170	1	0.7
17	40-50	1	0.9	12	160-170	1	1.4
17	40-50	1	0.2	10	170-180	1	3.3
18	40-50	1	0.3	11	170-180	1	0.4
11	50-60	1	1.4	12	170-180	1	0.5
11	50-60	1	0.7	12	170-180	1	0.2
14	50-60	1	1.3	11	180-190	1	0.8
14	50-60	1	1.2	12	180-190	1	1.5
15	50-60	1	0.3	12	180-190	1	1.5
16	50-60	1	2.7	12	180-190	1	0.1
16	50-60	1	1.1	12	190-200	1	1.2
16	50-60	1	0.5	12	190-200	1	0.8
16	50-60	1	0.4	12	190-200	1	0.8
16	50-60	1	0.1	12	190-200	1	0.2
17	50-60	1	1	11	200-210	1	1.6
17	50-60	1	0.6	12	200-210	1	0.5
17	50-60	1	0.5	12	200-210	1	0.1
18	50-60	1	0.9	11	210-220	1	0.6
18	50-60	1	0.9	11	210-220	1	0.3
11	60-70	1	0.5	11	220-230	1	0.4
11	60-70	1	0.6	12	220-230	1	0.5
11	60-70	1	0.5	12	220-230	1	0.7
12	60-70	1	3.2	11	230-240	1	0.7
12	60-70	1	0.6	11	230-240	1	0.3
12	60-70	1	0.5	12	230-240	1	0.7
14	60-70	1	1.6	12	230-240	1	0.4
14	60-70	1	1.1	11	240-250	1	0.8
14	60-70	1	0.4	12	240-250	1	0.7

Table 88 cont. Quartz(ite) Flat Bladelet Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
14	60-70	1	0.2	12	240-250	1	0.5
15	60-70	1	1.6	12	240-250	1	3.4
15	60-70	1	0.5	12	240-250	1	0.5
15	60-70	1	0.4	12	240-250	1	0.4
15	60-70	1	0.3	11	250-260	1	1
16	60-70	1	0.3	11	250-260	1	0.8
17	60-70	1	1.7	11	250-260	1	0.4
17	60-70	1	0.4	11	250-260	1	0.3
17	60-70	1	0.6	11	250-260	1	0.2
11	70-80	1	0.7	12	250-260	1	1.4
11	70-80	1	0.5	12	250-260	1	1
12	70-80	1	2.7	12	250-260	1	1.1
12	70-80	1	1.2	12	250-260	1	0.7
12	70-80	1	1.1	12	250-260	1	0.5
12	70-80	1	0.9	12	250-260	1	0.4
12	70-80	1	0.7	12	250-260	1	0.5
12	70-80	1	0.6	12	250-260	1	0.5
12	70-80	1	0.3	12	250-260	1	0.3
12	70-80	1	0.3	12	250-260	1	0.3
14	70-80	1	2.2	11	260-270	1	1.9
14	70-80	1	0.7	12	260-270	1	1.4
14	70-80	1	0.1	12	260-270	1	0.8
15	70-80	1	1.6	12	260-270	1	0.6
15	70-80	1	0.6	12	260-270	1	0.4
15	70-80	1	0.3	12	260-270	1	0.4
15	70-80	1	0.2	11	270-280	1	1.5
16	70-80	1	1.4	11	270-280	1	1.6
17	70-80	1	0.7	11	270-280	1	0.2
17	70-80	1	0.2	12	270-280	1	1.6
18	70-80	1	0.8	12	270-280	1	0.5
11	80-90	1	1.1	12	270-280	1	0.5
11	80-90	1	0.7	12	280-290	1	0.5
12	80-90	1	0.2	12	290-300	1	0.2
14	80-90	1	0.7	11	300-310	1	0.6
14	80-90	1	0.3	12	300-310	1	1.2
15	80-90	1	1	12	320-330	1	0.5
15	80-90	1	0.4	12	320-330	1	0.3
16	80-90	1	0.3	12	320-330	1	0.4
17	80-90	1	0.5	12	320-330	1	0.3
18	80-90	1	0.3	12	330-340	1	0.4
11	90-100	1	2.1	12	330-340	1	0.1
11	90-100	1	0.6	12	330-340	1	0.1
12	90-100	1	0.7	11	340-350	1	0.8
12	90-100	1	0.5	11	340-350	1	0.4
15	90-100	1	0.2	12	340-350	1	3
18	90-100	1	0.8	12	340-350	1	1.2
10	100-110	1	2	12	340-350	1	0.3
11	100-110	1	1.4	12	340-350	1	0.2
11	100-110	1	0.6	11	350-360	1	0.8
12	100-110	1	0.4	11	350-360	1	0.9
12	100-110	1	0.3	12	350-360	1	0.6

Table 88 cont. Quartz(ite) Flat Bladelet Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
12	100-110	1	0.3	12	360-370	1	0.1
12	100-110	1	0.2	12	370-380	1	1
14	100-110	1	2.3	12	370-380	1	0.5
14	100-110	1	0.8	12	380-390	1	0.6
14	100-110	1	0.7	11	390-400	1	2
14	100-110	1	0.4	11	390-400	1	1
14	100-110	1	0.2	12	390-400	1	0.5
14	100-110	1	0.2	11/12	420-430	1	1.8
15	100-110	1	1.8	11/12	420-430	1	0.4
15	100-110	1	0.5	11/12	440-450	1	3
15	100-110	1	0.3	11/12	450-460	1	1.8
16	100-110	1	0.4	11/12	450-460	1	0.6
18	100-110	1	1	11/12	450-460	1	0.3
18	100-110	1	0.7	11/12	450-460	1	0.3
18	100-110	1	0.2	11/12	460-470	1	1.5
10	110-120	1	0.9	11/12	460-470	1	1.1
10	110-120	1	0.5	11/12	460-470	1	1.4
11	110-120	1	1.9	11/12	460-470	1	0.7
11	110-120	1	0.6	11/12	460-470	1	0.4
11	110-120	1	0.4	11/12	460-470	1	0.6
11	110-120	1	0.5	11/12	460-470	1	0.4
12	110-120	1	0.4	11/12	460-470	1	0.3
12	110-120	1	0.3	11/12	460-470	1	0.2
12	110-120	1	0.1	11/12	460-470	1	0.2
13	110-120	1	0.3	11/12	460-470	1	0.1
14	110-120	1	2.2	11/12	460-470	1	0.1
14	110-120	1	3.9	11/12	470-480	1	1
15	110-120	1	1.2	11/12	470-480	1	0.6
15	110-120	1	1.2	11/12	470-480	1	0.6
15	110-120	1	1	11/12	470-480	1	0.4
15	110-120	1	0.4	11/12	470-480	1	0.3
15	110-120	1	0.4	12	480-490	1	0.5
15	110-120	1	0.3	12	490-500	1	0.6
15	110-120	1	0.2	12	500-510	1	1.3
17	110-120	1	0.6	12	510-520	1	2.6
17	110-120	1	0.6	12	510-520	1	0.3
11	120-130	1	3.1	12	520-530	1	1.7
				12	540-550	1	1.7

Totals: 275 218.9 gm Avg. Wt. .0796 gm

Early LSA
200-300 cm 47 34.6 gm Avg. Wt. .736 gm

Large Blade
300-420 cm 25 17.8 gm Avg. Wt. .712 gm

Upper MSA
420-450 cm 3 5.2 gm Avg. Wt. 1.733 gm

Table 89 Quartz(ite) Single Platform Cores

Square	Depth	R.M.	Wt.gms
17	10-20	1	2
16	10-20	1	4.8
18	20-30	1	1.8
16	30-40	1	11
12	40-50	1	3.2
17	40-50	1	2.5
15	50-60	1	9
11	60-70	1	18.7
15	60-70	1	6.1
16	60-70	1	1.5
13	70-80	1	1.9
16	70-80	1	3.7
18	70-80	1	1.8
15	80-90	1	4.2
12	90-100	1	3
16	90-100	1	2.1
15	120-130	1	1.5
13	180-190	1	1.5
11	360-370	1	16.9
11/12	440-450	1	23.8
11/12	440-450	1	15.7

Totals: 21 136.7 gm Avg. Wt. 6.51 gm

Early LSA
200-300 cm None

Large Blade
300-420 cm 1 Avg. Wt. 16.9 gm

Upper MSA
420-450 cm 2 Avg. Wt. 19.75 gm

Table 90 Quartz(ite) Radial-Disc Cores

Square	Depth	R.M.	Wt.gms
20	70-80	1	8.6
14	120-130	1	2.1
21	250-260	1	11.7
21	440-450	1	2.9
11/12	460-470	1	5.7
11/12	470-480	1	9.1
11/12	470-480	1	4

Totals: 7 44.1 gm Avg. Wt. 6.3 gm

Early LSA
200-300 cm 1 11.7 gm Avg. Wt. 11.7gm

Large Blade
300-420 cm None

Upper MSA
420-450 cm 1 2.9 gm Avg. Wt. 2.9 gm

Table 91 Quartz(ite) Levallois Cores

Square	Depth	R.M.	Wt.gms
20	170-180	1	16
21	560-570	1	6.4
21	610-620	1	2.5
12	620-630	1	9.9
Totals:		4	34.8 gm

Early LSA
200-300 cm None

Large Blade
300-420 cm None

Upper MSA
420-450 cm None

Table 92 Quartz(ite) Multi - Platform Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
15	0-10	1	0.9	12	250-260	1	8.5
14	10-20	1	3.5	12	250-260	1	3.8
25	10-20	1	27.4	12	250-260	1	2.6
14	30-40	1	2.6	19	250-260	1	13
14	30-40	1	2.5	19	250-260	1	9.1
16	30-40	1	3.8	19	250-260	1	7.7
12	40-50	1	18.3	20	250-260	1	4.8
12	40-50	1	9.5	20	250-260	1	4.9
12	40-50	1	9.2	21	250-260	1	7.6
12	40-50	1	9.1	21	250-260	1	7.6
13	40-50	1	102.1	11	260-270	1	48.8
13	40-50	1	16.9	12	260-270	1	2.5
18	40-50	1	2.6	19	260-270	1	12.2
10	50-60	1	9.3	19	260-270	1	8.5
14	50-60	1	3	22	260-270	1	26
14	50-60	1	1.7	22	260-270	1	10.2
15	50-60	1	4.1	11	270-280	1	12
15	50-60	1	2	21	270-280	1	9.7
15	60-70	1	6.6	22	270-280	1	14.7
16	60-70	1	1.3	22	270-280	1	9.2
17	60-70	1	16.8	11	280-290	1	6.8
17	60-70	1	14.8	21	300-310	1	6
12	70-80	1	23.5	11	310-320	1	22.4
14	70-80	1	6.7	21	310-320	1	10.9
14	70-80	1	4.7	23	310-320	1	11.2
15	70-80	1	10.2	21	320-330	1	45.4
15	70-80	1	5.1	12	330-340	1	14.1
17	70-80	1	9.7	11	340-350	1	5.9
17	70-80	1	8.2	12	340-350	1	3.1
17	70-80	1	2.8	23	340-350	1	25.2
18	70-80	1	26	22	350-360	1	8.2
22	70-80	1	23.1	22	360-370	1	10.7

Table 92 cont. Quartz(ite) Multi - Platform Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
14	80-90	1	2.4	22	370-380	1	8.4
15	80-90	1	4.3	12	380-390	1	8.7
12	90-100	1	9.5	22	380-390	1	14.8
17	90-100	1	4.1	23	380-390	1	9.6
12	100-110	1	1.8	12	390-400	1	2.4
16	100-110	1	2.4	22	390-400	1	24.4
16	100-110	1	0.6	22	390-400	1	18.2
18	100-110	1	5.7	22	390-400	1	16.8
22	100-110	1	13	21	400-410	1	13.6
22	100-110	1	10	22	400-410	1	20.5
22	100-110	1	8	22	400-410	1	8.9
24	100-110	1	8.1	23	400-410	1	10.5
11	110-120	1	2.5	20	410-420	1	8.1
12	110-120	1	6.4	22	410-420	1	8.3
18	110-120	1	4.7	23	410-420	1	10.4
22	110-120	1	7.1	11/12	420-430	1	21.9
23	110-120	1	9.8	11/12	420-430	1	18.5
14	120-130	1	8.3	22	420-430	1	16.8
15	120-130	1	3.7	23	420-430	1	14.5
15	120-130	1	0.8	11/12	430-440	1	31.1
17	120-130	1	5.6	22	440-450	1	17.1
18	120-130	1	3.9	22	440-450	1	8.1
18	120-130	1	1	23	440-450	1	33
21	120-130	1	17.8	23	440-450	1	11.5
23	120-130	1	4.1	23	440-450	1	12
23	120-130	1	3.8	11/12	450-460	1	20.3
26	120-130	1	12.6	11/12	450-460	1	19.4
19	130-140	1	5.5	11/12	450-460	1	22.4
12	150-160	1	3	11/12	450-460	1	7.5
19	160-170	1	3.9	22	450-460	1	34.6
23	160-170	1	11.8	22	450-460	1	12.2
12	170-180	1	5.5	11/12	460-470	1	14.5
11	180-190	1	22.1	11/12	460-470	1	10
12	180-190	1	16.3	11/12	460-470	1	4.2
13	180-190	1	5.7	21	460-470	1	7.4
22	190-200	1	15	11/12	470-480	1	6.7
23	190-200	1	15.5	11/12	470-480	1	7.4
23	190-200	1	10.3	11/12	470-480	1	4.3
11	200-210	1	18.4	1/21	480-490	1	12.9
22	200-210	1	4.2	22	480-490	1	8.8
22	200-210	1	4.1	22	490-500	1	21
23	210-220	1	11.8	23	500-510	1	14.4
23	210-220	1	6.8	22	510-520	1	20
11	220-230	1	1.3	22	510-520	1	10
12	220-230	1	5.1	12	530-540	1	7.3
20	220-230	1	7.3	23	530-540	1	14
10	230-240	1	18.2	12	540-550	1	11.3
11	230-240	1	21.2	21	540-550	1	11.8
11	230-240	1	14.1	23	540-550	1	8
12	230-240	1	8.1	12	550-560	1	3.6
20	230-240	1	27.2	23	550-560	1	3.5

Table 92 cont. Quartz(ite) Multi - Platform Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
23	230-240	1	19.3	12	560-570	1	32.3
20	240-250	1	7	12	560-570	1	5.4
21	240-250	1	28.4	21	560-570	1	40.5
21	240-250	1	6	23	560-570	1	7.1
22	240-250	1	11.2	12	570-580	1	18.9
22	240-250	1	8.1	12	570-580	1	2.7
22	240-250	1	4.5	12	590-600	1	6.2
22	240-250	1	9.7	23	650-660	1	6.9
22	240-250	1	5.1	23	670-680	1	25.3
				23	680-690	1	8.5

Totals:	185	2144.4 gm	Avg. Wt.	11.59 gm
Early LSA 200-300cm	43	477.3 gm	Avg. Wt.	11.1 gm
Large Blade 300-420 cm	26	346.7 gm	Avg. Wt.	13.33 gm
Upper MSA 420-450 cm	10	184.5 gm	Avg. Wt.	18.45 gm

Table 93 Quartz(ite) Bladelet Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
15	0-10	1	0.4	12	160-170	1	5.5
14	10-20	1	1.4	13	170-180	1	2.6
10	50-60	1	1.3	12	180-190	1	2.1
13	50-60	1	0.3	20	180-190	1	0.9
14	50-60	1	1.7	20	210-220	1	0.2
13	60-70	1	1.3	11	230-240	1	1
20	60-70	1	4.6	12	230-240	1	2.6
17	70-80	1	0.4	21	230-240	1	0.7
19	70-80	1	0.4	21	230-240	1	0.6
12	80-90	1	0.5	21	230-240	1	1.8
20	100-110	1	1.4	21	240-250	1	0.6
12	110-120	1	0.9	21	240-250	1	0.8
13	110-120	1	0.6	21	250-260	1	0.3
13	110-120	1	0.6	19	260-270	1	1.1
15	110-120	1	3.2	21	260-270	1	1
17	110-120	1	0.7	22	340-350	1	1.4
21	150-160	1	0.5	11/12	430-440	1	1.9
				11/12	440-450	1	0.7

Totals: 35 46 gm Avg. Wt. 1.31 gm

Early LSA
200-300 cm 11 10.7 gm Avg. Wt. .97 gm

Large Blade
300-420 cm 1 1.4 gm Avg. Wt. 1.4 gm

Upper MSA
420-450 cm 2 2.6 gm Avg. Wt. 1.3 gm

Table 94 Quartz(ite) Blade Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
10	180-190	1	21.6	11/12	450-460	1	3 B.P.
21	180-190	1	4.5	11/12	450-460	1	2.1 B.P.
21	340-350	1	8.4	11/12	460-470	1	3.6 B.P.
21	430-440	1	15.1	11/12	470-480	1	2.9 B.P.
21	430-440	1	3.5	11/12	470-480	1	3.2 B.P.
21	440-450	1	3.9	12	480-490	1	7.9
11/12	440-450	1	3.1 B.P.	12	520-530	1	5.7
11/12	450-460	1	4.4 B.P.	12	530-540	1	3.5 B.P.
11/12	450-460	1	3.6 B.P.	12	650-660	1	8.8

Totals: 18 108.8 gm Avg. Wt. 6.044 gm

Early LSA
200-300 cm None

Large Blade
300-420 cm 1 8.4 gm Avg. Wt. 8.4 gm

Upper MSA
420-450 cm 4 25.6 gm Avg. Wt. 6.4 gm

Table 95 Quartz(ite) Core Reduced Pieces

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
12	20-30	1	0.9	21	150-160	1	0.5
12	20-30	1	0.9	12	170-180	1	1.1
11	40-50	1	0.5	12	170-180	1	1.1
21	40-50	1	1.4	10	220-230	1	2.3
21	40-50	1	1	10	220-230	1	1.8
11	50-60	1	2.1	10	230-240	1	1.9
21	50-60	1	2.4	10	230-240	1	2.8
21	50-60	1	1.9	11	230-240	1	1.4
21	50-60	1	1.3	21	240-250	1	1.9
12	60-70	1	2.1	21	240-250	1	2.6
22	60-70	1	1.6	21	240-250	1	1.6
22	60-70	1	2.6	22	240-250	1	1.3
22	60-70	1	2.4	22	240-250	1	1.9
22	60-70	1	1.8	21	250-260	1	0.6
13	70-80	1	0.4	21	250-260	1	0.3
14	70-80	1	1.1	21	250-260	1	0.4
22	70-80	1	1.2	12	260-270	1	1.9
23	70-80	1	3	21	260-270	1	0.8
10	80-90	1	0.9	21	260-270	1	1.4
12	80-90	1	1	23	260-270	1	1.5
21	80-90	1	1.2	11	270-280	1	0.6
21	80-90	1	0.9	19	270-280	1	1.9
10	90-100	1	1.5	19	270-280	1	0.9
19	90-100	1	2.1	21	270-280	1	2
21	90-100	1	3.2	21	280-290	1	0.9
21	90-100	1	1.9	21	290-300	1	1.5
21	90-100	1	0.7	22	290-300	1	2.5
21	90-100	1	0.7	22	290-300	1	1.6
21	90-100	1	0.5	21	300-310	1	2.1
12	100-110	1	1.1	21	330-340	1	1.3
12	100-110	1	0.5	22	340-350	1	1.8
12	100-110	1	0.3	22	340-350	1	2.8
25	100-110	1	2.2	22	350-360	1	3.2
25	100-110	1	0.7	22	350-360	1	0.8
14	110-120	1	2	22	380-390	1	1
20	110-120	1	1.4	21	410-420	1	1
20	110-120	1	0.8	21	410-420	1	0.4
20	110-120	1	0.5	21	420-430	1	1.8
20	110-120	1	1.2	21	430-440	1	1.3
20	110-120	1	0.5	21	440-450	1	0.6
21	110-120	1	1.3	11/12	450-460	1	1.1
21	110-120	1	0.7	11/12	470-480	1	1.6
21	120-130	1	1.1	22	470-480	1	2.3
23	120-130	1	1.4	22	480-490	1	0.6
12	130-140	1	1.8	23	620-630	1	1.5
21	130-140	1	1	23	640-650	1	1.4
21	130-140	1	0.8	23	690-700	1	2.7
Totals:		94	132.8 gm		Avg. Wt.		1.41 gm
200-300 (ELSA)		25	38.3 gm		Avg. Wt.		1.53 gm
300-420 (LB)		9	14.4 gm		Avg. Wt.		1.6 gm
420-450 (UMSA)		3	3.7 gm		Avg. Wt.		1.23 gm

Table 96 Non-Quartz Single Platform Cores

Square	Depth	R.M.	Wt. gms	Square	Depth	R.M.	Wt. gms
17	50-60	2	1	11	170-180	7	4.3
15	90-100	2	2.6	21	180-190	7	44
15	100-110	2	4.7	12	190-200	7	4.8
18	100-110	2	1.1	12	190-200	7	1.4
13	110-120	2	2.3	12	570-580	7	1.7
11	120-130	2	6.3	19	30-40	8	0.5
13	120-130	2	21.9	12	40-50	8	5.1
14	120-130	2	3.4	16	50-60	8	0.8
16	120-130	2	6.4	16	70-80	8	1.6
17	120-130	2	0.7	14	110-120	8	6.7
17	110-120	3	0.8	15	110-120	8	1.3
18	120-130	3	1.7	16	120-130	8	7.5
13	40-50	4	5.9	17	120-130	8	0.7
18	70-80	6	0.2	18	120-130	8	1.4
17	50-60	7	1.1	11/12	400-410	8	6.4
14	110-120	7	1.2	14	60-70	9	1.7
17	120-130	7	1.2	14	60-70	9	0.7
11	170-180	7	23.8	17	90-100	9	0.9
11	170-180	7	10.1	16	100-110	9	1
				16	120-130	9	2.5

Totals : 39 191.4 gm Avg. Wt. 4.9 gm
Early LSA
200-300 cm None
Large Blade
300-420 cm None
Upper MSA
420-450 cm 1 6.4 gm Avg. Wt. 6.4 gm

Table 97 Non-Quartz Radial/Disc Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
10	170-180	2	13.9	12	140-150	7	12
12	250-260	2	5.7	20	170-180	7	1.1
11/12	420-430	2	3.6	22	420-430	7	13.2
20	170-180	3	3.4	11/12	440-450	7	1.1
21	460-470	3	1.9	11/12	460-470	7	6
16	70-80	4	0.5	21	440-450	8	8
16	60-70	7	16	11/12	460-470	8	1.7
22	80-90	7	99.3	11/12	460-470	9	4.3

Totals: 16 191.7 gm Avg. Wt. 11.98 gm
Early LSA
200-300 cm 1 5.7 gm Avg. Wt. 5.7 gm
Large Blade
300-420 cm None
Upper MSA
420-450 cm 4 25.9 gm Avg. Wt. 6.48 gm
Raw Material:
2 = Brown Chert 7 = Silcrete
3 = Chalcedony
4 = Jasper
6 = Black Chert

Table 98 Non-Quartz Levallois Cores

Square	Depth	R.M.	Wt.gms
21	510-520	2	14.7
21	470-480	4	4.4
21	480-490	4	15.2
21	480-490	4	22.3
21	490-500	4	13
21	580-590	4	7.5
10	180-190	7	41
12	380-390	7	23.3
22	420-430	7	136.5
21	430-440	7	15.4
11/12	450-460	7	13
21	460-470	7	23.3
11/12	470-480	7	11.1
21	480-490	7	14.3
12	520-530	7	19.7
12	530-540	7	8.8
12	550-560	7	16.2
21	600-610	7	2.5
22	420-430	8	16.2
22	450-460	8	8.3
21	460-470	8	19.6
21	470-480	8	9.7
21	490-500	8	10
21	510-520	8	4.2
12	520-530	8	6.2
12	520-530	8	4
12	560-570	8	31.5
11/12	410-420	9	2.6
20	420-430	9	4.6
21	510-520	9	14.7
21	520-530	9	9.5
12	580-590	9	3

Totals:	31	546.3 gm	Avg. Wt.	17.6
Early LSA				
200-300 cm	None			
Large Blade				
300-420 cm	2	25.9 gm	Avg. Wt.	12.9
Upper MSA				
420-450 cm	5	175.3 gm	Avg. Wt.	35.0

Raw Material:
2 = Brown Chert
4 = Jasper
7 = Silcrete
8 = Multi-Color Chert
9 = Other Fine Grained Raw Material

Table 99 Non-Quartz Multi-Platform Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms	
19	0-10	2	2.8	11/12	440-450	7	2.6	
19	0-10	2	1.4	11/12	440-450	7	2.2	
19	20-30	2	1.2	22	440-450	7	10.6	
21	20-30	2	1.6	11/12	450-460	7	3.9	
13	50-60	2	0.5	22	450-460	7	6.8	
17	50-60	2	5.6	23	450-460	7	11.8	
19	50-60	2	5.8	11/12	460-470	7	4.2	
29	50-60	2	11	21	460-470	7	12.6	
19	70-80	2	2.3	22	470-480	7	4.7	
23	70-80	2	1.9	23	470-480	7	15.6	
12	80-90	2	13.1	12	480-490	7	8.5	
12	80-90	2	1	12	480-490	7	5.7	
19	90-100	2	2.9	21	480-490	7	3.4	
11	100-110	2	15.3	21	480-490	7	6.1	
14	100-110	2	33.6	22	480-490	7	17.8	
25	100-110	2	8.9	23	480-490	7	3.8	
11	110-120	2	17.2	12	490-500	7	4.4	
13	110-120	2	7.9	12	490-500	7	4.6	
13	110-120	2	3.3	12	500-510	7	1.7	B.P.
13	110-120	2	1	21	500-510	7	14.7	
14	110-120	2	1.6	21	500-510	7	3	
28	110-120	2	45.1	12	520-530	7	110	
12	120-130	2	3.5	23	520-530	7	7.8	
12	120-130	2	1.7	12	530-540	7	16.9	
15	120-130	2	4.2	12	530-540	7	2.6	
17	120-130	2	4.1	23	530-540	7	4.4	
17	120-130	2	4.7	21	540-550	7	11.7	
23	120-130	2	1.4	12	550-560	7	23.7	
13	130-140	2	1.4	12	550-560	7	6.9	
28	130-140	2	24.7	23	550-560	7	26	
23	170-180	2	13.6	12	560-570	7	76.1	
11	210-220	2	4.4	12	560-570	7	10.2	
12	240-250	2	5.2	12	560-570	7	8.2	
11	250-260	2	147.7	12	560-570	7	8.2	
20	250-260	2	9.3	21	570-580	7	2.8	
11	260-270	2	17.8	23	570-580	7	5.4	
23	280-290	2	2	12	580-590	7	5.8	
11	290-300	2	4	12	580-590	7	3.9	
22	370-380	2	13.9	12	610-620	7	2.3	
11	380-390	2	6.4	11	20-30	8	52.3	
21	390-400	2	4.1	23	30-40	8	3.2	
22	390-400	2	5.2	23	30-40	8	1.8	
21	400-410	2	10.5	26	50-60	8	11.4	
21	400-410	2	6.6	20	60-70	8	11.6	
21	490-500	2	2.6	23	60-70	8	3.8	
12	530-540	2	6.4	11	80-90	8	33.6	
21	540-550	2	3.6	12	80-90	8	3.4	
12	550-560	2	16.9	19	80-90	8	1.9	
23	550-560	2	30.3	22	80-90	8	1.7	
12	570-580	2	5.4	17	90-100	8	2.2	
12	570-580	2	2.1	17	90-100	8	2.2	

Table 99 cont. Non - Quartz Multi-Platform Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
12	580-590	2	5.2	19	90-100	8	12.6
14	10-20	3	3.8	19	90-100	8	8.7
28	40-50	3	2.7	12	100-110	8	1.9
14	70-80	3	1.2	18	100-110	8	3
23	70-80	3	1.5	14	110-120	8	1.6
22	80-90	3	1.3	15	110-120	8	2.1
14	100-110	3	18.1	16	110-120	8	20.2
23	100-110	3	4.7	21	110-120	8	2.2
15	110-120	3	5.7	10	120-130	8	10.2
14	120-130	3	2.7	12	120-130	8	2.6
16	120-130	3	11.4	12	120-130	8	2.1
16	120-130	3	6.2	15	120-130	8	9.4
19	130-140	3	2	16	120-130	8	6.1
20	130-140	3	2.1	17	120-130	8	5.6
23	150-160	3	3.6	17	120-130	8	2.1
12	220-230	3	2.5	B.P. 24	140-150	8	2.1
19	220-230	3	2.6	25	140-150	8	5
22	240-250	3	2.7	10	160-170	8	17.1
23	240-250	3	4.9	19	180-190	8	7.3
21	260-270	3	2.4	12	220-230	8	6
12	370-380	3	1.8	12	220-230	8	2.5
20	410-420	3	13.1	11	230-240	8	2.7
21	440-450	3	3.1	11	230-240	8	2.5
11/12	470-480	3	3.8	19	230-240	8	9.2
12	480-490	3	5.1	11	240-250	8	3.7
12	500-510	3	3.8	11	240-250	8	2.9
22	500-510	3	2.8	11	240-250	8	2
12	530-540	3	4.3	12	240-250	8	39.1
12	540-550	3	15.3	21	240-250	8	2.4
14	10-20	4	6.8	12	250-260	8	20.1
12	20-30	4	2.4	12	250-260	8	8.5
19	20-30	4	8.3	12	250-260	8	2.8
12	30-40	4	12.5	19	250-260	8	5.1
17	40-50	4	13.5	21	250-260	8	4
16	50-60	4	0.8	21	270-280	8	4.5
18	50-60	4	0.7	11	330-340	8	4.9
21	80-90	4	9.1	11	360-370	8	2.5
19	90-100	4	10.6	12	380-390	8	8.9
12	100-110	4	2.6	20	380-390	8	48.2
12	100-110	4	2.2	11/12	400-410	8	8.5
13	110-120	4	4.8	21	410-420	8	10.7
13	110-120	4	2.9	22	410-420	8	24.7
11	120-130	4	3.7	20	420-430	8	2.3
17	120-130	4	5.4	21	420-430	8	11.4
27	120-130	4	6.7	11/12	440-450	8	63.4
24	140-150	4	3.7	21	440-450	8	10.3
12	160-170	4	10.1	11/12	450-460	8	8.8
12	170-180	4	2.1	11/12	450-460	8	3.3
12	180-190	4	2.1	21	450-460	8	2.1
21	230-240	4	1.4	11/12	460-470	8	19
21	240-250	4	5.6	22	460-470	8	5

Table 99 cont. Non - Quartz Multi-Platform Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
23	280-290	4	3.7	23	460-470	8	4.5
23	420-430	4	3	21	470-480	8	11
22	440-450	4	4.8	12	480-490	8	3.4
11/12	450-460	4	20.6	22	480-490	8	6.1
12	500-510	4	1.9	23	490-500	8	84.7
12	580-590	4	5	12	510-520	8	10
12	590-600	4	2.2	12	510-520	8	3.9
10	120-130	5	1.8	21	510-520	8	27
20	210-220	5	5.7	21	520-530	8	5.8
23	220-230	5	2.1	12	530-540	8	5.2
22	240-250	5	2.4	12	530-540	8	3
12	490-500	5	1.6	12	530-540	8	2.1
12	550-560	5	8.7	22	540-550	8	10
12	590-600	5	4.5	23	570-580	8	7
11	100-110	6	24.5	12	580-590	8	57.2
23	140-150	6	3.9	23	630-640	8	3.9
20	240-250	6	2.3	23	690-700	8	90.2
15	10-20	7	4.1	12	0-10	9	18.7
22	30-40	7	4.7	14	10-20	9	1
18	50-60	7	1.3	19	20-30	9	9.8
23	60-70	7	1.9	19	30-40	9	19.5
10	70-80	7	10.4	10	40-50	9	7.1
15	70-80	7	8.7	11	40-50	9	1.6
19	70-80	7	1.6	18	40-50	9	0.8
20	70-80	7	2.4	14	50-60	9	4.3
21	70-80	7	3.5	14	50-60	9	1.7
12	80-90	7	4.5	15	50-60	9	4.2
12	80-90	7	1.6	17	50-60	9	1.8
19	80-90	7	6.3	18	50-60	9	14.5
10	90-100	7	16	21	50-60	9	6.5
12	90-100	7	4	23	50-60	9	14.3
14	90-100	7	8.2	12	60-70	9	2.9
14	90-100	7	0.7	17	60-70	9	0.3
12	90-100	7	4	11	70-80	9	10.1
14	90-100	7	8.2	18	70-80	9	0.9
14	90-100	7	0.7	19	70-80	9	4.3
11	100-110	7	7.4	27	70-80	9	3
19	100-110	7	25.8	16	80-90	9	3.3
19	100-110	7	4.1	19	80-90	9	8.1
10	110-120	7	3.2	11	100-110	9	8.4
11	110-120	7	2.5	12	100-110	9	2.8
12	110-120	7	4.7	15	100-110	9	0.7
12	110-120	7	3.4	13	110-120	9	2.1
13	110-120	7	7.8	13	110-120	9	1
13	110-120	7	5.1	13	110-120	9	0.8
13	110-120	7	3.2	15	110-120	9	7.1
14	110-120	7	1.8	15	110-120	9	2.6
15	110-120	7	12.4	17	110-120	9	2.7
15	110-120	7	4.1	29	110-120	9	10
12	120-130	7	3	13	120-130	9	2.8
14	120-130	7	35.6	15	120-130	9	2.4

Table 99 cont. Non - Quartz Multi-Platform Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms	
14	120-130	7	9	16	120-130	9	0.7	
14	120-130	7	4.9	16	120-130	9	0.2	
14	120-130	7	1.1	23	120-130	9	8.4	
15	120-130	7	8.2	13	130-140	9	4	
15	120-130	7	5.7	12	160-170	9	1.9	
17	120-130	7	4.7	11	170-180	9	5	
22	120-130	7	5.2	21	170-180	9	6.9	
21	130-140	7	3.5	21	200-210	9	2.2	
23	130-140	7	5.5	11	210-220	9	7	
12	140-150	7	12.9	19	200-210	9	8.6	
20	160-170	7	1.5	20	210-220	9	21.1	
21	160-170	7	69.4	12	230-240	9	3.2	
11	170-180	7	8.1	21	230-240	9	1.6	
12	170-180	7	4.9	12	240-250	9	0.5	B.P.
19	170-180	7	11.4	12	240-250	9	3	
20	170-180	7	20.8	22	240-250	9	6.8	
22	170-180	7	7.5	12	260-270	9	9.2	
22	170-180	7	7	19	260-270	9	4.2	
23	170-180	7	48.1	11	300-310	9	31.2	
10	170-180	7	24.4	20	370-380	9	6	
11	180-190	7	41.9	12	380-390	9	3.3	
11	180-190	7	3.9	22	380-390	9	5.1	
11	180-190	7	4.7	21	390-400	9	11	
11	180-190	7	2.4	23	400-410	9	63.3	
12	180-190	7	6	23	400-410	9	21.8	
12	180-190	7	3.8	20	420-430	9	4.2	
20	180-190	7	27.3	22	430-440	9	34.2	
21	180-190	7	14	22	430-440	9	46.3	
23	180-190	7	15.4	23	440-450	9	5.6	
23	190-200	7	4.5	11/12	470-480	9	4.1	
22	200-210	7	26.4	21	470-480	9	5.5	
20	240-250	7	11.3	21	470-480	9	4.2	
23	250-260	7	5.7	21	480-490	9	6.1	
23	250-260	7	5.8	22	480-490	9	26.6	
19	270-280	7	3.7	23	480-490	9	7.5	
22	400-410	7	7.8	23	480-490	9	13.1	
11/12	410-420	7	3.5	12	530-540	9	3.5	
21	410-420	7	2.6	12	530-540	9	1.8	
22	410-420	7	5.6	22	540-550	9	8.3	
11/12	420-430	7	2.8	22	550-560	9	11.3	
20	420-430	7	6.2	23	560-570	9	19.5	
21	420-430	7	3.5	23	630-640	9	28.6	
22	420-430	7	30.3	23	660-670	9	36.4	
23	420-430	7	32.7	23	670-680	9	6.5	
11/12	430-440	7	3.8	23	670-680	9	5.9	
				23	680-690	9	4.2	

Totals : 397 3783.4 gm Avg. Wt. 9.53 gm

Table 99 cont. Non - Quartz Multi-Platform Cores

Early LSA			
200-300 cm	51 467 gm	Avg. Wt.	9.15 gm
Large Blade			
300-420 cm	26 331.2 gm	Avg. Wt.	12.74 gm
Upper MSA			
420-450 cm	20 283.3 gm	Avg. Wt.	14.16 gm

Raw Material:
2 = Brown Chert
3 = Chalcedony
4 = Jasper
5 = Transparent w/ black flecks
6 = Black Chert
7 = Silcrete
8 = Multi-Color Chert
9 = Other Fine Grained Raw Material

Table 100 Non-Quartz Bladelet Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
20	20-30	2	2.9	11/12	450-460	7	1.6
19	30-40	2	2.4	11/12	450-460	7	0.4
12	40-50	2	2.1	11/12	460-470	7	1.5
13	40-50	2	1	11/12	460-470	7	1.6
15	50-60	2	0.2	11/12	470-480	7	1.7
18	50-60	2	2.5	12	480-490	7	1
12	60-70	2	0.4	12	500-510	7	0.4
15	60-70	2	1.5	12	520-530	7	1.3
22	60-70	2	1.8	12	520-530	7	1.1
11	70-80	2	0.5	12	520-530	7	0.4
19	80-90	2	2.2	12	530-540	7	0.4
19	80-90	2	2.8	21	540-550	7	1.8
22	80-90	2	0.8	12	580-590	7	1.5
12	90-100	2	0.5	12	20-30	8	0.5
14	90-100	2	1.1	11	40-50	8	0.7
14	90-100	2	1.1	17	40-50	8	0.5
15	90-100	2	1	20	50-60	8	0.3
22	90-100	2	1	22	60-70	8	0.7
11	100-110	2	4.6	22	80-90	8	2.7
12	100-110	2	0.6	22	80-90	8	2.6
12	100-110	2	0.4	11	90-100	8	3.8
13	100-110	2	1.5	11	90-100	8	2.2
14	100-110	2	3	11	90-100	8	0.3
14	100-110	2	1.9	15	90-100	8	0.9
16	100-110	2	0.7	21	90-100	8	1.8
22	100-110	2	1.7	21	90-100	8	1.7
22	100-110	2	1.5	12	100-110	8	0.6
13	110-120	2	6.9	16	100-110	8	1.1
13	110-120	2	0.6	15	110-120	8	0.4
15	110-120	2	0.5	12	120-130	8	1.2
17	110-120	2	1.5	16	120-130	8	1.2
20	110-120	2	0.6	22	140-150	8	3.7
11	120-130	2	0.2	12	150-160	8	0.2
12	120-130	2	0.7	22	190-200	8	0.5
13	120-130	2	1.3	11	220-230	8	0.3
14	120-130	2	1.2	20	220-230	8	2.1
14	120-130	2	0.8	10	230-240	8	1.4
17	120-130	2	1.9	11	230-240	8	2
20	120-130	2	2.4	21	230-240	8	0.4
20	140-150	2	0.2	12	240-250	8	0.4
11	170-180	2	0.7	20	260-270	8	1
12	190-200	2	0.4	21	290-300	8	1.2
10	220-230	2	2.8	22	410-420	8	1.6
11	330-340	2	0.9	21	430-440	8	1.3
11/12	420-430	2	2	11/12	470-480	8	1.1
21	430-440	2	1	21	480-490	8	0.6
11/12	440-450	2	0.1	21	480-490	8	2.2
12	530-540	2	1.3	12	530-540	8	0.9
12	570-580	2	0.7	12	540-550	8	0.7
15	0-10	3	0.7	12	630-640	8	2.8
12	10-20	3	0.3	11	0-10	9	5.2

Table 100 cont. Non-Quartz Bladelet Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
11	60-70	3	1.5	11	0-10	9	0.6
12	60-70	3	1.2	12	0-10	9	0.3
12	70-80	3	0.6	12	0-10	9	0.1
20	70-80	3	1	13	10-20	9	6.5
12	80-90	3	1.7	14	10-20	9	3.8
10	90-100	3	0.8	20	10-20	9	0.7
15	90-100	3	0.7	11	20-30	9	1.2
11	110-120	3	0.7	11	30-40	9	1.6
15	110-120	3	3.2	14	30-40	9	2.8
15	110-120	3	0.9	10	40-50	9	0.4
17	110-120	3	0.8	13	40-50	9	1.6
12	120-130	3	1	15	40-50	9	1
13	120-130	3	1.9	20	40-50	9	0.3
15	120-130	3	5.9	10	40-50	9	0.8
17	120-130	3	0.4	15	50-60	9	0.8
12	150-160	3	0.5	15	50-60	9	0.6
20	150-160	3	0.4	18	50-60	9	0.2
12	170-180	3	2.1	12	60-70	9	3
11	230-240	3	0.3	14	60-70	9	1.6
12	240-250	3	0.4	14	60-70	9	1.1
12	250-260	3	1.7	15	60-70	9	0.5
21	250-260	3	0.9	15	60-70	9	0.3
12	260-270	3	3	12	70-80	9	0.2
11/12	440-450	3	0.4	13	70-80	9	3.1
11/12	470-480	3	0.5	15	70-80	9	2.9
21	470-480	3	2	15	70-80	9	0.9
21	470-480	3	1.7	17	70-80	9	0.1
21	480-490	3	1	10	80-90	9	1.2
21	490-500	3	2.1	12	80-90	9	1
12	520-530	3	0.5	14	80-90	9	0.6
12	530-540	3	0.9	10	90-100	9	2.3
13	20-30	4	1.4	10	90-100	9	0.4
19	30-40	4	1.5	10	90-100	9	0.4
12	40-50	4	0.3	10	100-110	9	0.7
17	40-50	4	2.9	10	100-110	9	0.4
18	40-50	4	0.3	10	100-110	9	0.2
14	50-60	4	2.8	11	100-110	9	2.1
14	60-70	4	0.2	11	100-110	9	2.7
15	60-70	4	0.2	11	100-110	9	0.8
14	70-80	4	0.4	11	100-110	9	0.8
17	70-80	4	0.5	12	100-110	9	4.8
11	80-90	4	4.1	12	100-110	9	1.1
12	80-90	4	2.9	12	100-110	9	0.3
12	80-90	4	0.8	12	100-110	9	0.5
12	80-90	4	0.8	13	100-110	9	0.2
12	80-90	4	0.4	14	100-110	9	0.6
11	90-100	4	0.7	14	100-110	9	0.4
14	100-110	4	8.4	14	100-110	9	0.1
22	100-110	4	0.6	17	100-110	9	1.7
22	100-110	4	0.9	18	100-110	9	0.8

Table 100 cont. Non-Quartz Bladelet Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms	
11	110-120	4	0.3	20	100-110	9	0.3	
12	110-120	4	0.9	10	110-120	9	2.7	
13	110-120	4	4.6	11	110-120	9	0.5	
13	110-120	4	1.2	13	110-120	9	3.1	
15	110-120	4	2	13	110-120	9	0.8	
15	110-120	4	1.7	13	110-120	9	1	
13	120-130	4	1.1	13	110-120	9	0.3	
20	120-130	4	0.3	13	110-120	9	0.3	
12	130-140	4	1.2	13	110-120	9	0.1	
22	140-150	4	4.2	14	110-120	9	1.2	
20	160-170	4	0.7	14	110-120	9	1.2	
11	170-180	4	0.6	15	110-120	9	6.1	
22	180-190	4	1.4	15	110-120	9	0.5	
22	180-190	4	0.3	15	110-120	9	0.1	
20	200-210	4	0.5	21	110-120	9	0.5	
12	230-240	4	0.3	11	120-130	9	2.1	
19	260-270	4	0.7	12	120-130	9	0.9	
19	270-280	4	0.8	12	120-130	9	0.8	
21	420-430	4	0.7	12	120-130	9	0.9	
11/12	430-440	4	0.3	12	120-130	9	0.2	
12	480-490	4	0.7	12	120-130	9	0.2	
12	480-490	4	0.4	13	120-130	9	2.5	
12	500-510	4	0.8	14	120-130	9	1.3	
12	580-590	4	1.7	14	120-130	9	1.2	
12	640-650	4	1	14	120-130	9	0.6	
11	90-100	5	0.4	14	120-130	9	0.1	
11	100-110	5	1	15	120-130	9	0.7	
14	120-130	5	0.9	15	120-130	9	0.4	
21	250-260	5	0.6	15	120-130	9	0.3	
22	390-400	5	0.8	15	120-130	9	0.3	
11	20-30	6	3.9	17	120-130	9	0.7	
20	70-80	6	0.6	17	120-130	9	0.6	
20	110-120	6	2.7	17	120-130	9	0.1	
16	20-30	7	0.7	12	130-140	9	0.4	
15	30-40	7	1.4	22	130-140	9	2.3	
13	40-50	7	5.7	22	130-140	9	10	
15	40-50	7	0.9	20	140-150	9	0.2	
15	50-60	7	6.1	22	140-150	9	2.4	
11	70-80	7	0.8	13	150-160	9	1	
14	70-80	7	8.7	12	160-170	9	0.7	
14	70-80	7	0.6	12	170-180	9	1.3	
14	80-90	7	5.7	12	170-180	9	0.4	
11	90-100	7	0.4	13	180-190	9	1.5	
12	90-100	7	1.7	12	190-200	9	0.9	
12	100-110	7	2.9	12	190-200	9	0.2	
12	100-110	7	0.3	22	190-200	9	3.2	
12	110-120	7	3.1	12	200-210	9	1.1	B.P.
13	110-120	7	1	12	220-230	9	0.7	
13	110-120	7	0.3	12	220-230	9	0.4	
13	110-120	7	0.2	21	230-240	9	0.3	

Table 100 cont. Non-Quartz Bladelet Cores

Square	Depth	R.M.	Wt.gms		Square	Depth	R.M.	Wt.gms
14	110-120	7	2.3		21	230-240	9	0.5
14	110-120	7	1		20	240-250	9	0.6
14	110-120	7	0.2		21	240-250	9	0.9
12	120-130	7	1.7		11	250-260	9	1.9
12	120-130	7	0.7		11	250-260	9	1
13	120-130	7	1.4		12	250-260	9	1.3
14	120-130	7	0.3		12	250-260	9	1.4
20	120-130	7	3		12	250-260	9	0.6
12	160-170	7	0.9		11	260-270	9	3.7
12	170-180	7	3.6		12	260-270	9	1
12	170-180	7	0.6		20	260-270	9	0.3
11	190-200	7	1.3		11	300-310	9	0.5
12	190-200	7	2.3		12	380-390	9	0.2
12	190-200	7	0.7		22	390-400	9	2.4
11	210-220	7	2	B.P.	22	430-440	9	1
10	220-230	7	0.3		11/12	450-460	9	0.2
11	230-240	7	0.4		21	470-480	9	0.7
11	250-260	7	3.7		12	480-490	9	1.3
12	250-260	7	0.7		12	480-490	9	0.5
12	260-270	7	0.9		12	500-510	9	0.4
12	270-280	7	0.5		12	500-510	9	0.3
12	380-390	7	0.7		21	500-510	9	1.6
12	390-400	7	1.8		21	510-520	9	0.7
11/12	440-450	7	0.9		21	540-550	9	0.5
11/12	440-450	7	0.6		22	540-550	9	1.7
11/12	450-460	7	2.1		22	560-570	9	1.1

Totals:	353	471.1 gm	Avg. Wt.	1.34 gm
Early LSA 200-300 cm	41	45 gm	Avg. Wt.	1.1 gm
Large Blade 300-420 cm	8	8.9 gm	Avg. Wt.	1.11 gm
Upper MSA 420-450 cm	10	8.3	Avg. Wt.	.83 gm

Raw Material:
2 = Brown Chert
3 = Chalcedony
4 = Jasper
5 = Transparent w/ black flecks
6 = Black Chert
7 = Silcrete
8 = Multi-Color Chert
9 = Other Fine Grained Raw Material

Table 101 Non-Quartz Blade Cores

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
10	160-170	2	5.2	11/12	470-480	7	9.1
21	310-320	2	15.7	11/12	470-480	7	5.2
21	420-430	2	4.2	12	520-530	7	8.4
12	550-560	2	15.5	12	520-530	7	2.9
22	450-460	3	2.5	12	560-570	7	9.1
22	480-490	3	5.9	12	570-580	7	3.2
11/12	450-460	4	4.4	12	570-580	7	2.1
21	490-500	4	4.3	12	590-600	7	10.2
12	520-530	6	2.2	10	170-180	8	6.9
11	170-180	7	9.8	20	260-270	8	6.6
11	170-180	7	7.5	22	290-300	8	3.5
11	180-190	7	4.4	20	370-380	8	19.4
12	350-360	7	3.2	21	400-410	8	8.5
20	370-380	7	21.3	22	420-430	8	3.3
11	390-400	7	10.8	12	520-530	8	13
23	390-400	7	5.5	12	560-570	8	12.1
23	390-400	7	13.1	12	190-200	9	6.7
21	400-410	7	30.6	11	300-310	9	19.5
21	400-410	7	6	22	370-380	9	6.4
11/12	420-430	7	5.2	21	390-400	9	5.1
21	450-460	7	23.8	22	440-450	9	3.2
11/12	460-470	7	5.3	23	520-530	9	3.6
11/12	460-470	7	3.6	12	530-540	9	6.4
				12	540-550	9	3.3

Totals:	47	387.7 gm	Avg. Wt.	8.25 gm
Early LSA 200-300 cm	2	10.1 gm	Avg. Wt.	5.05 gm
Large Blade 300-420 cm	13	165.1 gm	Avg. Wt.	12.7 gm
Upper MSA 420-450 cm	4	15.9 gm	Avg. Wt.	3.98 gm

Raw Material
2 = Brown Chert
3 = Chalcedony
4 = Jasper
6 = Black Chert
7 = Silcrete
8 = Multi-Color Chert
9 = Other Fine Grained Raw Material

Table 102 Non-Quartz Core Reduced Pieces

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
20	10-20	2	0.3	15	110-120	8	1.1
19	30-40	2	0.6	20	110-120	8	0.7
21	30-40	2	1.1	21	110-120	8	1.2
22	30-40	2	0.6	12	120-130	8	0.4
12	60-70	2	0.2	13	120-130	8	0.2
10	80-90	2	0.7	15	120-130	8	0.4
10	90-100	2	1	15	120-130	8	0.3
14	90-100	2	0.2	17	120-130	8	0.5
20	90-100	2	1	12	130-140	8	2.9
20	90-100	2	0.5	13	160-170	8	0.6
10	100-110	2	3	11	170-180	8	0.7
11	100-110	2	0.6	11	180-190	8	1.4
20	100-110	2	2.1	11	180-190	8	0.4
21	100-110	2	0.8	20	190-200	8	1
24	100-110	2	0.6	21	190-200	8	0.9
25	100-110	2	0.9	12	220-230	8	1
15	110-120	2	0.3	21	220-230	8	2
20	110-120	2	2.4	11	230-240	8	1
12	120-130	2	0.9	11	230-240	8	1.8
12	120-130	2	0.4	21	240-250	8	0.9
15	120-130	2	0.5	21	240-250	8	1.3
15	120-130	2	0.4	21	240-250	8	1.3
20	120-130	2	1.3	19	250-260	8	1.4
12	150-160	2	1	20	250-260	8	2.4
19	220-230	2	2.2	21	260-270	8	1.4
20	290-300	2	1.3	12	390-400	8	0.3
21	400-410	2	0.4	21	390-400	8	1.7
11/12	440-450	2	0.6	20	410-420	8	1.7
11/12	440-450	2	0.8	22	420-430	8	1.1
22	450-460	2	1.7	22	420-430	8	1.1
11/12	470-480	2	1.4	11/12	440-450	8	1.8
11/12	470-480	2	0.8	21	450-460	8	1.5
11/12	470-480	2	0.5	22	450-460	8	1.3
12	480-490	2	0.3	11/12	460-470	8	1.6
21	480-490	2	2.2	11/12	460-470	8	0.8
12	580-590	2	0.6	21	460-470	8	2
12	0-10	3	0.3	11/12	470-480	8	0.7
15	60-70	3	0.3	11/12	470-480	8	0.5
11	70-80	3	0.4	21	470-480	8	0.8
10	100-110	3	1.3	21	470-480	8	2.7
10	110-120	3	2.5	21	480-490	8	1.7
20	130-140	3	1.4	22	480-490	8	1.2
11	250-260	3	3.3	21	490-500	8	2
21	250-260	3	0.5	22	490-500	8	2.1
11/12	420-430	3	0.3	12	500-510	8	1.5
22	440-450	3	3	21	500-510	8	0.5
12	480-490	3	0.5	12	510-520	8	0.7
21	480-490	3	0.5	22	520-530	8	1.4
12	550-560	3	2.1	22	530-540	8	1.4
23	40-50	4	0.8	12	550-560	8	0.7
12	60-70	4	1.6	12	0-10	9	0.8

Table 102 cont. Non-Quartz Core Reduced Pieces

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
21	60-70	4	0.7	11	20-30	9	0.9
12	80-90	4	0.2	12	20-30	9	1
13	110-120	4	0.6	20	20-30	9	2.1
14	110-120	4	1.2	20	20-30	9	0.6
14	110-120	4	0.2	20	20-30	9	0.7
15	110-120	4	0.5	21	20-30	9	0.6
17	120-130	4	1	15	30-40	9	0.9
20	120-130	4	3.5	12	40-50	9	0.4
10	160-170	4	1.7	20	40-50	9	0.6
12	160-170	4	0.5	20	40-50	9	0.4
12	190-200	4	0.8	12	60-70	9	0.6
20	220-230	4	0.8	14	60-70	9	0.4
12	250-260	4	1.4	21	60-70	9	0.9
11/12	470-480	4	1.6	21	60-70	9	0.3
12	480-490	4	1.3	12	70-80	9	0.2
21	540-550	4	0.8	16	70-80	9	0.1
11	100-110	5	1.8	16	70-80	9	0.1
11	270-280	5	0.4	10	80-90	9	0.9
11	60-70	6	1.4	12	80-90	9	0.5
17	80-90	6	0.5	12	90-100	9	0.4
25	130-140	6	0.7	21	90-100	9	0.4
12	240-250	6	0.2	11	100-110	9	1.8
12	30-40	7	2	11	100-110	9	0.2
12	60-70	7	0.6	11	100-110	9	0.2
11	100-110	7	0.7	20	100-110	9	0.2
12	100-110	7	0.9	22	100-110	9	1.5
12	100-110	7	0.4	10	110-120	9	0.3
12	100-110	7	0.4	14	110-120	9	0.6
15	110-120	7	0.7	15	110-120	9	0.2
12	120-130	7	1.3	20	110-120	9	0.2
14	120-130	7	0.7	12	120-130	9	0.6
15	120-130	7	1.1	12	120-130	9	0.7
12	130-140	7	1.3	14	120-130	9	0.5
12	130-140	7	0.3	15	120-130	9	0.7
12	170-180	7	0.2	15	120-130	9	0.5
12	190-200	7	1.1	17	120-130	9	0.9
12	230-240	7	0.6	17	120-130	9	0.8
11	250-260	7	1.5	17	120-130	9	0.2
12	250-260	7	1.7	20	120-130	9	1.1
12	250-260	7	0.5	27	120-130	9	2.1
20	290-300	7	0.9	12	130-140	9	1.3
11/12	400-410	7	0.4	12	130-140	9	0.8
22	400-410	7	1.7	13	130-140	9	0.8
21	410-420	7	1.9	12	140-150	9	0.6
21	410-420	7	1.3	12	150-160	9	0.5
21	410-420	7	0.8	20	150-160	9	0.2
11/12	420-430	7	1.6	21	160-170	9	0.4
11/12	440-450	7	1.1	12	170-180	9	2
11/12	440-450	7	0.9	12	170-180	9	0.6
11/12	440-450	7	0.5	20	180-190	9	0.3
11/12	440-450	7	0.2	12	190-200	9	0.6

Table 102 cont. Non-Quartz Core Reduced Pieces

Square	Depth	R.M.	Wt.gms	Square	Depth	R.M.	Wt.gms
22	440-450	7	1.8	11	210-220	9	0.8
22	450-460	7	1.9	12	220-230	9	2
11/12	460-470	7	1.6	11	250-260	9	2.8
11/12	460-470	7	0.4	11	250-260	9	1.6
11/12	470-480	7	1.2	11	270-280	9	1.2
11/12	470-480	7	1.4	12	270-280	9	0.8
11/12	470-480	7	0.4	11	290-300	9	2.1
21	480-490	7	2.1	22	380-390	9	1.8
21	490-500	7	2.2	11/12	420-430	9	1.2
12	500-510	7	1.2	11/12	420-430	9	0.8
21	510-520	7	2.2	11/12	440-450	9	1.4
12	530-540	7	0.4	11/12	440-450	9	0.7
12	550-560	7	1.5	11/12	440-450	9	0.4
12	550-560	7	1.7	21	440-450	9	0.7
12	560-570	7	1.5	22	440-450	9	2.2
12	560-570	7	0.5	11/12	450-460	9	1
12	580-590	7	2.4	11/12	460-470	9	1.7
12	590-600	7	1.8	11/12	460-470	9	0.9
17	20-30	8	0.7	11/12	460-470	9	0.5
12	40-50	8	1	11/12	460-470	9	0.5
11	60-70	8	1.8	11/12	470-480	9	0.8
11	60-70	8	1.1	11/12	470-480	9	0.7
16	70-80	8	0.2	11/12	470-480	9	0.1
23	70-80	8	1	12	480-490	9	0.5
14	80-90	8	0.7	12	480-490	9	0.4
10	90-100	8	2.4	21	490-500	9	1.1
21	90-100	8	0.6	21	490-500	9	0.3
11	100-110	8	0.6	22	500-510	9	1.3
12	100-110	8	1	21	510-520	9	2.4
10	110-120	8	0.5	12	520-530	9	0.7
11	110-120	8	0.8	12	530-540	9	0.3
11	110-120	8	0.3	12	540-550	9	0.6
13	110-120	8	0.1	12	580-590	9	1.1

Totals:	270	271.1 gm	Avg. Wt.	1.01 gm
Early LSA				
200-300 cm	30	41.1 gm	Avg. Wt.	1.37 gm
Large Blade				
300-420 cm	10	12.0 gm	Avg. Wt.	1.20 gm
Upper MSA				
420-450 cm	20	22.2 gm	Avg. Wt.	1.11 gm

Raw Material:
2 = Brown Chert
3 = Chalcedony
4 = Jasper
5 = Transparent w/ black flecks
6 = Black Chert
7 = Silcrete
8 = Multi-Color Chert
9 = Other Fine Grained Raw Material

APPENDIX D

NON-CHIPPED LITHICS

Table 103 Hammerstones

Square	Depth	Raw Mat'l	Wt. gms.
11	20-30	Quartzite	46.4
20	20-30	Quartzite	26.7
23	30-40	Quartzite	73.9
22	40-50	Quartzite	79.6
23	40-50	Quartzite	25.3
11	50-60	Quartzite	173.4
19	50-60	Quartzite	65.7
23	50-60	Quartzite	45.5
10	60-70	Quartzite	73
10	60-70	Quartzite	26.8
11	60-70	Quartzite	164.5
15	60-70	Basalt	40.7
21	60-70	Quartzite	10.5
11	70-80	Quartzite	196
15	70-80	Schist baton	220.3
10	80-90	Quartzite	92.3
11	80-90	Quartzite	106.5
12	80-90	Quartzite	6.5
13	80-90	Quartzite	214.6
16	80-90	Quartzite	146.8
19	80-90	Quartzite	65.9
19	80-90	Quartzite	68.4
21	80-90	Quartzite	98.5
10	90-100	Quartzite	61.2
10	90-100	Quartzite	20.2
12	90-100	Quartzite	22.8
20	90-100	Quartzite	38.3
23	90-100	Quartzite	68.6
12	100-110	Quartzite	15.1
23	100-110	Quartzite	32.1
28	100-110	Quartzite	50.4
13	110-120	Quartzite	227.1
15	110-120	Quartzite	221.5
21	120-130	Quartzite	146.6
24	120-130	Quartzite	177.9
26	120-130	Quartzite	90.7
10	140-150	Quartzite	246
20	140-150	Quartzite	205.3
20	150-160	Quartzite	110
21	150-160	Quartzite	56.7
23	160-170	Quartzite	75.5
12	170-180	Quartzite	280.1
12	170-180	Silcrete	21.6
11	180-190	Silcrete	46.4
21	180-190	Quartzite	66.1
21	180-190	Quartzite	31.8
21	190-200	Quartzite	113.1
21	210-220	Quartzite	119.9
21	210-220	Quartzite	103.3
21	210-220	Quartzite	56.4
23	210-220	Quartzite	45.9

Table 103 cont. Hammerstones

Square	Depth	Raw Mat'l	Wt. gms.
20	220-230	Granite	341.5
10	230-240	Quartzite	227.4
22	240-250	Quartzite	161.5
23	240-250	Quartzite	19.2
11	250-260	Quartzite	11.2
19	250-260	Quartzite	9.7
21	250-260	Quartzite	13.9
12	270-280	Quartzite	26.8
22	290-300	Quartzite	43
22	310-320	Quartzite	51.4
22	320-330	Quartzite	33.2
12	350-360	Quartzite	23.5
23	350-360	Quartzite	132.7
11	370-380	Quartzite	38.1
20	370-380	Quartzite	60.8
11	380-390	Quartzite	10.1
21	430-440	Quartzite	122.1
22	450-460	Quartzite	88.9
22	470-480	Ryolite	392.5
21	530-540	Quartzite	226.8
22	560-570	Quartzite	129.5
22	600-610	Quartzite	36.8
23	630-640	Quartzite	95.6
Totals: 74			7114.6 gms.

Table 104 Grindstones

Square	Depth	Raw Mat'l	Wt.gms	Comments:
12	0-10	Schist	103.2	Fragment
14	20-30	Quartzite	95.6	Fragment
14	30-40	Quartzite	51.1	Fragment
17	60-70	Quartzite	65.1	Fragment
10	70-80	Quartzite	91.1	Fragment
25	70-80	Sandstone	182.5	
25	70-80	Quartzite	73.1	
19	80-90	Quartzite	50.3	
19	80-90	Quartzite	73	
11	90-100	Quartzite	16.4	Fragment
13	90-100	Quartzite	498	Double w/ red pigment
15	100-110	Quartzite	263	Single w/ red pigment
12	110-120	Schist	131.6	
20	110-120	Quartzite	3.8	Fragment
12	120-130	Quartzite	16	Fragment
15	120-130	Red Sandstone	15	Fragment
16	120-130	Quartzite	18.7	Fragment
17	120-130	Quartzite	29.9	Fragment
20	120-130	Quartzite DkGr	58.8	
27	130-140	Quartzite	509.6	Double
21	140-150	Quartzite	51.6	
25	140-150	Sandstone	66.7	
20	150-160	Quartzite	305.5	Single w/ red pigment 8.8 x 6.25 x 2.5 cm
21	150-160	Schist	108.7	Grindstone/Hammerstone
12	170-180	Quartzite Gr	264.1	Single
12	170-180	Quartzite	5.9	Fragment
22	190-200	Quartzite	2.4	Fragment
22	200-210	Quartzite	27.4	Fragment
20	220-230	Granite/Gniess	341.5	Grindstone/Hammerstone
11	250-260	Sandstone Grey	9.1	Fragment
22	260-270	Quartzite	196	Single
11	300-310	Quartzite	156.4	Fragment
23	440-450	Quartzite	47.1	Fragment
12	540-550	Schist	113.8	Possible Grindstone
Totals: 34			4042	gms.

Table 105 Pitted Cobbles

Square	Depth	Raw Mat'l	Wt.gms	Comments:
25	80-90	Quartzite	25.2	
22	410-420	Quartzite	251.9	
20	420-430	Schist	87.4	
Totals: 3			364.5	gms.

Table 106 Non-Chipped Lithics Measured in the Field

Square	Depth	Raw Mat'l	*Type	**L	W	T	Comments:
19	30-40	Schist	H/A	6.4	5.2	4.8	Split cobble
19	30-40	Schist	G	7.7	4.6	2.7	Edge ground mica schist fragment
19	50-60	Schist	O	10	9.4	2.2	Battered mica schist oval not ground
19	90-100	Quartzite	H/G	7.5	5	3.3	Fragment w/ traces of end grinding
19	160-170	Quartzite	H	12.5	5.3	4.9	Elongated hammerstone cobble
19	250-260	Schist	A/G	10.7	8.9	3.3	Anvil & edge grinding slab
20	10-20	Schist	G	13	8.7	6.9	Cobble (traces)
20	50-60	Schist	G/H	10.1	6.6	4.5	Cobble, whole
20	60-70	Quartzite	H/A	6.3	5.8	4.9	Whole pebble
20	60-70	Schist	G	7.4	5.3	4.1	Edge ground
20	60-70	Quartzite	G	5.8	4.7	2.6	Edge ground fragment
20	60-70	Schist	G	7.3	5.6	3.1	Fragment
20	130-140	Schist	G/A				Complete block-like cobble-has at least 4 facets & pitting (formal)
20	150-160	Schist	G	9.1	4.9	3.5	Broken end of cobble with peak produced by grinding facets-end ground
20	150-160	Quartzite	H	8.8	5.2	4.4	Possible hammerstone cobble
20	150-160	Quartzite	G	6	5.3	5.3	Cobble with small ground edge plus flaking (grinder)
20	240-250	Schist	A	10.2	9.4	7.2	Central dimple (Mongongo stone)
20	330-340	Quartzite	H	10.2	8.6	6.6	Large cobble hammerstone

Table 106 cont. Non-Chipped Lithics Measured in the Field

Square	Depth	Raw Mat'l	*Type	**L	W	T	Comments:
21	10-20	Schist	G	7.4	6.5	2.5	Slab with rounded end-possibly utilized
21	30-40	Schist	G?	8.2	6.2	3.7	Possible ground schist cobble
21	60-70	Quartzite	H/G	5.1	4.4	4.6	Round, whole, "golf ball"
21	70-80	Schist	A/H/G	8.1	4.7	4.6	Pitted, ground, whole pebble
21	70-80	Quartzite	A/H/G	6.4	5.5	4.7	Pitted, ground, whole pebble
21	140-150	Quartzite	A?	7.2	6.2	6.2	
21	140-150	Schist	G	13	9.5	3.8	Ground concave, basal stone-slab
21	200-210	Quartzite	H/G	8.6	6.4	4.3	Hammerstone & possible edge grinding
21	270-280	Quartzite	H/A	8.7	6.2	5.9	Cobble
21	370-380	Quartzite	G	9.7	8.9	3.1	Smoothed surface appears ground
21	490-500	?	H/G	7.3	5.1	4.8	Hammerstone & possible edge ground pebble
21	490-500	Granite	RF	11.9	6.4	3.6	Large flake with plain platform Large Flake
22	20-30	Schist	G	7.1	4	3.1	Flat facet/broken cobble
22	70-80	Quartzite	G/H/A	8	6.8	5.2	Cobble-extensive grinding on edge
22	70-80	Quartzite	G/H	7.6	4.1	3.8	Large pebble fragment
22	150-160	Quartzite	G	8	5	3.3	Cobble fragment, narrow facet
22	150-160	Quartzite	H	8.2	6.9	4.5	Traces
22	150-160	Schist	G	8.3	6	2.4	Edge ground oval
22	170-180	Schist	G/A/H	6.9	5.5	4.8	Cobble

Table 106 cont. Non-Chipped Lithics Measured in the Field

Square	Depth	Raw Mat'l	*Type	**L	W	T	Comments:
22	170-180	Schist	G	9.4	6.2	5.8	Blocklike cobble-flat facet
22	180-190	Schist	G	10.2	5.4	4.6	Blocklike slab-flat facet
22	190-200	Quartzite	H	6.6	5.2	4.4	Possible Hammerstone pebble
22	200-210	Schist	G/H	7.5	6.3	3.8	Cobble fragment flat facet
22	210-220	Schist	A/H	11.1	7.3	6.9	Mong. stone
22	400-410	Schist	H	6.8	5.8	3.9	Weathered end of schist cobble, possibly used as hammer
22	410-420	Quartzite	H	7.8	6.3	5.1	Possible hammerstone cobble
22	420-430	Quartzite	H	6.8	5.9	5.3	Baseball" rounded large pebble/small cobble (but not as smooth as late ones)
22	440-450	Schist	G?	11.4	6	2.5	Flat facet on fragment of broken slab
23	40-50	Schist	G	6.9	5.6	4.2	End ground schist cobble
23	40-50	Quartzite	H	9.8	5.9	4	Highly battered piece of quartz
23	50-60	Quartzite	H	6.3	5	5.7	Baseball" hammer cobble also ground
23	60-70	Schist	G	11	6.4	5.8	Surface ground-large area cobble
23	70-80	Quartzite	IC	10.6	7.7		Block like quartz core, crude
23	90-100	Schist	G/H	7.8	6.1	4.4	Block/Cobble
23	90-100	Schist	G	7.7	7.1	3.1	Flat cobble fragment

Table 106 cont. Non-Chipped Lithics Measured in the Field

Square	Depth	Raw Mat'l	*Type	**L	W	T	Comments:
23	110-120	Schist	A	10.3	8.7	5.4	Multiple Anvil 2 dimples Mongongo stone
23	110-120	Schist	G	10.4	8.6	3.4	Edge ground cobble
23	190-200	Quartzite	G	6.7	4.8	3.9	Possible ground edge
23	250-260	Silcrete	IC	9.9	8.7	5.7	Initial core/Unifacial chopper, 4 large flakes off of cobble
23	320-330	Schist	A	13.5	10.4	6	Major depression but not dimpled
23	430-440	Quartzite	H	10.5	8.3	5.8	Possible hammer on cobble
23	490-500	Schist	G	10.4	8.7	4.6	Possible traces of grinding split cobble
24	60-70	Quartzite	G	5.8	4.5	3.6	Striated & concave cobble
24	60-70	Quartzite	G	6.3	5.1	3.6	Possible grindstone
24	100-110	Quartzite	G	10.8	7.4	4.7	Cobble
25	60-70	Quartzite	G	9.2	7.1	4.4	Split cobble on edge
25	140-150	?	A?	7.7	5.2	4	Possible anvil
26	60-70	?	G	8.2	6.5	4.4	Major heavy ground, flat facet cobble fragment
26	60-70	Schist	G	7.4	6.6	3	Heavy edge grinding Mica schist
26	120-130	Schist	G	10.8	7.8	4.5	3/4 cobble Big mano-type flat facet & edge ground

*G = Grindstone
H= Hammerstone
O= Oval
IC= Initial Core
A/G etc.= Combined
** Measurements in centimeters

APPENDIX E

UTILIZED FLAKES

Table 107 Utilized Flakes

Square	Depth	R.M.	Edge Damage Loc.	Wt.gms
19	0-10	1	Dist	0.5
19	0-10	1	Dist	0.65
19	0-10	1	Unilat	1
12	10-20	1	Unilat	0.8
19	10-20	1	Unilat	0.3
11	30-40	1	Unilat	2
19	30-40	1	Unilat	0.8
19	30-40	1	Unilat	0.5
19	30-40	1	Unilat	0.8
19	30-40	1	Unilat	0.4
19	30-40	1	Unilat	0.3
19	40-50	1	Unilat	2.2
19	40-50	1	Unilat	0.7
19	40-50	1	Prox	1
22	40-50	1	Dist	1.3
22	40-50	1	Unilat	0.5
15	50-60	1	Dist	0.3
19	50-60	1	Unilat/Dist	1.2
19	50-60	1	Unilat	0.2
19	50-60	1	Dist	0.1
19	50-60	1	Dist	0.1
25	50-60	1	Unilat/Dist	3.9
25	50-60	1	Unilat/Prox	1.7
27	50-60	1	Unilat	1
11	60-70	1	Unilat	1.1
19	60-70	1	Unilat	0.2
19	60-70	1	Prox	0.8
28	80-90	1	Unilat	5.2
11	90-100	1	Unilat	4.9
19	90-100	1	Unilat	1.8
11	100-110	1	Unilat	8.6
28	110-120	1	Unilat	0.4
28	110-120	1	Bilat	0.6
28	110-120	1	Dist	1
28	110-120	1	Dist	1.2
28	110-120	1	Bilat	0.1
28	110-120	1	Bilat	0.8
22	120-130	1	Unilat	3.3
19	130-140	1	Unilat	3.4
22	130-140	1	Dist	1.6
19	140-150	1	Prox/Dist	0.3
19	140-150	1	Unilat/Dist	14.2
29	140-150	1	Dist	0.5
19	180-190	1	Unilat	12.3
19	180-190	1	Unilat/Dist	4.2
19	180-190	1	Unilat	7.6
19	180-190	1	Dist	0.8
19	180-190	1	Unilat	2.4
19	180-190	1	Dist	0.3
19	180-190	1	Unilat	10.7
22	190-200	1	Unilat	8.2

Table 107 cont. Utilized Flakes

Square	Depth	R.M.	Edge Damage Loc.	Wt.gms
22	190-200	1	Unilat	4.9
22	210-220	1	Unilat	4.2
19	220-230	1	Unilat	0.8
19	230-240	1	Unilat	3.6
19	250-260	1	Bilat	0.9
22	250-260	1	Dist	2.5
22	250-260	1	Dist	1.1
19	260-270	1	Unilat	2.6
19	260-270	1	Unilat	0.7
19	310-320	1	Unilat	0.5
22	350-360	1	Unilat	3.4
21	410-420	1	Unilat	0.9
23	410-420	1	Dist	1.9
23	420-430	1	Unilat	1
23	420-430	1	Unilat	1.1
22	430-440	1	Unilat	1.7
22	430-440	1	Dist	0.8
11/12	470-480	1	Unilat/Dist	3.4
23	550-560	1	Dist	5.5
21	560-570	1	Dist	0.4
19	0-10	2	Unilat	1.1
23	40-50	2	Unilat	0.2
19	60-70	2	Unilat	1.9
19	60-70	2	Unilat	0.7
19	60-70	2	Unilat	0.7
21	80-90	2	Unilat	4.5
24	90-100	2	Dist	1.3
23	110-120	2	Unilat	0.8
23	110-120	2	Bilat	0.6
22	140-150	2	Unilat	1.5
11	150-160	2	Unilat	1.6
21	150-160	2	Unilat	1.8
22	190-200	2	Unilat	4
23	210-220	2	Unilat	1.1
23	210-220	2	Unilat	2.3
23	220-230	2	Unilat	0.3
22	260-270	2	Unilat	0.4
21	360-370	2	Unilat	0.7
23	410-420	2	Unilat	1.9
23	410-420	2	Unilat	2.3
23	440-450	2	Unilat/Dist	0.5
19	0-10	3	Dist	1.7
19	0-10	3	Unilat	0.4
25	50-60	3	Unilat	1.4
19	60-70	3	Bilat	0.4
27	70-80	3	Unilat	0.3
28	90-100	3	Bilat	0.2
26	100-110	3	Unilat	0.6
22	110-120	3	Dist	0.7
23	110-120	3	Dist	0.7
22	130-140	3	Unilat/Dist	1.6

Table 107 cont. Utilized Flakes

Square	Depth	R.M.	Edge Damage Loc.	Wt.gms
23	490-500	3	Unilat	3.1
12/23	690-700	3	Dist	7.5
22	10-20	4	Dist	0.5
19	20-30	4	Unilat	0.2
20	20-30	4	Unilat	2.7
12	40-50	4	Dist	0.3
21	50-60	4	Bilat	0.7
12	60-70	4	Bilat	0.4
24	70-80	4	Dist	1.9
25	80-90	4	Unilat	2.9
15	90-100	4	Bilat	0.1
25	100-110	4	Dist	0.4
15	110-120	4	Unilat	0.4
23	110-120	4	Dist	0.4
19	160-170	4	Dist	0.3
19	250-260	4	Unilat	4.5
23	430-440	4	Unilat	2.3
23	470-480	4	Unilat/Prox	0.5
23	670-680	4	Unilat	1.1
25	0-10	5	Unilat	0.9
22	20-30	5	Unilat	0.4
22	100-110	7	Unilat	2.5
14	110-120	7	Dist	1.5
22	110-120	7	Dist	1
20	140-150	7	Unilat	3.5
22	140-150	7	Unilat	4.6
19	180-190	7	Unilat	3.2
19	180-190	7	Unilat	15.2
19	180-190	7	Dist	0.6
23	180-190	7	Unilat	9
20	200-210	7	Unilat	2.5
22	210-220	7	Unilat	5.2
19	260-270	7	Dist	1.2
22	270-280	7	Dist	1.7
22	300-310	7	Unilat	2.9
21	400-410	7	Unilat	2.8
22	450-460	7	Unilat	11.1
23	520-530	7	Unilat	2
23	560-570	7	Unilat	1.5
23	650-660	7	Unilat	1.7
23	670-680	7	Unilat	1.2
21	40-50	8	Unilat	1.3
11	70-80	8	Unilat/Dist	2.7
26	80-90	8	Unilat/Prox	1.3
22	110-120	8	Prox	0.9
25	110-120	8	Unilat	0.7
22	120-130	8	Bilat	4.7
22	250-260	8	Dist	5
22	250-260	8	Unilat	5.3
22	250-260	8	Unilat	4
22	250-260	8	Unilat	0.7

Table 107 cont. Utilized Flakes

Square	Depth	R.M.	Edge Damage Loc.	Wt.gms
22	370-380	8	Unilat/Dist	4.8
11/12	400-410	8	Unilat	2.4
23	430-440	8	Dist	0.6
23	560-570	8	Unilat/Prox	2.2
23	670-680	8	Unilat	3.3
12/23	690-700	8	Prox	8.3
15	20-30	9	Unilat	4.8
12	40-50	9	Unilat	0.7
20	50-60	9	Unilat	1.1
23	110-120	9	Dist	1.4
21	160-170	9	Unilat	3.2
12	180-190	9	Dist	0.6
22	250-260	9	Bilat	0.9
22	250-260	9	Bilat	0.7
11	350-360	9	Unilat	0.3
12	350-360	9	Unilat	0.2
12	360-370	9	Dist	2.8
12	380-390	9	Unilat	24.8
12	610-620	9	Unilat	10.8
23	650-660	9	Unilat/Prox	1.8
23	650-660	9	Unilat	3
23	670-680	9	Unilat	6.5
23	670-680	9	Unilat	5.5

Totals:176 422.55 gm

Avg. Wt. 2.04 gm

Key:
Dist. = Distal
Unilat. = Unilateral
Prox. = Proximal
Bilat. = Bilateral

Raw Material
1 = Quartz
2 = Brown Chert
3 = Chalcedony
4 = Jasper
5 = Transparent w/ black flecks
6 = Black Chert
7 = Silcrete
8 = Multi-Color Chert
9 = Other Fine Grained Raw Material

BIBLIOGRAPHY

BIBLIOGRAPHY

Aldworth, E.
1979 An interpretation of the Upper Pleistocene sequence in the Transvaal and Lesotho. Paper presented at Southern African Association of Archaeologists workshop: Towards a better understanding of the Upper Pleistocene in sub-Saharan Africa, Stellenbosch, June 27-29.

Ambrose, S.H.
1998 Chronology of the Later Stone Age and Food Production in East Africa. Journal of Archaeological Science 25:337-392.

Ammerman, A.J. and M.W. Feldman
1974 On the making of an assemblage of stone tools. American Antiquity 39(4):610-616.

Armstrong, A.L.
1931 Rhodesian archaeological expedition (1929): excavations in Bambata Cave and researches on prehistoric sites in Southern Rhodesia. Journal of the Royal Anthropological Institute 61:239-276.

Avery, D.M.
1979 Upper Pleistocene and Holocene Palaeoenvironments in the Southern Cape: The Micromammalian Evidence from Archaeological Sites. Unpublished Ph.D. thesis, University of Stellenbosch.

Avery, G.; K. Cruz-Uribe; P. Goldberg; F.E. Grine; R.G. Kline; M.J. Lenardi; H.P. Schwarcz; A.I. Thackeray; M.L. Wilson
1997 The 1992-1993 Excavations at the Die Kelders Middle and Later Stone Age Cave Site, South Africa. Journal of Field Archaeology 24:263-291.

Bamforth, D.B.
1991 Technological organization and hunter- gatherer land use: A California example. American Antiquity 56(2):216-234.

Barham, L.S.
1987 The Bipolar Technique in Southern Africa: A Replicaton Experiment. The South African Archaeological Bulletin 42:45-50.

Beaumont, P.B.
1973a Border Cave--a progress report. South African Journal of Science 69:41-46.

1973b The ancient pigment mines of southern Africa. South African Journal of Science 69:140-146.

1978 Border Cave. Unpublished M.A. thesis, University of Cape Town.

1979a The Stone Age cultural stratigraphy of Border Cave. Paper presented at Southern African Association of Archaeologists workshop: Toward a better understanding of the Upper Pleistocene in sub-Saharan Africa, Stellenbosch, June 27-27.

1979b A first account of recent excavations at Wonderwerk Cave. Paper presented at Southern African Association of Archaeologists workshop: Towards a better understanding of the Upper Pleistocene in sub-Saharan Africa, Stellenbosch, June 27-29.

1980 On the age of Border Cave Hominids 1-5. Palaeontologia Africana 23: 21-33.

Beaumont, P.B. and J.C. Vogel
1972 On a new radiocarbon chronology for Africa south of the equator. African Studies 31:65-89, 155-182.

Beaumont, P.B.; H. DeVilliers and J.C. Vogel
1978 Modern man in sub-Saharan Africa prior to 49,000 years B.P.: a review and evaluations with particular reference to Border Cave. South African Journal of Science 74:409-419.

Beaumont, P.B.; E.M. Van Zinderen Bakker and J.C. Vogel
1984 Environmental changes since 32,000 BP at Kathu Pan, northern Cape. In Late Cainozoic paleoclimates of the Southern Hemisphere, ed. by J.C Vogel, pp. 329-338. Rotterdam: Balkema.

Berndt, R.M.
1951 Ceremonial exchange in western Arnhem Land. Southwestern Journal of Anthropology 7:156-176.

Bettinger, R.L.
1987 Archaeological approaches to hunter-gatherers. Annual Review of Anthropology 16:121-142.

Bettinger, R.L.
1991 Middle-range theory and hunter-gatherers. In Hunter-Gatherers: Archaeological and Evolutionary Theory, ed. by R.L. Bettinger, pp. 61-82. Plenum Press, New York and London.

Bettinger, R.L. and M.A. Baumhoff
1982 The Numic spread: Great Basin cultures in competition. American Antiquity (47):485-503.

1983 Return rates and intensity of resource use in Numic and Prenumic adaptive strategies. American Antiquity 48:830-834.

Bielawski, E.
1988 Paleoeskimo variability: The Early Arctic small-tool tradition in the Central Arctic. American Antiquity 53(1):52-74.

Biesele, M. A.
1975 Folklore and ritual of !Kung hunter-gatherers. Unpublished Ph.D. thesis, Harvard University.

Binford, L.R.
1973 Interassemblage variability--the Mousterian and the "functional" argument. In The Explanation of Culture Change, ed. by C. Renfrew, pp. 227-254. London: Dukworth.

1978 Nunamiut ethnoarchaeology. New York: Academic Press.

1979 Organization and formation processes: looking at curated technologies. Journal of Anthropological Research 35:255-273.

1980 Willow Smoke and Dogs' Tails: Hunter gatherer settlement systems and archaeological site formation. American Antiquity (45):4-20.

1982 The archaeology of place. Journal of Anthropological Archaeology (1):5-31.

1983 Working at archaeology. New York: Academic Press.

1986 An Alyawara day: Making men's knives and beyond. American Antiquity 51(3):547-562.

Binford, L.R. and G.I. Quimby
1963 Indian Sites and Chipped Stone Materials in the Northern Lake Michigan Area. Fieldiana: Anthropology 26:277-307.

Binford L.R. and S.R. Binford
1966 A Preliminary Analysis of Functional Variability in the Mousterian of Levallois Facies. American Anthropology 68(2):238-295.

Binneman, J.N.F.
1982 Mikogebruikstekens op steenwerktuie: eksperimentele waarnemings en 'n studie van werktuie afkomstig van Boomplaasgrot. Ongepubliseerde M.A. tesis, Universiteit van Stellenbosch.

Bishop, W.W. and J.D. Clark (eds.)
1967 Background to Evolution in Africa. Chicago: University of Chicago Press.

Bisson, M.L.
1990 Lithic reduction sequences as an aid to the analysis of Late Stone Age quartz assemblages from the Luano Spring, Chingola, Zambia. African Archaeological Review 8:103-138.

Blumenschine, R.J. and C.W. Marean
1993 A Carnivore's View of Archaeological Bone Assemblages. In From Bones to Behavior, ed. by J. Hudson, pp. 273-301. Carbondale: Center for Archaeological Investigations.

Blumenschine, R.J.; C.W. Marean and S. D. Capaldo
1996 Blind Tests of Interanalyst Correspondence and Accuracy in the Identification of Cut Marks, Percussion Marks, and Carnivore Tooth Marks on Bone Surfaces. Journal of Archaeological Sciences 23: 493-507.

Bordes, F.H.
1950 Principes d'une Methode d'etude des techniques de debitage et de la typologie du Paleolithique ancien et moyen. L'Anthropologie 54:19-34.

1961 Mousterian cultures in France. Science 134:803-810.

Bordes, F.H. and M. Bourgon
1951 Le complexe mousterien: Mousterien, Levalloisien et Tayacien. L'Anthropologie 55:1-23.

Boushier, A. and P.B. Beaumont
1972 Mining in southern Africa and the emengence of modern man. Optima 22:2-12.

Bradley, B.A.
1975 Lithic reduction sequences: a glossary and discussion. In Lithic Technology: making and using stone tools, ed by E. Swanson, pp. 5-14. The Hague: Moutonpp.

Brain, C.K.
1969a Faunal remains from the Bushman Rock Shelter, eastern Transvaal. South African Archaeological Bulletin 24:52-55.

1969b New evidence for climatic change during Middle and Late Stone Age timens in Rhodesia. South African Archaeological Bulletin 24:127-143.

Brain, C.K. and C.K. Cooke
1967 A preliminary account of the Redcliff Stone Age cave sith in Rhodesia. South African Archaeological Bulletin 21:171-182.

Brink, J.S.
1987 The Archaeozoology of Florisbad, Orange Free State. Unpublished M.A. thesis, University of Stellenbosch.

Broadbent, N.
1979 Coastal Resources and Settlement Stability. Uppsala: Uppsala University Institute of North European Archaeology.

Brook, G.A.; D.A. Burney and J.B. Cowart
1990 Desert paleoenvironmental data from cave speleothems with examples from the Chihuahuan, Somali-Chalbi, and Kalahari deserts. Palaeogeography, Palaeoclimatology, Palaeoecology 76(3-4):311-329.

Brook, G.A.; K.A. Haberyan and S. De Filippis
1992 Evidence of a shallow lake at Tsodilo Hills, Botswana, 17,500 to 15,000 yr BP: further confirmation of a widespread Late Pleistocene humid period in the Kalahari Desert. Paleoecology of Africa and the Surrounding Islands 23:165-175.

Brook, G.A.; Cowart, J.B. and E. Marais
1996 Wet and dry periods in the southern African summer rainfall zone during the last 300 kyr from speoeothem, tufa and sand dune data. Paleoecology of Africa 24:147-158.

Brooks, A.S.
1984 San land-use patterns, past and present: Implications for Southern African prehistory. In Frontiers: Southern African archaeology today, ed. by M. Hall; G. Avery; D.M., Avery; M.L. Wilson and A.J.B. Humphreys, pp. 40-51. BAR reports, monographs in African Archaeology 10.

1989 Past Subsistence and Settlement Patterns in the Dobe Area: An Archaeological Perspective. Paper presented at the 1988 Annual Meeting of the American Anthropological Association, Washington D.C., November.

Brooks, A.S. and J.E. Yellen
1977 Archaeological excavations at =Gi: a preliminary report on the first two field seasons. Botswana Notes and Records 9:21-30.

Brooks, A.S.; A.L. Crowel and J.W. Yellen
1980 =Gi: A stone age archaeological site in the northern Kalahari Desert, Botswana. In Proceedings of the 8th PanAfrican Congress of Prehistory and Quaternary Studies, ed. by R.E. Leakey and B.A. Ogot, pp. 304-309. Nairobi.

Brooks, A.S. and J.E. Yellen
1986 The preservation of activity areas in the archaeological record: ethnoarchaeological and archaeological work in northwest Ngamiland Botswana. In Method and Theory of Activity Area Use, ed. by S. Kent. New York, Columbia University Press.

Brooks, A.S.; P.E. Hare; J.E. Kokis; G.H. Miller; R.D. Ernst and F. Wendorf
1990 Dating Pleistocene Archaeological Sites By Protein Diagenesis in Ostrich Eggshell. Science 248: 60-64.

Brooks, A.S.; D. Helgren; J. Cramer; A. Franklin; W. Hornyak; J. Keating; R. Klein; W. Rink; H. Schwarcz; J. Smith; K. Stewart; N. Todd; J. Verniers and J. Yellen
1995 Dating and Context of Three Middle Stone Age Sites with Bone Points in the Upper Semliki Valley, Zaire. Science 268:548-553.

Brooks, A.S. and S. McBrearty
1998 New Interpretations of the Origins of Modern Human Behavior. Paper presented at the Society of Africanist Archaeologists meetings, Syracuse University, New York. May 20-24.

Bunn, H.
1983 Comparative Analysis of Modern Bone Assemblages from a San Hunter-Gatherer Camp in the Kalahari Desert, Botswana, and from a Spotted Hyena Den near Nairobi, Kenya. In Animals and Archaeology, ed. by J. Clutton-Brock and C. Grigson pp. 21-30. BAR reports, London.

Butzer, K.W.
1978a Sediment stratigraphy of the Middle Stone Age sequences at Klasies River Mouth, Tsitsikama coast, South Africa. South African Archaeological Bulletin 33:141-151.

1979 Comment on "Implications of Border Cave skeletal remains for later Pleistocene human evolution." Current Anthropology 20:28.

1984a Archaeology and Quaternary environment in the interior of southern Africa. In Southern African prehistory and paleoenvironments, ed. by R.G. Klein, pp. 1-64. Rotterdam: Balkema.

1984b Late Quaternary environmnets in South Africa. In Late Cainozoic paleoclimates of the Southern Hemisphere, ed. by J.C. Vogel, pp. 235-264. Rotterdam: Balkema.

Butzer, K.W. and D.M. Helgren
1972 Late Cenozoic evolution of the cape coast between Knysna and Cape St. Francis, South Africa. Quaternary Research 2:143-169.

Butzer, K.W.; G.J. Fock; R. Stuckenrath and A. Zilch
1973 Palaeohydrology of Late Pleistocene Lake, Alexandersfontein, Kimberly, South Africa. Nature 243:328-330.

Butzer, K.W.; R. Stuckenrath; A.J. Bruzewicz and D.M. Helgren
1978 Late Cenozoic paleoclimates of the Gaap Escarpment, Kalahari margin, South Africa. Quaternary Research 10:310-339.

Butzer, K.W. P.B. Beaumont and J.C. Vogel
1978 Lithostratigraphy of Border Cave, KwaZulu, South Africa: A Middle Stone Age Sequence beginning ca. 195,000 B.P.. Journal of Archaeological Science 5:317-341.

Butzer, K.W. and J.C. Vogel
1979 Archeo-sedimentological sequences from the sub-montane interior of South Africa: Rose Cottage Cave, Heuningneskrans, and Bushman Rock Shelter. Paper presented at Southern African Association of Archaeologists workshop: Towards a better understanding of the Upper Pleistocene in sub-Saharan Africa, Stellenbosch, June 27-29.

Cable, C.
1984 A model for terminal Later Stone Age subsistence strategies in southern Natal. In Frontiers: Southern African archaeology today, ed. by M.G. Hall, Avery, D.M. Avery, M.L. Wilson, and A.J.B. Humphreys, pp. 167-181. Oxford: British Archaeological Reports International Series 207.

Cahen, D., L.H. Keeley, and F.C. VanNoten
1979 Stone tools, tool kits, and human behavior in prehistory. Current Anthropology 20(4):661-683.

Cann, R.L.
1987 In Search of Eve. The Sciences, September /October, pp. 30-37.

1988 DNA and Human Origins. Annual Review of Anthropology 17:127-143.

1987 Mitochondrial DNA and Human Evolution. Nature 325:31-36.

Campbell, A.C.
1980 The Guide to Botswana. Winchester Press Limited: Johannesburg, South Africa.

Campbell, A.C. and D. Coulson
1988 Cultural Confrontation at Tsodilo. Optima 36:12-19.

Campbell, A.C., L. Robbins, M. Murphy, L. Murphy and D. Cherry
1992 Archaeological Research at Tsodilo continues. The Zebra's Voice (19)3/4:8-10.

Campbell, A.C.; J. Denbow and E. Wilmsen
1994 Paintings like engravings: Rock art at Tsodilo. In Contested images: diversity in Southern African rock art research, ed. by T.A. Dowson and D.L. Williams, pp. 131-58. Johannesburg, Wits. University Press.

Campbell, A.C. and L.H. Robbins
1994 A Decorated Bone Artifact from the Tsodilo Hills. Botswana: Implications for Rock Art. Botswana Notes and Records 25:19-28.

Carter, P.L.
1969 Moshebi's Shelter: excavations and exploitation in eastern Lesotho. Lesotho Notes and Records 8:1-11.

1970 Late Stone Age exploitation patterns in southern Natal. South African Archaeological Bulletin 25:55-58.

1977 The Prehistory of Eastern Lesotho. Unpublished Ph.D. thesis, University of Cambridge.

Carter, P.L. and J.C. Vogel
1974 The dating of industrial assemblages from stratified sites in eastern Lesotho. Man 9:557-570.

Carter, P.L.; P.J. Mitchell and P. Vinnicombe
1988 Sehonghong: The Middle and Later Stone Age industrial sequence at a Lesotho rock-shelter. Oxford: BAR International Series 406.

Cashdan, E.
1983 Territoriality among human foragers: ecological models and an application to four Bushman groups. Current Anthropology 24:47-66.

Clark, A.M.B.
1997 The MSA/LSA transistion in southern Africa: new technological evidence from Rose Cottage Cave. South African Archaeological Bulletin LII:113-124.

Clark, J.D.
1950 The newly discovered Nachikufu Culture of Northern Rhodesia and the possible origin of certain elements of the South African Smithfield Culture. South African Archaeological Bulletin 5:86-98.

1957b A re-examination of the industry from the type-site of Magosi, Uganda. In Proceedings of the Third Pan-African Congress on Prehistory, Livingston, 1955. London: Chatto and Windus. pp. 228-241.

1959 The prehistory of Africa. London: Thames and Hudson.

1969 The Kalambo Falls Prehistoric Site, Volume I. Cambridge: Cambridge University Press.

1974 The Kalambo Falls Prehistoric Site, Volume II. Cambridge: Cambridge University Press.

1975 Africa in Prehistory: peripheral or paramount? Man 10:175-198.

1980 Raw Material and African lithic technology. Man and Environment 4:44-55.

Clark, J.D. (ed.)
1957 Proceedings of the third Pan-African Congress on Prehistory, Livingstone, 1955. London: Chatto and Windus.

Clark, J.D.; G.H. Cole; G. LI. Iassc and M.R Kleindienst
1966 Precision and definition in African archaeology. South African Archaeological Bulletin 21:114-121.

Cole, G.H.
1967 A re-investigation of Magosi and Magosian. Quaternaria 9:153-167.

Collins, M.B.
1975 Lithic technology as a means of processual inference. In Lithic technology: making and using stone tools, ed. by E. Swanson, pp. 15-34. The Hague: Mouton.

Conkey, M.W.
1980 The identification of prehistoric hunter-gatherer aggregation sites: the case of Altamira. Current Anthropology 21:609-630.

Cooke, C.K.
1963 Report on excavations at Pomongwe and Tshangula Caves, Matopo Hills, Southern Rhodesia. South African Archaeological Bulletin 18:73-152.

1968a The early Stone Age in Rhodesia. Arnoldia 3(39):1-1.

1968b What does the future hold for the amateur archaeologists? South African Archaeological Bulletin 23:3-8.

1969 A re-examination of the "Middle Stone Age" industries of Rhodesia. Arnoldia (Rhodesia) 4(7):1-20.

1971 Excavations in Zombepata Cave, Sipolilo District, Moshonaland, Rhodesia. South African Archaeological Bulletin 26:104-126.

1973 The Middle Stone Age in Rhodesia and South Africa. Arnoldia (Rhodesia) 6(20):1-4.

1976 An open Middle Stone Age, Tshangula site near the Victoria Falls, Rhodesia. Arnoldia (Rhodesia) 8(2):1-15.

1978 The Redcliff Stone Age site, Rhodesia. Occasional Papers of the National Museum of Rhodesia A Human Sciences 4(2):45-73.

1979 The industries of the Upper Pleistocene in Rhodesia. Paper presented at Southern African Association of Archaeologists workshop: Toward a better understanding of the Upper Pleistocene in sub-Saharan Africa, Stellenbosch, June 27-29.

Cooke, C.K.; R. Summers and K.R. Robinson
1966 Rodesian prehistory re-examined Part I: The Stone Age. Arnoldia (Rhodesia) 2(12):1-8.

Cooke, H.J.
1975 The paleoclimatic significance of caves and adjacent landform in western Ngamiland, Botswana. Geographical Journal 141:430-444.

1983 The evidence from northern Botswana of Late Quaternary climatic change. In Late Cainozoic palaeoclimates of the southern hemisphere, ed. by J.C. Vogel. SASQUA International Symposium, Swaziland, August 29-September 2,.

Cooke, H.J. and B.T. Verhagen
1977 The dating of cave development-an example from Botswana. In Proceedings of the 7th International Speoeological Congress, Sheffield, U.K. pp. 122-124.

Cooke, H.J. and B.T. Verstappen
1984 The landforms of the western Makgadikgadi Basin of northern Botswana, with a consideration of the chronology of Lake Paleo-Makgadikgadi. Zeits. Gemorhp. NF 28:1-19.

Cooke, H.B.S.; D.B. Malan and L.H. Wells
1945 Fossil man in the Lebombo Mountains, Soth Africa: the Border Cave, Ingwavuma District, Zululand. Man 45:6-13.

Cooke, J.D.
1979 The Stone Age In Botswana: A Preliminary Survey. Arnoldia 8:1-32.

Cotterell, B. and J. Kamminga
1987 The formation of flakes. American Antiquity 52(4):675-708.

Dart, R.A. and P.B. Beaumont
1968 Ratification and retrocession of the earlier Swaziland iron ore mining radiocarbon dates. South African Journal of Science 64:241-246.

1971 On a further radiocarbon date for ancient mining in southern Africa. South African Jounal of Science 67:10-11.

Deacon, H.J.
1976 Where hunters gathered: a study of Holocene Stone Age peoples in the eastern Cape. South African Archaeological Society Monograph Series 1.

1978 The Langkloof archaeological project (Cango Valley). Palaeoecology of Africa 10:135-137.

1979 Excavations at Boomplaas Cave-a sequence through the Upper Pleistocene and Holocene in South Africa. World Archaeology 10:241-257.

1980 Late Pleistocene and Holocene industries in the southern Cape and wider correlations. In Proceedings of the 8th Pan-African congress of Prehistory and Quaternary Studies, ed. by R.E. Leakey and B.A. Ogot, pp. 231-234. Nairobi: Louis Leakey Memorial Institute of African Prehistory.

1989a Late Pleistocene Palaoecology and Archaeology in the Southern Cape, South Africa. In The Human Revolution, ed. by P. Mellers and C. Stringer, pp. 547-564. Princeton University Press, Princeton, New Jersey.

1989b Origins of Modern Man-Ancestors of Us All. The Phoenix: Magazine of the Albany Museum 2:9-16.

Deacon, H.J. and M. Brooker
1976 The Holocene and Upper Pleistocene sequences in the southern Cape. Annals of the South African Museum 71:203-214.

Deacon, H.J.; J. Deacon and M. Brooker
1976 Four painted stones from Boomplaas Cave, Oudtshoorn District. South African Archaeological Bulletin 31:141-145.

Deacon, J.
1975 Demography, subsistence and culture during the Acheulean in southern Africa. In After the australopithecines, ed. by K.W. Butzer and G.L. Isaac, pp. 543-569. The Hague: Mouton.

1976b Review articles of The Stone Age Archaeology of Southern Africa. (by C.G. Sampson). South African Archaeological Bulletin 31:58-63.

1979a Guide to Archaeological Sites in the Southern Cape. Stellenbosch: Department of Archaeology, University of Stellenbosch.

1979b The Howiesons Poort and related industries in southern Africa with special reference to the name site collection. Paper presented at Southern African Association of Archaeologists workshop: Towards a better understanding of the Upper Pleistocene in sub-Saharan Africa, Stellenbosch, June 27-29.

1984a The Later Stone Age of Southernmost Africa. Cambridge Monographs in African Archaeology 12 BAR International Series 213.

1984b Later Stone Age people and their descendants in southern Africa. In Southern African Prehistory and Paleoenvironments, ed. by R. G. Klein pp. 221-328. Rotterdam: A.A. Balkema.

Deacon, J. and N. Lancaster
1988 Late Quaternary Paleoenvironments of Southern Africa. Oxford University Press.

Deacon, H.J. and J. Deacon
1980 The hafting, function and distribution of small convex scrapers with and example from Boomplaas Cave. South African Archaeological Bulletin 35:31-37.

Denbow, J.R. and E.W. Wilmsen
1983 Iron Age pastoral settlements in Botswana. South African Journal of Science 79:405-408.

1986 Advent and the Course of Pastoralism in the Kalahari. Science 234:1509-1515.

De Sonneville-Bordes, D. and J. Perrot
1954-1956 Lexique typologique du Paleolithique superieur. Bulletin de la Societe Prehistorique Francaise 52:327-335; 52:76-79; 53:408-412, 547-559.

De Villiers, H.
1973 Human skeletal remains from Border Cave, Ingwavuma District, KwaZulu, South Africa. Annals of the Transvaal Museum 28:229-256.

Dibble, H.
1987a The interpretation of Middle Paleolithic scraper morphology. American Antiquity 52(1):109-117.

Diester-Haas, H.K.; P. Rothe and H. Schrader
1988 Late Quaternary histroy of continental climate change and the Benguela current off South West Africa. Paleogeography, Palaeoclimatology, Palaeoecology 65:81-91.

Draper, N.
1985 Back to the drawing board: A simplified approach to assemblage variability in the Early Paleolithic. World Archaeology 17(1):2-16.

Dunnell, R.C.
1986 Methodological issues in Africanist artifact classification. In Advances in Archaeological Method and Theory 9:149-207.

Ebert, J.I. and R.K. Hitchcock
1977 Ancient Lake Makgadikgadi, Botswana: Mapping, Measurement and Paleoclimatic Significance. In Palaeoecology of Africa and the Surrounding Islands, ed. by E.M. Van Zinderen Bakker, Sr. and J.A. Coetzee, pp. 47-56. A.A. Balkema,Rotterdam.

Elkin, A.P.
1934 Anthropology and the future of the Australian Aborgines. Oceania V(1):1-18.

Eloff, J.F.
1969 Bushman Rock Shelter, eastern Transvaal: excavations, 1967-8. South African Archaeological Bulletin 24:60.

Feathers, J.
1997 Luminescence Dating of Sediment Samples From White Paintings Rockshelter, Botswana. Quaternary Science Reviews (Quaternary Geochronology) 16:321-331.

Fitting, J.E.
1968 Northern Lake Michigan Lithic Industries. In The Prehistory of the Burnt Bluff Area, pp. 116-133. Ann Arbor: University of Michigan Museum of Anthropology, Anthropological Papers 34.

Flenniken, J.J.
1981 Replicative systems analysis: a model applied to the vein quartz artifacts from the Hoko River site. Laboratory of Anthropology Reports of Investigation 59. Pullman: Washington State University.

1985 Stone tool reduction techniques as cultural markers. In Stone Tool Analysis, ed. by M.G. Plew; J.C. Woods and M.G. Paversic. University of New Mexico Press, Albequerque.

Grove, A.T.
1969 Landforms and climatic change in the Kalahari and Ngamiland. Geographical Journal 135:191-212.

Goodwin, A.J.H.
1926a South African stone implement industries. South African Journal of Science 23:784-788.

1928a An introduction to the Middle Stone Age of South Africa. South African Journal of Science 25:419-425.

1929a The Middle Stone Age. Annals of the South African Museum 27:95-145.

1945 Some historical Bushman arrows. South African Journal of Science 41:429-443.

Goodwin, A.J.H. and C. Van RietLowe
1929 The Stone Age cultures of South Africa. Annals of the South African Museum (27):1-289.

Gould, R.A.
1968a Living Archaeology: The Ngatatjara of Western Australia. Southwestern Journal of Anthropology 24(2):101-122.

1977 Some current problems in ethnoarchaeology. In Experimental archaeology ed. by D. Ingersoll; J.E. Yellen and W. MacDonald, pp. 359-377. New York: Columbia University Press.

1980 Living archaeology. Cambridge: Cambridge University Press.

Grine, F.E., R.G Klein, and T.P. Volman
1991 Dating, Archaeology and Human Fossils from the Middle Stone Age Layers of Die Kelders Cave 1, South Africa. Journal of Human Evolution 21:363-395.

Hassan, F.A.
1988 Prolegomena to a grammatical theory of lithic artifacts. World Archaeology 19(3):281-296.

Hayden, B.
1977 Stone tools functions in the Western Desert. In Stone tools as cultural markers ed. by R.V.S. Wright, pp. 178-188. Canberra: Australian Institute of Aboriginal Studies.

1979 Paleolithic reflections: lithic technology and ethnographic excavation among Australian Aborgines. Canberra: Australian Institute of Aboriginal Studies.

Heine, K.
1978b Radiocarbon chronology of late Quaternary lakes in the Kalahari, southern Africa. Catena (Braunschweig) 5:145-149.

1987 On the older late Quaternary lake-level fluctuations in the central Kalahari, Southern Africa. Paleoecology of Africa and of the Surrounding Islands 18:73-101.

Heine, K. and M.E. Geyh
1984 Radiocarbon dating of speleothems from the Rossing cave, Namib desert, and paleoclimatic implications. In Late Cainozoic Palaeoclimates of the Southern Hemisphere, ed. by J.C. Vogel, pp. 465-470. A.A. Balkema, Rotterdam.

Helgren, D.M.
1978 Acheulian settlement along the lower Vaal River, South Africa. Journal of Archaeological Science 5: 39-60.

1984 Historical gemorphology and geoarchaeology in the southwestern Makgadikagadi basin, Botswana. Annals of the Association of American Geographers 74(2): 298-307.

Helgren, D.M. and A.S. Brooks
1983 Geoarchaeology of Gi, a Middle Stone Age and Later Stone Age site in the northwest Karlhari. Journal of Archaeological Science, 10:181-197.

Henshilwood, C. and J. Sealy
1997 Bone Artefacts from the Middle Stone Age at Blombos Cave, Southern Cape, South Africa. Current Anthropology 38:890-895.

Hitchcock, R.K.
1987 Socioeconomic change among the Basarwa in Botswana: An ethnohistorical analysis. Ethnohistory (34):219-255.

Inizan, M.L.; H. Roche; J. Tixier
1992 Technology of Knapped Stone. Meudon: CREP.

Isaac, G.L.
1975 Stratigraphy and cultural patterns in East Africa during the middle ranges of Pleistocene time. In After the Australopithecines, ed. by K.W. Butzer, and G.L.Isaac, pp. 495-542. The Hague: Mouton.

1976 Plio-Pleistocene artifact assemblages from East Rudolf, Kenya. In Earliest Man and Environments in the Lake Rudolf Basin, ed. by Y. Coppens; F.C. Howell; G.L. Isaac and R.E.F. Leakey, pp. 552-564. Chicago: University of Chicago Press.

1977 Olorgesailie: Archaeological Studies of a Middle Pleistocene Lake Basin in Kenya. Chicago: University of Chicago Press.

Ivester, A.H.
1995 A Late Quaternary Paleoenvironmental Record From Sediments At The White Paintings Rock Shelter, Tsodilo Hills, Botswana, M.A. thesis, University of Georgia.

Jones, N.
1933 Excavations at Nswatugi and Madiliyangwa, and notes on new sites located and examined in the Matopo Hills, Southern Rhodesia, 1932. Occasional Papers of the Rhodesian Museum 1(2):1-44.

1940 Bambata Cave: a reorientation. Occasional Papers of the National Museums of Southern Rhodesia. 2(11):39-46.

Kaplan, J.
1989 45,000 years of hunter-gatherer history in Natal as seen from Umhlatuzana Rock Shelter. South Africa Archaeological Society Goodwin Series 6:7-16.

Kelly, R.L.
1992 Mobility/sedentism: Concepts, archaeological measures, and effects. Annual Review of Anthropology (21):43-66.

1995 The Foraging Spectrum: Diversity in Hunter-Gatherer Lifeways. Smithsonian Institution Press, Washington D.C.

Kent, S.
1984 Analyzing Activity Areas: An Ethnoarchaeological study of the use of space. Albuquerque: University of New Mexico Press.

1991 The relationship between mobility strategies and site structure. In The Interpretation of Archaeological Spatial Patterning, ed. by E.M. Krool and T.D. Price, pp. 22-59. New York: Plenum.

Kent, S. ed.
1989 Farmers as Hunters. Cambridge: Cambridge Univesity Press.

Kent, S. and H. Vierich
1989 The myth of ecological determinism-anticipated mobility and site spatial organization. In Farmers as Hunters, ed. by S. Kent, pp. 96-130. Cambridge: Cambridge University Press.

Kerrich, J.E. and D.L. Clarke
1967 Notes on the possible misuse and errors of cumulative percentage frequency graphs for the comparison of prehistoric artifact assemblages. Proceedings of the Prehistoric Society, 33:57-69.

Kitagawa, H. and J. van der Plich
1998 Atmospheric Radiocarbon Calibrations to 45,000 years B.P.: Late Glacial Fluctuations and Cosmogenic Isotope Production. Science 279:1187-1190.

Klein, R.G.
1974a Environment and subsistence of prehistoric man in the southern Cape Province, South Africa. World Archaeology 5:249-284.

1974b A provisional statement on terminal Pleistocene mammalian extinctions in the Cape Biotic Zone (southern Cape Province, South Africa). South African Archaeological Society Goodwin Series 2:39-45.

1975a Middle Stone Age man-animal relationships in southern Africa: evidence form Die Kelders and Klasies River Mouth. Science 190:265-267.

1976b The mammalian fauna of the Klasies River Mouth sites, southern Cape Province, South Africa. South African Archaeological Bulletin 31: 74-98.

1977a The Ecology of Early Man in Southern Africa. Science 177(4299):115-126.

1978c A preliminary report on the larger mammals from the Boomplaas Stone Age cave site, Cango Valley, Oudtshoorn District, South Africa. South African Archaeological Bulletin 33:66-75.

1978d Stone Age predation on large African bovids. Journal of Archaeological Science 5:195-217.

1979 Stone Age exploitation of animals in southern Africa. American Science 67:151-160.

1980a Environmental and ecological implications of large mammals from Upper Pleistocene and Holocene sites in southern Africa. Annals of the South African Museum 81:223-283.

1980b Later Pleistocene hunters. In The Cambridge Encyclopedia of Archaeology, ed. by A. Sherratt. Cambridge: Cambridge University Press.

1981 Stone Age predation on samll African bovids. South African Archaeological Bulletin 36:55-65.

1984 Mammalian extinctions and Stone Age people in Africa. In Quaternary Extinctions: A Prehistoric Revolution, ed. by P.S. Martin and R.B. Klein, pp. 553-573. Tucson: University of Arizona Press.

1989 Biological and Behavioral Perspectives on Modern Humans in Southern Africa. In The Human Revolution, ed. by P. Mellars and C. Stringer, pp. 529-546. Edinburgh, Edinburgh University Press.

1995 Anatomy, Behavior, and Modern Human Origins. Journal of World Prehistory 9:167-197.

Klein, R.G. (ed.)
1984 Southern African prehistory and paleoenvironments. A.A. Balkema.

Kleindienst, M.R.
1967 Questions of terminology in regard to the study of Stone Age industries in eastern Africa: Cultrual Stratigraphic Units. In Background to Evolution in Africa, ed. by W.W. Bishop and J.D. Clark, pp.821-859. Chicago: University of Chicago Press.

Kobayashi, H.
1975 The experimental study of bipolar flakes. In Lithic Technology ed by. E. Swanson, pp. 115-127. The Hague: Mouton.

Kuman, K.A.
1989 Florisbad and =Gi: The Contribution of Open-Air Sites to Study of The Middle Stone Age in Southern Africa. Unpublished Ph.D. dissertation, University of Pennsylvania.

Lancaster, N.
1979 Evidence of a widespread late Pleistocene humid period in the Kalahari. Nature 279:145-146.

1984 Aridity in southern Africa: age, origins and expression in landforms and sediments. In Late Cainozoic Paleoclimates of the Southern Hemisphere, ed. by J.C. Vogel, pp. 433-444. A.A. Balkema: Rotterdam.

1987 Formation and reactivation of dunes in the southwestern Kalahari: Palaeoclimatic implications. Palaeoecology of Africa 18:103-110.

1989 Late Quaternary Palaeoenvironments in the southwestern Kalahari. Palaeogepgraphy, Palaeoclimates, Palaeoecology 70:367-376.

Lee, R.B.
1979 The !Kung San: men, women and work in a foraging society. Cambridge: Cambridge University Press.

Lewis-Williams, J.D.
1984 Ideological continuities in prehistoric southern Africa: the evidence of rock art. In Past and present in hunter-gatherer studies, ed. by C. Schire, pp. 225-251. Orlando, Florida: Academic Press.

Louw, A.W.
1969 Bushman Rock Shelter, Ohrigstad, eastern Transvaal: a preliminary investigation, 1965. South African Archaeological Bulletin 24:39-51.

Malan, B.D.
1946 The distribution and chronology of the Modderpoort culture. South African Journal of Science 42:254-260.

1949 Magosian and Howieson's Poort. South African Archaeological Bulletin 4:34-36.

1952 The Final phase of the Middle Stone Age in South Africa. In Proceedings of the Pan-African Congress on Prehistory, 1947, ed. by L.S.B. Leakey. Oxford: Basil Blackwell.

Marshall, L.
1969 The medicine dance of the !Kung Bushmen. Africa 39:347-381.

1976 The !Kung of Nyai Nyai. Harvard University Press, Cambridge, Mass.

Martin, A.R.H.
1968 Pollen analysis of the Groenvlei lake sediments, Knysna (South Africa). Review of Palaeobotany and Palynology 7:107-144.

Mason, R.J.
1957 The Transvaal Middle Stone Age and statistical analysis. South African Archaeological Bulletin 12: 119-137.

1962 Prehistory of the Transvaal. Johannesburg: Witwatersrand University Press.

1967a Analytical procedures in the Earlier and Middle Stone Age cultures in southern Africa. In Background to Evolution in Africa, ed. by W.W. Bishop and J.D. Clark. Chicago: University of Chicago Press.

1969 Tentative interpretations of new radiocarbon dates for stone artefact assemblages from Rose Cottage Cave, O.F.S. and Bushman Rock Shelter, Transvaal. South African Archaeological Bulletin 24:57-59.

1971 Multivariate analysis of Cave of Hearths Middle Stone Age artefact assembalges. University of the Witwatersrand Department of Archaeology Occasional Papers 7:1-34.

Mazel, A.
1983 Eland, reedbuck and cranes: identifying seasonality in the paintings of the Drakenberg. The South African Archaeological Society Goodwin Series 4:34-37.

McBryde, I.
1984 Kulin greenstone quarries: The social context of production and distribution for the Mt. William site. World Archaeology 16(2):267-285.

McPherron, A.L.
1966 The Juntunen Site and the Late Woodland Prehistory of the Upper Great Lakes Area. Ph.D. dissertation, University of Michigan. Ann Arbor: University Microfilms.

Miller, S.F.
1969 The Nachikufu industries of the Later Stone Age in Zambia. Unpublished Ph.D. thesis, University of California, Berkeley.

Mitchell, P.J.
1994 Understanding the MSA/LSA transition: the pre-20,000 B.P. assemblages from new excavations at Sehonghong Roch Shelter, Lesotho. Southern African Field Archaeolgy 3:15-25.

Mitchell, P.J. and J.M. Steinberg
1992 Ntloana Tsoana: A Middle Stone Age Sequence from Lesotho. South African Archaeological Bulletin 47: 26-33.

Murphy, M.L.
1991 Archaeological Investigations at the Tsodilo Hills. The Zebra's Voice: National Museum, Monuments and Art Gallery, Gaborone, Botswana 18(2/3/4):6-7.

Murphy, M.L; L. Murphy; A.C Campbell and L.H. Robbins
1994 Prehistoric Mining of Mica Schist at the Tsodilo Hills, Botswana. Journal of the South African Institute of Mining and Metallurgy 94:87-92.

Musonda, F.B.
1984 Late Pleistocene and Holocene microlithic industries from the Lusemfwa Basin, Zambia. South African Archaeological Bulletin 39:24-36.

1985 Aspects of the Prehistory of the Lunsemfwa Drainage Basin, Zambia, during the last 20,000 years. Unpublished Ph.D. thesis, University of California, Berkeley.

Netterberg, F.
1980 Observation of calcretes at some archaeological and palaeontological sites in South Africa. South African Archaeological Society, Goodwin Series 2:20-24.

O'Connell, J.F.
1977 Aspects of variation in Central Australian lithic assemblages. In Stone tools as cultural markers, ed. by R.V.S Wright. Canberra: Australian Institute of Aboriginal Studies.

Parkington, J.
1977 Follow the San. Unpublished Ph.D. thesis: University of Cambridge.

1980 Time and place: some observations on spatial and temporal patterning in the Later Stone Age sequence in southern Africa. South African Archaeological Bulletin 35:73-83.

1981 The effects of environmental change on the scheduling of visits to Elands Bay Cave, Cape Province, South Africa. In Patterns of the Past: studies in honour of D. Clarke, ed. by I. Hodder; G. Isaac; G. Hammond and N. Hammond. pp. 341-59. Cambridge: Cambridge University Press.

1984 Changing views of the Late Stone Age of South Africa, In Advances in World Archaeology, Volume 3, ed. by F. Wendorf and A.E. Close, pp. 89-142. New York: Academic Press.

Patterson, L.W.
1983 Criteria for determining the attributes of man-made lithics. Journal of Field Archaeology 10:297-301.

1990 Characteristics of bifacial reduction flake size distribution. American Antiquity 55:550-558.

Peacock, E.
1991 Distinguishing between artifacts and geofacts: A test case from eastern England. Journal of Field Archaeology 18:345-361.

Phillipson, D.W.
1976 The prehistory of eastern Zambia. British Institute in Eastern Africa Memoir 6:1-229.

1977 The Later Prehistory of Eastern and Southern Africa. New York: Africana.

1993 African Archaeology. Cambridge University Press, Cambridge and New York.

Pickford, M.
1990 Some fossiliferous Plio-Pleistocene cave systems of Ngamiland. Botswana Notes and Records 22:1-15.

Plug, I.
1978 Die Latere Steentydperk van die Boesmanrotsskuiling in Oos-Transvaal. Unpublished M.A. thesis, University of Pretoria.

1979 Bushman Rock Shelter (BRS): some research results on the late Pleistocene/early Holocene deposits. Paper presented at the Southern African Association of Archaeologists workshop: Towards a better understanding of the Upper Pleistocene in sub-Saharan Africa, Stellenbosch, June 27-29.

Pough, F.H.
1976 A Field Guide To Rocks and Minerals. Fourth edition, Houghton Mifflin Company, Boston.

Price-Willians, D. and A. Watson
1982 New observations on the prehistory and palaeoclimate of the the late Pleistocene in southern Africa. World Archaeology 13:372-381.

Protsch, R.
1974 The fish Hoek hominid: another member of basic Homo sapiens afer. Anthropologischer Anzeiger 24: 241-249.

Rightmire, G.P.
1978b Human skeletal reamins from the southern Cape Province and their bearing on the Stone Age prehistory of South Africa. Quaternary Research 9:219-230.

1979a Implications of Border Cave skeletal remains for later Pleistocene human evolution. Current Anthropology 20:23-35.

1989 Middle Stone Age Humans from Eastern and Southern Africa. In The Human Revolution, ed. by P. Mellars and C. Stringer, pp. 109-122. Princeton University Press, Princeton, New Jersey.

Ritter, P. and M. Mann
1995 Discovery and Exploration of two new caves in the Northwest District. Botswana Notes and Records 27: 1-12.

Robbins, L.H.
1984 Archaeology in Southeastern Botswana. Current Anthropology 25:229.

1985 The Manyana Rock Painting Site. Botswana Notes and Records 17:1-14.

1986 Recent Archaeological Research in Southeastern Botswana: the Thamaga site. Botswana Notes and Records 18.

1987 Stone Age Archaeology in the Northern Kalahari: Savuti and Kudiakam Pan. Current Anthropology 28: 567-569.

1989 Rock Shelter archaeology at Tsodilo and the implications for Khoisan Prehistory. Paper presented at AAA annual meeting, Washington D.C.

1990a The Depression Site, A Stone Age Sequence in the Northwest Kalahari Desert, Botswana. National Geographic Research 6:329-338.

1990b Excavations at the White Paintings Rock Shelter, Tsodilo Hills. Nayame Akuma.

1991 The White Paintings Rock Shelter: Western Kalahari Desert, Botswana. Reasarch and Exploration (National Geographic Society).

1996 All that glitters is not gold: Evidence of Intensive Specularite Mining at the Tsodilo Hills, Botswana. Paper presented at the 13th Biennial Conference, Society of Africanist Archaeologists, Poznan, Poland (Sept).

Robbins, L.H. and A.C. Campbell
1989a The Depression Rock Shelter, Tsodilo Hills. Botswana Notes and Records 20:1-3.

1989b Tsodilo Hills, More Excavations at the National Monument. Zebra's Voice, National Museum and Art Gallery, Gaborone.

Robbins, L.H.; M.L. Murphy and K.M. Stewart
1992 The Aquatic Civilization of Middle Africa Surfaces in Southern Africa: Barbed Bone "Harpoons" and Fish from the Western Kalahari Desert, Botswana. Paper presented at the Society of Africanist Archaeologists meeting held at UCLA, Los Angeles, California. March, 1992.

Robbins, L.H.; M.L. Murphy; K.M. Stewart; A.C. Campbell and G.A. Brook
1994 Barbed bone points, Paleoenvironment and the Antiquity of Fish Exploitation in the Kalahari Desert, Botswana. Journal of Field Archaeology 21: 257-264.

Robbins, L.H. and M.L. Murphy
1994 The Early Stone Age in The Kalahari. Paper presented at the Society of Africanist Archaeologists Conference, Indiana University, Bloomington. April.

Robbins, L.H.; M.L. Murphy; N.J. Stevens; G.A. Brook; A. Ivester; K.A. Haberyan; R.G. Klein; R. Milo; K.M. Stewart; D.G. Mattieson and A. Winkler
1995 Paleoenvironment and archaeology of Drotsky's Cave: Western Kalahari Desert, Botswana. Journal of Archaeological Science 23:7-22.

Robbins L.H. and M.L. Murphy
1996 The Early and Middle Stone Age of Botswana. Paper presented at the Archaeology of Botswana Conference, University of Botswana, Gaborone. October.

Robbins, L.H.; M.L. Murphy; A.C. Campbell and G.A. Brook
1996 Excavations at the Tsodilo Hills Rhino Cave. Botswana Notes and Records 28:23-45.

Robbins, L.H. and M.L. Murphy
1998 The early Late Stone Age and evidence of modern human behavior. Paper presented at the Paleoanthropology Society Annual Meeting, Seattle, Washington. March.

Robbins, L.H.; M.L. Murphy; A.C. Campbell and G.A. Brook
1998 Intensive Mining of Specular Hematite in the Kalahari ca A.D. 800-1000. Current Anthropology 39: 144-150.

Rovner, I.
1975 Lithic Sequences from the Maya Lowland. Ph.D. dissertation, University of Wisconsin, Madison. Ann Arbor: University Microfilms.

Sampson, C.G.
1968a The Middle Stone Age industries of the Orange River scheme area. <u>National Museum, Bloemfontein, Memoir</u> 4:1-111.

1968b Two analyses of the Middle Stone Age industries from the Cave of Hearths and Olieboompoort Shelter, northern Transvaal--method B. <u>University of the Witwatersrand Archaeological Research unit Occasional Papers</u> 2:1-11.

1972 The Stone Age industries of the Orange River scheme and South Africa. <u>National Museum, Bloemfontein, Memoir</u> 6:1-288.

1974 <u>The Stone Age Archaeology of Southern Africa</u>. Academic Press, New York.

Sampson, C.G. and B. Bousman
1985 Variation in the size of archaeological sites attributed to the Seacow River Bushman. <u>South African Journal of Science</u> 81:321-323.

Schiffer, M.B.
1976 <u>Behavioral Archaeology</u>. New York: Academic Press.

Sealy, J. and R. Yates
1996 Direct radiocarbon dating of early sheep bones: Two further results. <u>South African Archaeological Bulletin</u> 51:109-110.

Shaw, P.A.
1985a The desiccation of Lake Ngami: an historical perspective. <u>Geographic Journal</u> 151:318-326.

1985b Late Quaternary landforms and environmental change in north-west Botswana: the evidence from Lake Ngami and the Mababe Depression. <u>Trans. Inst. Br. Geogr. NS</u> 10:333-346.

Shaw, P.A., and H.J. Cooke
1986 Geomorphic evidence of the late Quaternary palaeoclimates of the middle Kalahari of northern Botswana. <u>Catena</u> (Giessen) 13(4):349-359.

Shaw, P.A. and D.S.G. Thomas
1988 Lake Caprivi: a late Quaternary link between the Zambezi and middle Kalahari drainage system. <u>Zeitschrift fuer Geomorphologie</u> 32(3):329:337.

Shaw, P.A.; S. Stokes; D.S.G. Thomas; F.B.M. Davies and K. Holmgren
1997 Paleoecology and age of a Quaternary high lake level in the Makgadikagadi Basin of the Middle Kalahari, Botswana. South African Jounal of Science 93:273-276.

Shelly, P.H.
1990 Variation in lithic assemblages: An experiment. Journal of Field Archaeology 17:187-193.

Sheppard, J.G. and E.R. Swart
1967 Rhodesian radiocarbon measurements III. Radiocarbon 9:382-386.

1971 Rhodesian radiocarbon measurements IV. Radiocarbon 13:420-431.

Silberbauer, G.
1981 Hunter and habitat in the central Kalahari Desert. Cambridge University Press, Cambridge.

Singer, R. and J. Wymer
1982 The Middle Stone Age at Klasies River Mouth in South Africa. University of Chicago Press, Chicago.

Solway, J.S. and R.B. Lee
1990 Foragers, Genuine or Spurious? Situating the Kalahari San in history. Current Anthropology 31(2):109-146.

Sorensen, J.H.
1978 The Lithic Assemblages of the Hacklander Site, Allegan County, Michigan. M.A. thesis, Western Michigan University. Ann Arbor: University Microfilms.

Speth, J.D.
1972 Mechanical basis of percussion flaking. American Antiquity 37(1):34-60.

Stanner, W.E.H.
1933-4 Ceremonial economies of the Mulluk Mulluk and Madngella tribes of the Daly River, North Australia. A preliminary paper. Oceania IV(2):156-175; IV(4):458-471.

Stevenson, M.G.
1985 The formation of artifact assemblages at workshop /habitation sites: Models from Peace Point in Northern Alberta. American Antiquity 50(1):63-81.

Stewart, K.M.
1989 Fish remains from Beds I and II, Olduvai Gorge, Tanzania. BAR International Series 521.

Stringer, C.B. and P. Andrews
1988 Genetic and Fossil Evidence for the Origins of Modern Humans. Science 239:1263-1268.

Sullivan, A.P. and K.C. Rozen
1985 Debitage analysis and archaeological interpretation. American Antiquity 50(4):755-779.

Tanaka, J.
1980 The San hunter-gatherers of the Kalahari. Tokyo: University of Tokyo Press.

Teller, J.T.; N. Rutter and N. Langcaster
1990 Sedimentology and paleohydrology of late Quaternary lake deposits in the northern Namib sand sea, Namibia. Quaternary Science Reviews 9:343-364.

Thackeray, A.I.
1981 The Holocene cultural sequence in the northern Cape Province, South Africa. Unpublished Ph.D. thesis: Yale University.

1989 Changing Fashions in the Middle Stone Age: The Stone Age Artefact Sequence form Klasies River Main Site, South Africa. The African Archaeological Review 7:33-57.

Thackeray, A.I.; J.F Thackeray; P.B. Beaumont and J.C. Vogel
1981 Dated rock engravings from Wonderwerk Cave, South Africa. Science 214:64-67.

Thomas, D.H.
1972 A computer simulation model of Great Basin Shoshonean Subsistence and settlement patterns. In Models in Archaeology, ed. by D.L. Clarke, pp. 671-704. Methuen and Co.,London.

1973 An Empirical Test for Steward's Model of Great Basin Settlement Patterns. American Antiquity 38:155-176.

1976 Figuring Anthropology: First Principles of Probability and Statistics. Holt, Rinehart and Winston.

Thomas, D.S.G. and P. Shaw
1991 The Kalahari Environment. Cambridge University Press, Cambridge.

Toth, W.
1987 Behavioral inferences from Early Stone artifact assemblages: An experimental model. Journal of Human Evolution 16:763-787.

Tringham, R.; G. Cooper; G. Odell; B. Voytek and A. Whitman
1974 Experimentation in the formation of edge damage: A new approach to lithic analysis. Journal of Field Archaeology 1:171-196.

Truswell, J.F.
1977 The Geological Evolution of South Africa. Cape Town: Purnell.

Tyson, P.D.
1986 Climatic Change and Variability in Southern Africa. Cape Town: Oxford University Press.

Van Wyk, W.L.
1980 Geological Map of Namibia. Geological Survey Department of South Africa and South West Africa, Windhoek, Namibia.

Vogel, J.C.
1969 Radiocarbon dating of Bushman Rock Shelter, Ohrigstad District. South African Archaeological Bulletin 24:56.

1979 Problems in dating Middle Stone Age. Paper presented at Southern African Association of Archaeologists workshop: Towards a better understanding of the Upper Pleistocene in sub-Saharan Africa, Stellenbosch, June 27-29.

1989 Evidence of past climatic change in the Namib desert. Palaeogeography, Palaeclimates, Palaeoecology 70:355-366.

Vogel, J.C. and P.B. Beaumont
1972 Revised radiocarbon chronology for the Stone Age in South Africa. Nature 237:50-51.

Volman, T.P.
1981 The Middle Stone Age in the Southern Cape. Ph.D. dissertation, University of Chicago.

1984 Early prehistory of southern Africa. In Southern African Prehistory and paleoenvironments, ed. by R.G. Klein, pp. 169-220. Balkema, Rotterdam.

Wadley, L.
1984 Subsistence strategies in the Transvaal Stone Age: a preliminary model. In Frontiers: southern African archaeology today, ed. by M. Hall; G. Avery; D.M. Avery; M. Wilson and A.J.B. Humphreys, pp. 207-214. Oxford: British Archaeological Reports International Series 207.

1987 Later Stone Age hunters and gatherers of the southern Transvaal. Oxford: BAR International Series 380.

1991 Rose Cottage Cave: background and a preliminary report on the recent excavations. South African Archaeological Bulletin 46:125-130.

1993 The Pleistocene: Later Stone Age South of the Limpopo River. Journal of World Prehistory 7:287.

1996 The Robberg levels of Rose Cottage Cave: technology, environments and spatial analysis. South African Archaeological Bulletin 51:64-74.

1998 MSA and LSA Behavioral Differences: The evidence from Rose Cottage Cave, South Africa. Paper presented at the Society of Africanist Archaeologists meetings at Syracuse University, New York. May 20-24.

Wadley, L. and P. Harper
1988 Rose Cottage Cave revisited: Malan's Middle Stone Age Collection. South African Archaeological Bulletin 44:23-32.

Wadley, L. and J.N.F. Binneman
1995 Arrowheads or penknives? A microwear analysis of Mid-Holocene stone segments from Jubilee Shelter, Transvaal. South African Journal of Science 91:153-156.

Walker, N.J.
1978 The Later Stone Age of the Matopos. Rhodesian Prehistory 16:2-7.

1990 Zimbabwe at 18,000 B.P. In The World at 18,000 B.P. Vol. 2: The low latitudes, ed. by. C. Gamble and O. Soffer, pp. 206-213. London: Unwin Hyman.

1991 Technological changes in the Later Stone Age of the Matopos, Zimbabwe. The Zimbabwe Service News 25:37-41.

1995 Late Pleistocene and Holocene Hunter-gatherers of the Matopos. Societas Archaeologica Upasaliensis, Uppsala. Almqvist and Wiksell, Sweden.

Wayland, E.J. and M.C. Burkitt
1924 The Magosian culture of Uganda. Journal of the Royal Anthropological Institute 62:369-390.

Weedman, K.J.
1993 Foragers, Pastoro-Foragers, and Agro-Pastoralist: Lithic Use in Botswana from the 2nd Millennium BC Through the 19th Century AD. Unpublished MA thesis. The University of Texas at Austin.

Wellington, J.
1955 Southern Africa: A Geographical Study. 2 vols. Cambridge University Press. Cambridge.

Wendorf, F. and R. Schild
1974 A Middle Stone Age Sequence from the Central Rift Valley, Ethiopia. Warsaw: Polish Academy of Sciences.

Wendt, W.E.
1972 Preliminary report on an archaeological research programme in South West Africa. Cimbebasia (B)2:1-61.

1974 "Art Mobilier" aus der Apollo 11-Grotte in Sudwest-Afrika: die altesten datierten Kunstwerke Afrikas. Acta Prasehistorica et Archaeologica 5:1-42.

1976 "Art mobilier" from from the Apollo 11 Cave, South West Africa: Africa's oldest dated works of art. South African Archaeological Bulletin 31:5-11.

Whallon, R.
1973 Spatial analysis of occupation floors: Application of dimentional alalyis of variance. American Antiquity 38:266-278.

White, J.P.
1968 Fabricators, Outils ecilles of scalar cores? Mankind 6:658-666.

White, J.P. and D. Thomas
1972 What mean these stones? Ethnotaxonomic models and archaeological interpretations in the New Guinea Highlands. In Models in archaeology, ed. by D.L. Clarke, pp. 275-308. London: Methuen.

Wiessner, P.
1977 "Hxaro": a regional system of reciprocity for reducing risk among the !Kung San. Unpublished Ph.D. thesis: University of Michigan.

1982 Risk, reciprocity and social influences on !Kung San economies. In Politics and history in band societies, ed. by E.R Leacock and R.B. Lee, pp. 61-84. London: Cambridge University Press.

1983 Style and social information in Kalahari San projectile points. American Antiquity 48(2):253-276.

1984 Considering the behavioral basis for style: a case study among the Kalahari San. Journal of Anthropological Archaeology 3:190-234.

1985 Style or isochrestic variation?: A reply to Sackett. American Antiquity 50(1):160-166.

Wilmsen, E.N.
1989 Land Filled With Flies: A political economy of the Kalahari. Chicago: University of Chicago Press.

Wilmsen, E.N. and J.R. Denbow
1990 Paradigmatic history of San-speaking peoples and current attempts at revision. Current Anthropology 31(5):489-524.

Wilson, B.H. and T. Dincer
1976 An introduction to hydrology and hydrography of the Okavango Delta. In Proceedings of the Symposium on the Okavango Delta and its future utilisaton, ed. by A.C. Campbell; D.N. Nteta; J. Hermans; L.D. Ngcongo. Botswana Society, Gaborone.

Yellen, J.E.
1977 Archaeological approaches to the present: Models for reconstructing the past. New York: Academic Press.

1990 The transformation of the Kalahari !Kung. Scientific American 262:96-105.

Yellen, J.E.; A.S. Brooks; R. Stuckenrath and R. Welbourne
1987 A terminal Pleistocene assemblage from Drotsky's Cave, western Ngamilangd, Botswana. Botswana Notes and Records 19:1-6.

Yellen, J.E.; A.S. Brooks; E. Cornelissen; M.J. Mehlman; Kathlyn Stewart
1995 A Middle Stone Age Worked Bone Industry from Katanda, Upper Semliki Valley, Zaire. Science 268:553-556.