DOLORES ARCHAEOLOGICAL PROGRAM TECHNICAL REPORTS

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Reductive Technologies Analysis

by

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Under the supervision of
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ABSTRACT

The University of Colorado's proposal for the Dolores Cultural Resources Mitigation Program contained provisions for the establishment of a lithic tool analysis program. To implement this program, Dr. R. Knudson, University of Idaho, acted as a design consultant and formulated standard procedures during the summer of 1978. The laboratory, later enlarged to accommodate the analysis of all artifacts produced by reductive technologies, became operational during the fall of 1978. Work thus far has been directed to the preliminary analysis of lithic tools recovered from archaeological sites excavated in 1978. Other tasks accomplished during 1978 and the spring of 1979 included the drafting of a lithics laboratory procedures manual and lithics glossary, initiation of a materials source study, and compilation of a reference list of pertinent literary sources.

Research is continuing into the possible applicability of protein analysis and obsidian hydration studies to program data. The exact form and goals of the final detailed analysis to be performed on a sample of the artifact collections are currently in a preliminary stage of formulation.

INTRODUCTION

The University of Colorado's mitigation proposal submitted to the Bureau of Reclamation (Breternitz and Kane 1978) included provisions for the analysis of lithic, bone and shell tools by a qualified analyst. During the early part of the 1978 field season the directors of the project contracted with a consultant, Dr. R. Knudson of the University of Idaho, to begin designing the theoretical framework and operational guidelines necessary for implementing the lithics program. As part of her duties, R. Knudson drafted the Lithics Laboratory Research Design. On 21 August 1978, the lithics task specialist identified eight tasks necessary for the establishment and operation of the lithics laboratory. These are:

1. Design a training program for personnel who will staff the laboratory.
2. Review and revise the flaked and non-flaked lithics preliminary sort outline. All revisions were to be based on trial runs using actual sample collections, review of the typological literature of the Four Corners region, and upon the experience of the task specialist.
3. Begin the preliminary analysis of lithic materials recovered during the 1978 field season by the excavation and survey crews. The initiation of this program was dependent upon the successful completion of tasks 1, 2 and 6.
4. Design the Final Detailed Analysis sort programs as outlined in the Dolores Archaeological Program Lithics Research Design.
5. Design and initiate a quarry (and source area) materials search and analysis program. This involves:
    a. conducting field trips to known or suspected material source localities
    b. designing and testing a Material Source and Quarry Form compatible with the research design
    c. establishing a materials type collection using samples gathered from Material Source localities and obtained from collections from other institutions in the Four Corners region
    d. designing a program for heat treatment, hydration analysis, and trace minerals analysis of specific and/or distinctive lithic materials.
6. Determine the types and quantities of equipment needed to operate a lithics laboratory staffed by five persons, and implement ordering.
7. Conduct a literature search for publications containing:
    a. data and/or discussions contained in reports of surveys or excavations in the Four Corners region that refer to lithic materials present
    b. reports on lithic materials, lithic analysis, or geologic formations from the Four Corners region
    c. reports pertaining to lithic analysis and/or typological problems from other regions that may be an aid to our work here.
8. Investigate the feasibility of doing special analytical projects such as protein analysis, hydration analysis, thermoluminescence analysis and trace mineral analysis.

As a result of the General Staff Meeting held in November 1978 the lithics task specialist acquired two new responsibilities which changed the status of his laboratory. The responsibility for the analysis of non-lithic reductively manufactured artifacts, and for assisting in the designing of an architectural stone analysis program were the new additions. As a result of the first of these, the laboratory and task specialist designations were changed from Lithics to Reductive Technology. The task specialist is now responsible for all reductively produced artifacts made from stone, bone, shell and wood. In compliance with this decision the design of an appropriate analytical program and sort format has been initiated.

Action has been initiated on all the above-mentioned projects. Their individual status summaries are presented in the section on Training Programs and Establishment of Laboratory Facilities.

RESEARCH DESIGN

The Dolores Archaeological Program Lithics Research Design was prepared by Dr. R. Knudson in July 1978 (see Appendix 1). This document was prepared in order to identify the specific problem domains to which the lithics laboratory need address itself in order to fulfill its purposes as outlined in the general research design of the Dolores Archaeological Program. The five problem domains outlined were: ecological adaptations, paleodemography, community activities and social organization, trade and foreign relations, and culture change. In the design a number of analytic questions were presented to clarify the process of defining data sources and identifying artifact attributes. Based on the results of this exercise, the analysis format was divided into two sections, the preliminary analytical sort and the final detailed analysis. R. Knudson designed the preliminary analytical sort format which has undergone several limited modifications perpetrated by R. Knudson and R. Moore.

The final section of the Lithics Research Design outlines the general parameters of the final analytic sort format and design, defining the artifact classes to be dealt with and the type of attributes to be monitored.

TRAINING PROGRAMS AND ESTABLISHMENT OF LABORATORY FACILITIES

Training

It was realized that the personnel selected from Young Adult Conservation Corps and University of Colorado rosters would have varying degrees of educational background, ranging from high school level to the B.A. degree level, and a similar range of experience and exposure to geology and lithics technology, as well as archaeological concepts in general; with this in mind, the following program was established.

The training program consists of four general sections: geology, typology, lithics preliminary analysis and data entry on the REX automatic data processing system. The geological section offers a very general introduction to the three basic rock types used for manufacture of tools by prehistoric peoples in the project area, how they were formed and their identifying properties. A review is then made of the specific rock and mineral types found in this region of the Southwest and in the local archaeological lithics collections. In the typological section, the typological concept is defined, the history of the traditional typologies used in this country and Europe are reviewed, and the laboratory worker is introduced to the Dolores Archaeological Program lithics typology and kinds of questions it can answer if properly implemented. The preliminary analysis section covers the particular concepts behind an artifact's creation as well as a detailed explanation of each variable and value contained in the analytical format.

The three sections outlined above are taught in a classroom situation over a two- to three-day period. A three- to five-week period follows, during which each newly trained laboratory worker actually works with the material from a site, under the direct supervision of the task specialist and an exprienced laboratory worker assigned to the new person for the duration of the training period. The new person does not work on his own until both the experienced person assigned to him and the task specialist feel he is competent to do so. At this point the new laboratory worker may begin training on the REX data entry program. This part of the training program requires three to five two-hour sessions per week over a period of three to five weeks. In short, it takes six to twelve weeks to train an individual to be competent for preliminary analysis and data entry, depending on his background and interest in the program. To assist newly assigned personnel in becoming familiar with their tasks, a Lithics Laboratory Procedural Manual was prepared during December 1978 (Appendix 2). The manual describes the step-by-step movement of lithic materials through the laboratory and details the necessary analytical tasks to be accomplished by the individual technician. In addition, the manual incorporates a glossary of lithics terms (Appendix 2, Table 1) to assist the new technician in becoming familiar with specialized terminology employed by the program.

To date, the training program has been used three times, with a total of 22 persons having completed the three-day session in which geology, typologies, and the preliminary analysis outline were covered. Five persons have completed the three to five weeks on-the-job training under supervision. Two additional persons are currently in this stage of

training. One person has completed the REX data entry program and two others are still involved in this training stage. The final level of the training program has not been started by any personnel; this involves training for the final detailed analysis program.

Equipment

An initial equipment requisition was submitted by the task specialist in September 1978; this request was based on the recommendations made by R. Knudson (Appendix 1). By the time the second training session had started in late November 1978 a minimally adequate amount of the equipment had arrived; however, between 1 December and 15 January most of the rest of the equipment had arrived and full-scale preliminary analysis operations were possible.

Literature Search

Another activity undertaken in the process of establishing a working laboratory was a literature search. This search revealed over 120 references pertinent to our reductive technology program. A copy of this list was given to the Government in October 1978 to use in ordering references for the project library. The present list is not exhaustive as there is no ready access to a major university library. The current list is presented as Appendix 3 of this report.

ANALYSIS

Preliminary Analysis Program

The preliminary analysis of lithic materials was initiated on 30 November with a laboratory crew of five. For the first two weeks from this date these people were still in the second stage of training. The number of laboratory personnel has fluctuated somewhat since the starting date, but can be averaged at about 3.7 persons present in the laboratory for any given working day. Three persons are on divided duty with other areas of the project. Woodward-Clyde Consultants prepared a dictionary program for lithic data, which became operational on 12 January 1979. The Govrnment computer personnel finished writing the data entry programs by mid-February.

The current status of each site is listed below (effective March 1979).

5MT2151

Analysis of the priority F.S. units was completed on 13 December 1978. Analysis of the remaining F.S. units containing flaked lithic material is 37 percent completed. The remaining non-flaked material has not been started.

5MT2191

No priority F.S. units were designated by the crew chief. Analysis of the lithic material was completed and the material returned to the Government in February 1979. The data will be entered on the ADP REX file in March.

5MT2193

No priority F.S. units were designated by the crew chief. Analysis of the flaked lithic material is 75 percent completed and the non-flaked analysis has not been started.

5MT2198

No priority F.S. units were designated by the crew chief. All material was analyzed and turned over to the Government storage facility in January 1979. The data was entered into the REX file beginning 26 February 1979.

5MT2202

No priority F.S. units were designated by the crew chief. All lithics analysis was completed on 7 February 1979. The material was turned over to the Government storage facility in January 1979. All preliminary analysis data has been entered on the REX data file.

5MT2235

The analysis of priority F.S. units was completed on 13 December 1978. All remaining flaked lithic material was finished on 16 February 1979. The non-flaked lithic material was started on 21 February 1979.

5MT4475

Preliminary analysis of this site's material will begin in early March.

Survey Sites

Flaked lithic analysis for Sites 5MT2221 through 5MT4541 has been completed. This represents 40 percent of the flaked lithic material. Non-flaked lithic analysis has not been started.

General

For the priority F.S. materials from Sites 5MT2151 and 5MT2235, cross-tabulation charts have been prepared for specified areas within a site and for whole sites. Similar charts were prepared from all F.S. unit data for Sites 5MT2191, 5MT2202 and 5MT2198. The data contained on the cross-tabulation charts consists of rock material types and morpho-use (traditional typology categories) types. This information was prepared for the crew chiefs who excavated the sites to aid them in writing their preliminary site reports.

The preliminary analysis outline has undergone several revisions since its inception in July 1978. The first revision was the most extensive, with a number of new variables being added. The subsequent revisions have consisted mainly of changes in wording, additions of several values and changes in some values. A few of the minor changes have taken place since 30 November, when analysis began. These changes were minor enough to allow the automatic correction of the forms filled out before the dates of change. One additional minor revision will take place in mid-March. The current forms used for flaked and non-flaked lithic analysis are presented in Figures 3.1, 3.2, 3.3 and 3.4; these forms are used with the Variable/Value Lists included in Appendix 1.

The preliminary analysis format for non-lithic reductively produced tools is in the last stage of revision prior to its integration in the ongoing analytical program of the laboratory. The original conception in formulating this program was to provide analysis for bone and shell artifacts only. After some consideration this has been expanded to include artifacts reductively manufactured from animal body parts other than bone, and for plant parts. This expansion means that analysis will include not only tools, but also ornamental items, non-tool utilitarian items, and musical instruments. The analysis of these items is deemed necessary for an accurate construction of the technological and material inventory and of activities represented at prehistoric or historic aboriginal sites. In order to make comparable evaluations of artifacts involved in non-lithic tool categories, the non-lithic tool evaluation format follows a pattern comparable to that of the two tool analysis formats. The Variable/Value List for non-lithic reductively manufactured artifacts is presently in the final stages of development.

Final Detailed Analysis

Based on the stipulations set forth in the Lithics Research Design, format and design orientation were initiated. The task specialist has designed a tentative outline for the research design and analysis format for projectile points and non-flaked tools. The lithic consultant has made similar progress with the debitage format and the flaked tool use

Figure 3.1: D.A.P. Data Coding Form No. 1 for Flaked Lithics.

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FS Page: _____ of _____

Recorder: [ ][ ][ ][ ]

Date: _____

DATA CODING FORM NO. 1 FOR FLAKED LITHICS (11/78)

State	County	Site Number	FS Number	Material I.D.	Special Specimen Type	Special Specimen Number
[ ][ ]	[ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ][ ]	0 3	[ ][ ]	[ ][ ][ ][ ]

No. of Indeterminate Items: [ ][ ][ ]

A. DATA CODING FOR DEBITAGE

A1. Catalog Item Number	A2. Point Location Number	A3. Temporal Designation
[ ][ ][ ][ ]	[ ][ ][ ]	[ ][ ]

A4. Material Type	A5. Quantity of Items	A6. Weight in Grams	A7. Quantity of Items with Weathering	A8. Quantity of Items with Striking Platform
1 Coarse >.25 mm	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]
2 Finely granular .125-0.24 mm	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]
3 Detrital <.062 mm	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]
4 Non-granular	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]
0 Unidentifiable	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]		

B. DATA CODING FOR TOOL/CORES

Attribute	Artifact Number 1	2	3	4
B1. Catalog item number	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]
B2. Point location	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]
B3. Temporal designation	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]
B4. Material class	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]
B5. Color	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]
B6. Specific resource I.D.	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]
B7. Weight in grams	[ ][ ][ ][ ].[ ]	[ ][ ][ ][ ].[ ]	[ ][ ][ ][ ].[ ]	[ ][ ][ ][ ].[ ]
B8. Condition	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]
B9. Thermal alteration	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]
B10. Cultural adhesions	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]
B11. Facial designation	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]
B12. Thinning stage, dorsal face	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]
B13. Thinning stage, ventral face	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]
B14. EU shaping stage	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]
B15. Core form	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]
B16. Tool morpho-use form	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ]
B17. Condition modification	a b c d e / f g h i j	a b c d e / f g h i j	a b c d e / f g h i j	a b c d e / f g h i j
B18. Illustration status	a b c d e	a b c d e	a b c d e	a b c d e

FS Matches: [ ][ ][ ][ ][ ][ ] / [ ][ ][ ][ ][ ][ ]

Fig. 3.1
a
Pg.

Figure 3.2: D.A.P. Data Coding Form No. 2 for Flaked Lithics.

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DATA CODING FORM NO. 2 FOR FLAKED LITHICS (11/78)

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Recorder: [ ][ ][ ][ ]

Date: _____

State	County	Site Number	FS Number	Material I.D.	Special Specimen Type	Special Specimen Number
[ ][ ]	[ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ][ ]	0 3	[ ][ ]	[ ][ ][ ][ ]

B. DATA CODING FOR TOOL/CORES

Attribute	Artifact Number																													
B1. Catalog item number																														
B2. Point location																														
B3. Temporal designation																														
B4. Material class																														
B5. Color																														
B6. Specific resource I.D.																														
B7. Weight in grams				•					•					•					•					•					•	
B8. Condition																														
B9. Thermal alteration																														
B10. Cultural adhesions																														
B11. Facial designation																														
B12. Thinning stage, dorsal face																														
B13. Thinning stage, ventral face																														
B14. EU shaping stage																														
B15. Core form																														
B16. Tool morpho-use form																														
B17. Condition modification	a	b	c	d	e	a	b	c	d	o	a	b	c	d	e	a	b	c	d	e	a	b	c	d	o	a	b	c	d	e
	f	g	h	i	j	f	g	h	i	j	f	g	h	i	j	f	g	h	i	j	f	g	h	i	j	f	g	h	i	j
B18. Illustration status	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e

Fig. 3.2
pg. 11

Figure 3.3: D.A.P. Data Coding Form No. 1 for Non-flaked Lithics.

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DATA CODING FORM NO. 1 FOR NON FLAKED LITHICS (11/78)

State	County	Site Number	FS Number	Material I.D.	Special Specimen Type	Special Specimen Number
				0 4		

A. DATA CODING FOR UNDIFFERENTIATED ITEMS

A1. Catalog Item Number	A2. Point Location Number	A3. Temporal Designation	A4. General Form I.D.	A5. Quantity of Items
			1 Curated fossils, unique stones	
			2 Paint materials	
			3 Shaped pieces	
			4 Incised building stone	
			5 Shaped, not incised, spec. purpose	
			6 Other materials	

B. DATA CODING FOR MODIFIED ITEMS

Attribute	Artifact Number 1	2	3
B1. Catalog item number			
B2. Point location			
B3. Temporal designation			
B4. Item completeness			
B5. Material class			
B6. Material specific I.D.			
B7. Item weight in grams			
B8. Thermal alteration			
B9. Cultural adhesions			
B10. Production technique	a b c d e	a b c d e	a b c d e
B11. Production stage			
B12. Use damage	a b c d e f	a b c d e f	a b c d e f
B13. Morpho-use form			
B14. Condition modification	a b c d e f g h i j	a b c d e f g h i j	a b c d e f g h i j
B15. Illustration status	a b c d e	a b c d e	a b c d e

F.S. Matches

Fig 3.3
p. 3

Figure 3.4: D.A.P. Data Coding Form No. 2 for Non-flaked Lithics.

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DATA CODING FORM NO. 2 FOR NON-FLAKED LITHICS (11/78)

State	County	Site Number	FS Number	Material I.D.	Special Specimen Type	Special Specimen Number
[ ][ ]	[ ][ ]	[ ][ ][ ][ ][ ]	[ ][ ][ ][ ][ ][ ]	0 4	[ ][ ]	[ ][ ][ ][ ]

B. DATA CODING FOR MODIFIED ITEMS

Attribute	Artifact Number																																	
B1. Catalog item number																																		
B2. Point location																																		
B3. Temporal designation																																		
B4. Item completeness																																		
B5. Material class																																		
B6. Material specific I.D.																																		
B7. Item weight in grams																																		
B8. Thermal alteration																																		
B9. Cultural adhesions																																		
B10. Production technique		a	b	c	d	e		a	b	c	d	e		a	b	c	d	e		a	b	c	d	e		a	b	c	d	e		a	b	c	d	e
B11. Production stage																																		
B12. Use damage	a	b	c	d	e	f	a	b	c	d	e	f	a	b	c	d	e	f	a	b	c	d	e	f	a	b	c	d	e	f	a	b	c	d	e	f
B13. Morpho-use form																																		
B14. Condition modification		a	b	c	d	e		a	b	c	d	e		a	b	c	d	e		a	b	c	d	e		a	b	c	d	e		a	b	c	d	e
		f	g	h	i	j		f	g	h	i	j		f	g	h	i	j		f	g	h	i	j		f	g	h	i	j		f	g	h	i	j
B15. Illustration status		a	b	c	d	e		a	b	c	d	e		a	b	c	d	e		a	b	c	d	e		a	b	c	d	e		a	b	c	d	e

Fig 3.4
pg 5

damage format. The Final Detailed Analysis Programs should be operational by the time the preliminary analysis is completed.

MATERIAL SOURCE STUDY

The material source study program was initiated along two lines. A Material Source Sample Form (Table 1) and Key (Fig. 3.5) have been developed and are currently undergoing testing and revision. The task specialist recently attended a lithics identification and quarry source workshop, sponsored by the New Mexico State University Cultural Resources Management Division, which supplied him with information that has proved helpful in developing his quarry study program.

From September through November 1978 several field trips were undertaken to gather materials from known quarry locations for our type collection. The localities visited were: Beaver Creek; Cross Canyon; the Four Corners Monument area; Washington Pass, New Mexico; Torreon, New Mexico; the Hogback formation next to Hogback Trading Post, New Mexico; and Mesa Verde National Park. The present type collection was derived from the above locations, from the task specialist's own collection, and also contains samples exchanged with the Salmon Ruins lithics laboratory. It now contains over 40 samples; when the collection is complete there will probably be around 150 and 200 type samples.

Architectural Stone Analysis

An architectural stone analysis program was discussed at the November 1978 General Staff Meeting. The design of such a program became largely the responsibility of the reductive technology laboratory. The situation has been discussed and some conclusions are presented below.

This program is seen as part of a proposed larger catchment study of the bedrock geology in the project area. With this in mind, V. Clay has submitted a proposal for a small crew (headed by her and aided by a Recent Era geologist consultant) which will spend the 1979 field season conducting a survey of the geological formations in the project area and relevant neighboring areas. It is hoped that this crew will also be allowed to investigate the geologic formations outside the project area that are known to be, or are suspected of being, source areas for lithic materials. Such areas should include The Glade, the La Plata Mountains, Cross Canyon, Cannonball Mesa, the Stoner Mountain area, and the northern Chuska Mountains. If, as is likely, some of the obsidian artifacts in the project area originated from one or more of the source areas in New Mexico, trips should be made to those localities to gather samples for trace mineral analysis. Further consideration of this topic will have to wait until the principal investigators outline the types of requirements this program would need to meet in order to help fulfill the goals of the project research design.

Protein Analysis

The amino acid testing program has been renamed the protein analysis to make it more consistent with the unit of description of the analysis. At the February 1979 General Staff Meeting it was discovered that Dr. R. Bye (to become Co-Principal Investigator for Environmental Studies) had some interest in this area, so a sample of items recovered during project excavations was sent to him on 16 Febuary to be tested. The sample was made up of artifacts and selected using the following requirements:

Table 1.

Dolores Archaeological Program Variable/Value List and

Material Source Sample Key

Right Side of Form

1. M.S. Number - The M.S. number is assigned by the lab supervisor after return of the sample to the lab. Leave blank until number is assigned. Right justified with zeroes in the blank spaces.

2. Sample Type - Indicate the type of sample being taken:

CS - Ceramic (clay) sample

GT - Geological type sample

LS - Lithic (quarry) sample

TS - Temper sample

3. Collected By - Enter recorder's four-letter computer initials.

4. Date - Using numbers only, record month, date, and year in that order.

5. UTM Zone - Most maps of the Four Corners are in Zone 12. Number is located on the bottom left-hand corner of the quad map. Enter that number in the boxes.

Table 1, continued.

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6. mE - Record meters East. Right justified. Fill in all spaces.

7. mN - Record meters North. Right justified. Fill in all spaces.

8. Map - Record name of map being used. Code quad map in the two spaces using the two-digit codes attached, PROJECT MAP CODES). Codes will be added as needed.

9. Township, Range, Section, 1/4, 1/4, 1/4 - Record data from map as a supplement to UTM coordinates.

10. Sample Color - Record the dominant color of the sample from the Munsell Soil Color Chart. 10 YR 4/3 would be coded as:

1 0. 0 Y R 4. 0 / 3

11. Stratigraphy - Indicate formation, member and nature of deposit using the attached codes, FORMATIONS AND MEMBERS, and NATURE OF DEPOSITS. Be specific as possible. Fill in all unused blanks with zeroes.

12. Comparable M.S. Numbers - Record other M.S. Samples which are similar in nature to this sample.

Table 1, continued.

PROJECT MAP CODES
(Standard USGS Maps)

NAME	DATE	QUADRANGLE
1. Egnar	1949	7.5'
2. Joe Davis Hill	1949	7.5'
3. Dawson Draw	1964	7.5'
4. McKenna Peak	1964	7.5'
5. North Mountain	1964	7.5'
6. Lone Cone	1964	7.5'
7. Beaver Park	1964	7.5'
8. Little Cone	1964	7.5'
9. Dove Creek	1964	7.5'
10. Secret Canyon	1964	7.5'
11. The Glade	1964	7.5'
12. Glade Mountain	1964	7.5'
13. South Mountain	1964	7.5'
14. Groundhog Reservoir	1964	7.5'
15. Groundhog Mountain	1964	7.5'
16. Dolores Peak	1953	7.5'
17. Cedar 3 NW	1955	7.5'
18. Cahone	1965	7.5'
19. Doe Canyon	1965	7.5'
20. Narraguinnep Mtn.	1965	7.5'
21. Willow Spring	1965	7.5'
22. Nipple Mountain	1963	7.5'
23. Clyde Lake	1963	7.5'
24. Rico	1960	7.5'
25. Cedar 3 SW	1955	7.5'
26. Pleasant View	1965	7.5'
27. Yellow Jacket	1965	7.5'
28. Trimble Point	1965	7.5'
29. Boggy Draw	1965	7.5'
30. Stoner	1963	7.5'
31. Wallace Ranch	1963	7.5'
32. Orphan Butte	1963	7.5'
33. Moqui NW	1955	7.5'
34. Woods Canyon	1965	7.5'
35. Arriola	1965	7.5'
36. Dolores West	1965	7.5'
37. Dolores East	1965	7.5'
38. Millwood	1965	7.5'
39. Rampart Hills	1963	7.5'
40. La Plata	1963	7.5'
41. Moqui SW	1955	7.5'
42. Moqui SE	1955	7.5'
43. Cortez SW	1955	7.5'
44. Cortez	1965	7.5'

Table 1, continued.

45. Point Lookout	1965	7.5'
46. Mancos	1965	7.5'
47. Thompson Park	1963	7.5'
48. Hesperus	1963	7.5'
49. Sentinel Peak NW	1955	7.5'
50. Sentinel Peak NE	1955	7.5'
51. Towaoc	1966	7.5'
52. Wetherill Mesa	1966	7.5'
53. Moccasin Mesa	1967	7.5'
54. Trail Canyon	1966	7.5'
55. Mormon Reservoir	1968	7.5'
56. Kline	1968	7.5'
57. Sentinel Peak SW	1966	7.5'
58. Sentinel Peak SE	1966	7.5'
59. Tanner Mesa	1966	7.5'
60. Moqui Canyon	1966	7.5'
61. Greasewood Canyon	1966	7.5'
62. Red Horse Gulch	1966	7.5'
63. Redmesa	1968	7.5'
64. Pinkerton Mesa	1968	7.5'
65. Aneth	1962	15'
66. Washington Pass	1966	15'
67. Needles, Utah	1953	15'

Table 1, continued.

CODING: FORMATIONS AND MEMBERS

FORMATIONS	MEMBERS
00 Undefined or unknown (do not use)	00 Not differentiated or unknown
01 Soil	01 Billings Series 02 Otero Series 03 Limon Series 04 Midway Series 05 Renohill Series 06 Belmear Series 07 Gladel Series 08 Cahona Series 09 Bowdish Series 10 Sharps Series 11 Pulpit Series 12 Hesperus Series 13 Ackmen Series 14 Granath Series 15 Witt Series
02 Creede	
03 San Jose	
04 Animas	16 Farmington Sandstone 17 Ojo Alamo Sandstone
05 Kirkland Shale	
06 Fruitland	
07 Picture Cliffs Sandstone	
08 Menefee	18 Lewis Shale 19 Cliff House Sandstone
09 Crevasse Canyon Sandstone	20 Point Lookout
	21 Upper Mancos Shale 22 Dilco
	23 Gallup Sandstone
10 Lower Mancos Shale	24 Juana Lopez Sandstone 25 Greenhorn Limestone

Table 1, continued.

11 Dakota Sandstone	
12 Burro Canyon	
13 Morrison	26 Brushy Basin 27 Westwater Canyon 28 Recapture Creek 29 Salt Wash
14 Bluff Sandstone	
15 Summerville	
16 Burro Canyon/Morrison/Summerville Undivided	
17 Todilto	
18 Entrada Sandstone	
19 Navaho Sandstone	
20 Kayenta	
21 Wingate Sandstone	
22 Dolores	
23 Chinle	
24 Shinarump	
25 Moenkopi	
26 Cutler	35 White Rim Sandstone 36 Cedar Mesa Sandstone
27 Rico	
28 Honaker Trail	
28 Paradox	30 Ismay Zone 31 Desert Creek Zone 32 Akah Zone 33 Barker Creek Zone
30 Pinkerton Trail	
31 Molas	
32 Leadville Limestone	
33 Ouray	

Table 1, continued.

34	Elbert	34 McCracken Sandstone
35	Aneth	
36	Ignacio Quartzite	
37	Rocks of the La Plata Mountains Igneous Center	37 Quartz diorite porphyry
38	Rocks of the Rico Mountains Igneous Center	38 Monzonite and monzonite porphyry
39	Rocks of the Sleeping Ute Mountain Igneous Center	39 Quartz diorite porphyry
40	Minette	
41	Granogabbro	
42	Intrusive igneous	

Table 1, continued.

CODING: NATURE OF DEPOSIT

00 Not applicable
01 Indeterminate
02 None
03-09 Unassigned
10 Aeolian
11 Loess
12 Pavement
13 Dunes
14 Blowouts
15 Ventifacts
16-19 Unassigned
20 Alluvial
21 Fan
22 Plain
23 Sheetwash
24 Channel deposits (river/stream)
25 Terrace gravels
26 Upland gravels
27 Arroyos
28 Mud flat
29 Swamp, pond
30 Colluvial
31 Talus
32 Mud earth flow
33 Debris slide
34 Rock slide
35-39 Unassigned
40 Bedrock
41 Horizontal exposure
42 Vertical exposure
43 Ridge tops
44-49 Unassigned
50 Residual
51-99 Unassigned
6/79

Table 1, continued.

Left Side of Form

1. Surface Location - Describe how to relocate the M.S. location. Include scale map with north arrow and major topographic and cultural features.

2. Sample Description - Describe the nature of the sample, including sample type, texture, luster and other identifying criteria.

3. Stratigraphic Location - Describe sample location in relation to other stratigraphic units. Include description of stratigraphic unit (e.g., inclusions, anomalies, etc.)

4. Comments - Record the extent and dimensions of the sample outcrop; also record any other comments such as the variability of the sample or cultural associations (i.e., prehistoric mine or quarry).

5. Photographs - Record film type, camera number, roll number, and frame numbers. Describe photo indicating directions and scale.

6/79

Figure 5. D.A.P. Material Source Samples Field Record.

CONTINUATION PAGE FOR LITHIC SOURCES

Material type _____
Specific type name _____

Color range: _____, _____, _____,
_____, _____, _____

Description of variability: _____
_____
_____

Fracture properties: _____
_____

Weathering: _____
Means of extraction from environment: _____

WARREN'S LITHIC CODE: __ __ __ __

MECHANICAL PROPERTIES:
Tensile stength _____ Compressive strength _____
Density _____ Specific gravity _____
Poisson's ratio _____ Young's modulus _____

Size of quarry: _____
Extent of prehistoric use: _____
Extractive tools present: _____
COMMENTS: _____
_____

THERMAL ALTERATION:

unaltered	300°C	400°C	500°C
Luster:			
Color:			
Wt. change:			
Fracture properties:			

8/79 R. Moore

1. Items appearing to be actual tools or utilized flakes
2. Items which were found in situ on activity surfaces
3. Items which were collected in the field without having been touched and which were not washed in the processing laboratory.

Obsidian Hydration

Dr. Irving Friedman and Fred Trembour have been contacted as to the possibility of their conducting obsidian hydration testing. They responded that they would analyze a sample of our material and if the data gathered was mutually rewarding, they would continue testing.

Before an obsidian sample undergoes hydration testing it should undergo trace-mineral analysis. Due to the particular combination of trace minerals, as well as to the presence or absence of particular minerals, there will be a significant effect on the hydration rate; trace mineral analysis will significantly improve the quality of hydration testing results. R. Knudson has informed us that the University of Idaho has the capability of doing non-destructive trace-mineral analysis. The possibility of their doing this analysis procedure is currently being investigated.

FUTURE DIRECTIONS

Currently all members of this laboratory are involved in preliminary analysis of lithic material recovered during the 1978 field season. The task specialist and consultant are currently engaged in preparing final detailed analysis programs for flaked lithic use damage, projectile points, debitage, and non-flaked lithic artifacts. Other programs in preparation are the quarry analysis format and the non-lithic tool analysis program.

It is hoped that by the end of March nearly all preliminary analysis will have been completed and that the three laboratory personnel learning REX data entry will be fully trained. The formulation of the final detailed analysis programs should be nearing completion by this time. Laboratory personnel will be trained to conduct the new analysis procedures as they finish the preliminary analysis and will perform the new analysis until new material starts flowing into the laboratory from the sites opened for excavation in April 1979.

When the 1979 field season begins, three of the laboratory personnel will transfer to the excavation crews. These three people should be an asset to their respective field crews because of the technical training they have received and the better understanding they now have of how to properly deal with the excavation and recording of lithic materials, lithic features, and the type of field note information needed by the reductive technology task specialist for data interpretation.

The remaining five laboratory personnel will spend approximately 3 and 1/2 days a week doing preliminary analysis of materials coming out of the field and the remaining 1 and 1/2 days a week entering data into the computer, inspecting sites under excavation, or taking part in quarry recording field trips. The task specialist will supervise analysis and data entry, make one to two half-day trips a week to inspect excavations, spend several days taking low-altitude, low-angle photographs of selected geologic features, direct quarry recording field trips, conduct and supervise final detailed analysis (if time permits this activity), act as technological consultant for the geology field crew, and conduct analysis and evaluation of data in the reductive computer storage programs. The assistant task specialist will assist the task specialist in the above activities and act as personnel manager for the laboratory.

APPENDIX 1

DOLORES ARCHAEOLOGICAL PROGRAM

LITHICS RESEARCH DESIGN

DOLORES ARCHAEOLOGICAL PROGRAM LITHICS RESEARCH DESIGN[1]

Ruthann Knudson
Consultant, Lithics Analysis

The General Research Design

The general research design of the Dolores Archaeological Program (D.A.P.) has identified two major research areas for the long-term investigations into the culture history and adaptations in the Dolores River area: (1) regional description of the Anasazi pattern there, and (2) the explication and explanation of spatial and temporal variation (hence, "culture process") within that pattern.

Within these broad topics, five specific "problem domains" have been designated. A detailed understanding of the lithic production, technical use, sociofunctional, and/or stylistic systems must be an integral component in the data base used in description or solution of most of these problem domains, in the following ways. A full outline of these "problem domains" is provided in the D.A.P. Research Design.

1. Ecological Adaptations - Definitions of extractive tool kits include analysis of the technical uses of flaked and non-flaked stone tools. Since production of those tools is itself an extractive activity, analysis of lithic resource acquisition and reduction to tool form is also basic to understanding ecological adaptations.

2. Paleodemography - This involves constructions of site typologies, which are in turn based on the definitions of tool kits (including lithics and their technical uses). In addition, site typologies are constructed within single units of cultural time, and lithic styles are basic to defining the various culture historical units.

3. Community Activities and Social Organization - Households are defined by activities and use areas, those activities including lithic tool production and tool use. Analysis of hamlets or villages involves study of the activity relationships between households. Again, analysis of inter-community systems involves construction of site typologies as discussed in (2) above.

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1 PALEO-DESIGNS Research Manuscript No. 78-1 (first draft). Moscow, ID: PALEO-DESIGNS.

4. Trade and Foreign Relations - As this involves lithics, it requires information on lithic resource distribution and procurement, and perhaps on lithic stylistic similarities as compared with those of other regions.

5. Culture Change - This involves variation in all of the above (1-4) problem domains, insofar as each deals with lithic data. Explanations for any variations in lithic production or use over time are likely to be external to the lithic systems themselves, i.e., to be because of environmental change affecting cultural adaptations, or because of social organizational changes. Lithic variations will probably be the effect of change in cultural ecological systems, not a cause of the latter. One situation in which they might be a cause is that in which a particular tool form can only be made with a particular quality of lithic material, and for some reason that material becomes unavailable -- the change to a new form of tool is not therefore an effect of change in subsistence techniques, but may even be a cause of such change if the lack of the old tool form requires a change in extractive methods or techniques.

In studying these problem domains during 1978-1979, some more specific questions will be addressed that will use lithic data:

a. Ecological Adaptations - (1) The nature of Basketmaker III and Pueblo I processing and storage technologies, (2) variation in subsistence patterns among community types, (3) variation in subsistence patterns among localities.

b. Paleodemography - Site catchment analysis to determine range of resources available within and between localities, relationship of resource availability and demography (as the latter reflects resource exploitation).

c. Community Activities and Social Organization - Especially of Basketmaker III and Pueblo I communities.

d. Trade and Foreign Relations - Especially identification of "exotic" items and source analysis.

e. Culture Change - (1) If possible, transition from Basketmaker II to III, (2) transition from Basketmaker III to Pueblo I, (3) reason for abandonment of area, AD 850 - AD 950.

Thus, in general the D.A.P. requires description of flaked and unflaked lithic tool production and use systems, including both technical and socio-economic functions, from an array of temporally, spatially, and typologically distinct archaeological sites within the project area. This is to be accomplished by a rough sort and minimal description of all lithic items collected during the project's survey and excavations, and a detailed analysis of a sample of material for more specific descriptions of production, use, and design systems. Data collection is organized in terms of those lithic systems, from whose descriptions are derived inferences for delineating broader cultural patterns.

In consequence, data collection is organized to relate to the systemic areas and questions as displayed in Tables 1 and 2.

Terminology used in Table 1 and subsequent sections of this report is defined in Knudson 1973, 1978a (Appendix A), n.d. (Appendix B). Comments relating to thinning and edging stages are presented in Appendix B, and definitions of employable units and partitive use analysis are best outlined in Appendix A. For the sake of brevity, these concepts are discussed only briefly within the body of the present report.

Specific Research Hypotheses and Test Implications

Given the large body of archaeological literature from the American Southwest, particularly on Anasazi cultural adaptations, it is possible to develop some specific hypotheses about lithic tool production, use, style, and function within and between cultural units in the Dolores area. Analytic questions and relevant data presented in Tables 1-2 may be used to outline the test implications of any such hypotheses, but such are not detailed in this paper.

Table 1. Lithic analytic questions and data resources.

Lithic system	Analytic question	Data source	Relevant artifact attributes
Tool Production (flaked and non-flaked)	What lithic resources are available in what localities?	Geol. lit, rockhounds, field recon.	N.a.
	How is the material available and what must be done to extract it? (Define alternatives)	Do.	N.a.
	How many and how much of the available resources are exploited?	Quarry sites & archaeol. assemblage	Material, quantity, weight
	What materials seem locally unavailable, perhaps traded into the region?	Negative evid. from local geol; archaeol. assemblage	Material
	Given a known local resource: How was it extracted?	Quarry data, sometimes artifact data	Sometimes morphology of cortex surfaces
	In what "natural" form does it occur before reduction, e.g., tabular slab, block, river cobble?	Quarry site and artifact data	Morphology of cortex surfaces
	What options are availale for reduction methods and techniques with this material?	Lithic technical literature	N.a.
	How much reduction occurs at the resource area/quarry?	Artifact data from quarry	Debitage and core analysis, tool thinning indicators (see below for more detail)

DOLORES ARCHAEOLOGICAL PROJECT
U.S. Bureau of Reclamation

MATERIAL SOURCE SAMPLES
FIELD RECORD

Surface Location

Sample Description

Stratigraphic Location

Comments

Photographs

M.S. Number

Sample Type

Collected by

Date

UTM Zone

mE

mN

Map

Township

Range

Section

¼ of ¼ of ¼

Sample Color

Hue Value Chroma

Stratigraphy

Formation

Member

Nature of Deposit

Comparable M.S. Numbers

Fig. 3.5
p. 29

Table 1, continued.

Lithic system	Analytic question	Data source	Relevant artifact attributes
Tool Style: Flaked tools	b. Within single components?	Do.	Do.
	c. Among temporally and spatially distinct cultural units?	Do.	Do.
	How does the formal variation and/or spatial distribution of stylized tools relate to their possible social functions (e.g., kinship markers, class designators, religiously important items)?	Tools, distributional data with rest of artifact assesmblage and contextual data	Do.
Tool Style: Non-flaked tools	Non-flaked lithic items are also designated as "stylized" if they have been significantly reduced into symmetrical forms, and/or are produed from special quality or unique raw materials. The analytic questions asked in defining their stylistic system are generally the same as those asked about flaked lithic items, except that they are couched in terms of abrasion attributes rather than flake characteristics.		
Tool Production: Flaked tools	What techniques are used in basic flaked core production?		
	a. Core platform preparation; point, kind, and alignment of applied force	Artifact data esp. debitage	Flake platform remnant w, t, morphology; ; morphology of proximal portion of flake dorsal face; ventral face morphology
	b. Sequence of flake removals from core	Do.	Flake dorsal scar number, orientation; core morphology
	What basic flaked core reduction/ flake production method(s) and stages occur?	Do.	Summary of data based on intersecting flake scars on core face, flake dorsal face

Table 1, continued.

Lithic system	Analytic question	Data source	Relevant artifact attributes
Tool Style: Flaked tools	Which reduction method/technique(s) is/are used for this material? Specify if these change over time.	Artifact data from study area	Do.
	Reduction systems may be material specific within any designated cultural unit, or a single system may be applied to a suite of materials (e.g., a flaked bifacial system applied to a range of fine grained cryptocrystalline and detrital silicates including chert, obsidian, silicified siltstone). The following questions relate to description of any single lithic tool production system, irrespective of whether such is applied to one or many lithic material types; for each assemblage there is likely to be more than one production system.		
	What stylized tool forms occur consistently within the general artifact assemblage?		
	a. What forms appear to be specially produced to have formal symmetry or distinctive patterning of thinning/edging flake scars? (Identify the particular suite of attributes used to define "stylized" forms.)	Tools	Maximum piece thinning and/or edging in symmetrical pattern; symmetry of form plan and/or profile
	b. What raw materials appear to have been specifically selected for color, quality?	Tools, some debitage; geological lit, field recon.	Material with bright and/or varied color, often highly vitreous and/or fine grained; often not locally available
	How are these stylized tool forms distributed?		
	a. Within spatial units in single components (e.g., households, activity areas)?	Tools, distributional	Inferred stylized tool system distributions

Table 1, continued.

Lithic system	Analytic question	Data source	Relevant artifact attributes
Tool Production: Flaked Tools	At what point(s) in the reduction sequence do flakes begin to themselves serve as cores?	Do.	As above, matched with general morphology of flakes and inferred original flake size based on information from early stage flake scars on reduced flakes (that are used later as cores)
	Given a reduced core, or flake that serves as a core, how many stages and what method and techniques are used to thin the piece?	Artifact data, tools and some debitage	Summary of data based on intersecting flake scars on thinned pieces, and morphology of removed debitage
	At which thinning stage(s) does edging occur?	Do.	Summary of stage data, correlated with morphology of worked edges and resultant edging debitage
	For each edging stage, what method and techniques are used?	Do.	Summary of flake morphology as described in (a) and (b) above, and of tool edge morphology
	What are the tool forms produced in this system, and how do they spin out of the reduction system?	Flaked lithic tools	Tool form data as derived from use analysis (see below), correlated with production sequence data (see above)
	How much tool reshaping (thinning and/or edging) occurs within this reduction system?	Flaked lithic tools, debitage	Flake scar sequencing, changes in surface patination; abrupt changes in contour on tools; use damage on dorsal flake face

Table 1, continued.

Lithic system	Analytic question	Data source	Relevant artifact attributes
Tool Production: Flaked tools	Where and in which spatial units (e.g., households, workshops) do various reduction activities occur?	Tools, debitage, site distributional data	Correlation of inferred tool production and distributional data
	How far is worked material moved from its original source area?	Geol. and quarry data, artifact distributional data	Material
	How do various reduction systems within single cultural units compare?	Tools and debitage, distributional data	Inferred tool production and distributional data
	How do various reduction systems compare among temporally and/or spatially distinct cultural units?	Do.	Do.
Tool Production: Non-flaked tools	"Non-flaked lithics" within the D.A.P. include hammerstones, mauls, axes, adzes, anvils, manos, metates, palettes, abraders, and even gizzard stones, mineral paint lumps, and curated fossils. Some of these, such as hammerstones, are selected from natural deposits and used without entering further into the tool production system. However, many of these "non-flaked" tools are deliberately fashioned by pecking, grinding, and sometimes even initial flake shaping before abrasion. A set of questions is needed to deal with these predominantly abrasive production systems.		
	What techniques are used for manufacturing reduction of various materials (e.g., granite vs. sandstone)?		
	a. Is initial flaking used?	Debitage and tools	Original flake scars, partially obscurred by subsequent abrasion

Table 1, continued.

Lithic system	Analytic question	Data source	Relevant artifact attributes
Tool use: Flake tools	What damage indicative of use is observable on EUs within the archaeological assemblage?	Do.	Detailed observations of flake scars, striations, and/or polish on EUs
	What organic residues indicative of use are present on EUs within the assemblage?	Do.	(Requires collection of artifacts under sterile conditions.) Residues
	What is the correlation of EU and whole parent tool. . .		
	a. Material?	Do.	Material
	b. Weight?	Do.	Weight
	c. Form?	Do.	General tool morphology, including plan and profile
	d. Reduction/thinning stage?	Do.	Inferred tool reduction data
	e. Style/design?	Do.	Inferred design class (see below), usually a well reduced/thinned piece
	How do the EU/whole tool correlate forms compare with traditional Southwestern flaked lithic tool types?	Southwestern archaeol. literature D.A.P. tools	Correlted information on EU and whole tool forms
	What is the distribution of EU forms, and EU/whole tool correlate forms, within site spatial units (e.g., households, activity areas)	Tools, site distributional data	Inferred EU types, EU/whole tool correlate types

Table 1, continued.

Lithic system	Analytic question	Data source	Relevant artifact attributes
Tool use: Flaked tools	How does the distribution of flaked lithic tool types correlate with other elements (non-flaked lithics, bone, etc., to form extractive tool kits)?	Full D.A.P. inventory of lithic, bone, wood, shell, extractive tools	Inferred typology of extractive tools of various materials
	How do these extractive tool kits distributively correlate with paleosubsistence data (floral and faunal remains) within site spatial units?	Tool distributional data	Inferred tool use and distributional data
	a. Across a single cultural component?	Do.	Do.
	b. Among temporally and/or spatially distinct cultural units.	Do.	Do.
Tool use: Non-flaked tools	Employable units, or EUs, may still serve as the analytical unit on non-flaked lithics although their boundaries are often less easy to define because of the lack of abrupt contour changes (e.g., sharp edges on flaked tools). Thus, with non-flaked lithic tools an EU is still defined as a deliberately shaped and/or damaged area. Non-flaked lithic tools may be abraded by battering or grinding, and they may serve either as an actor (e.g., a mano) or as something acted upon (e.g., a metate).		
Tool style: Flaked tools	Style or design are very poorly defined concepts in archaeology, though they are basic to designation of cultural historical units. A relatively negative definition of style, "those morphological attributes and flake patterning not constrained by production or use requirements," usually most noticeable on well thinned or specifically retouched forms, is most frequently implicit in archaeological analyses.		

LITHIC ANALYTICAL DOMAINS

As defined in discussions with D.A.P. archaeologists, consultants, lab personnel, Woodward-Clyde advisors, and Government advisors and lab staff, on 6 July 1978, artifact description will be conducted in three major stages: (1) Government inventory, as material first enters the laboratory from the field; (2) a preliminary analytical sort of the whole artifact population, done by the Contractor; and (3) a detailed analysis of sampled artifacts, done by the Contractor. The initial Government inventory will classify artifacts only by material (i.e., flaked lithics, non-flaked lithics, bone, ceramics) and lot number, the Field Specimen (F.S.) number serving as the first segment of the catalog identification of the lots. Following this inventory, all lithic artifacts will be submitted to the Contractor's laboratory personnel, specifically to the lithic analyst or his trained technicians, for analytic description by lot and/or item.

Preliminary analytical sort. This sort and description is the responsibility of the Contractor; cleaned and lot-bagged (labelled by bag) materials are submitted to the Contractor following Government inventory. The purpose of this "preliminary" sort is to get as much basic description of the entire D.A.P. artifact assemblage as is possible with a cursory review and assessment of perhaps a half-dozen attributes on each item. It is a compromise between detailed quantification of the analytical base for inferring tool production and use systems, and more qualitative assessments of those systems. Its description of the broadest parameters of the assemblage, as well as its annotation of unique items within the population, provide a basis for stratifying further analytical samples on the basis of tool or production forms if so desired. Certainly, a broad description of the entire lithic tool population is desirable to answer basic questions of Anasazi culture change.

Final detailed analysis. This final sort and description is also the responsibility of the Contractor, and involves a detailed description and analysis by the lithics consultant of:

1. All projectile points, for production, use, stylistic, and socio-functional analysis; this is particularly important for definition of temporally diagnostic styles and components.
2. Samples flaked debitage, especially flakes, for production analysis.
3. Samples flaked tools other than projectile points, for use analysis especially (but also to obtain additional detailed production data.
4. Samples non-flaked tools (unless total population is small, and then all items will be analyzed), for stylistic, production, use, and socio-functional analysis; this again is particularly important for definition of temporally diagnostic styles and components.

From the information obtained in both the preliminary and final analytical descriptive domains, as coded, sorted, and statistically

analyzed in consultation with Woodward-Clyde Consultants, the lithics expert will attempt to answer questions as defined in Table 1 and other specific hypotheses posed to explain models of Anasazi culture change. The lithics analyst will also work with, and make data and inferences available to, other project personnel preparing specific site reports and the final report. Senior D.A.P. investigators need to clarify as soon as possible the lithic analyst's reporting responsibility -- whether he should submit brief statements to be appended to each site report, or a single report to be appended to the final report only, or should serve as a collaborator on these, or should somehow try to provide input to all of these.

It is recommended that a handbook of the project lithic analytical system, including a glossary of terms and a detailed statement of analytical methods and techniques, be constructed as soon as possible. This should be appended to the first year report as an appendix if at all possible, even if only for a limited number of final report copies. Such a handbook would provide more structure to the first year's research, and provide more consistency among various laboratory personnel from year to year. It would also allow all D.A.P. personnel, including site supervisors and the Woodward-Clyde Consultants, to understand data categories and fit them into the full project research package. It should not be just a looseleaf notebook of miscellaneous notes and photocopied references, but be a systematized and indexed handbook.

Preliminary Analytical Sort Format and Design

A suggested descriptive outline for data recording during the "preliminary analytical sort" is presented in Tables 3 (for Flaked Lithics) and 4 (for Non-flaked Lithics). The format for this data record has been developed in consultation with Woodward-Clyde Consultants and thus should be compatible with the rest of the D.A.P. analyses. All items noted as flaked or non-flaked lithic artifacts are to be individually sorted into lots of materials, and then certain of those lots (e.g., tools) will be further described as individual items. Descriptive attributes have been selected for recording during this preliminary sort on the basis of their informational content, in an attempt to acquire information about tool production, use, and style as efficiently and as broadly as possible. Tools will also be classified within a traditional terminology, for initial comparability with previous Southwestern archaeological studies.

An important analytical classification of lithic items as "flaked" or "non-flaked" must be made by the Government laboratory when artifacts are initially entered into the inventory, and this decision determines the subsequent analytical routine used by the Contractor. Thus, there need to be clear and explicit guidelines for this differentiation written up by the Contractor and submitted to the Government. These guidelines are best made by the lithic analyst after review of the range of materials collected by the D.A.P., and will be incorporated into the formal Laboratory Manual, but the following model has been used in developing the preliminary Analytical Sort Outline in Tables 3 and 4 here.

Table 3. Flaked Lithics Preliminary Sort Outline

NUMBER OF SPACES	VARIABLES AND VALUES
9	VAR 01, Site Number, written as the Smithsonian designation with state, county, and sequential designation; the last four digits are the sequential designation, and they are justified to the right with zeroes in the empty spaces (e.g., 5MT23 is written as "05MT0023").
6	VAR 02, Field Specimen Number: justified from the right with zeroes in empty spaces (e.g., FS 9 is recorded as "0009" here).
2	VAR 03, Material Identification 00: Indeterminate 01: Ceramics 02: Non-human bone 03: Flaked lithics 04: Non-flaked lithics 05: Shell 06: Vegetal 07: Human bone 08: Other inorganic materials 09: Other organic materials 10: Historic 11: Other materials not specified above 00: Indeterminate
2	VAR 04, Special Specimen Type: numeric designator for specimens other than Artifact Samples, a subcategory of materials within the Field Specimen catalog. 00: Not applicable; the material is an Artifact Sample and has no other specimen designation 01: Archaeomagnetic sample 02: Radiocarbon sample 03: Dendrochronological sample 04: Material source sample 05: Pollen cores 06: Pollen sample 07: Stratigraphic column 08: Sediment sample 09: Bulk soil sample 10: Assigned 11: Assigned 12: Botanical specimen 13: Latex peels 14: Plaster positive 15: Monolith 16: Soil peel 17: Ethnobotanical sample 18: Unassigned 80: Reconstr. complex 82: Reconstr. flaked lithics 83: Reconstr. non-flaked lithics 84: Reconstr. human bone 85: Reconstr. non-human bone 87: Reconstr. shell 88: Reconstr. glass 89: Reconstr. metal 90: Reconstr. synthetic 99: Isolated finds
4	VAR 05, Special Specimen number: justified from the right with zeroes in empty spaces (e.g., BS 49 is recorded as"0049"); if no Special Specimen Type is recorded in columns 19-20, record "0000" for VAR 05.

Table 3, continued.

1 VAR 06, General Artifact Form: this is the key to activating the subroutines, since each lot or individual item is described further only in one subroutine depending upon its artifact form. (This variable does not actually appear on the analysis form.)

0: Indeterminate, e.g., too heavily burned or spalled for further identification (this material is not described further). Indeterminate flaked lithic items: stone material, has flake scars, has apparent cultural significance (no junk!) but is so burned or calcined that it cannot confidently be determined to be either a tool or manufacturing debris.

1: Debitage, including flakes, chunks, fragments of those, and core fragments that are so small as to not be worth describing as individual items (this material is described as a lot, in SUBROUTINE A: DEBITAGE).

2: Tools, tool fragments, cores or major core fragments, flaked "ornamental" lithics (including edge-damaged or "used" but not "retouched" flake tools) (this material is described individually, in SUBROUTINE B: TOOLS/CORES).

SUBROUTINE A: DEBITAGE

The lot of flaked lithic materials (Catalog Item Number 1 within each Field Specimen) should now be spread out and separated into the material classes specified in VAR A-1; all further description within Subroutine A is in terms of these separated material classes. For each identified class of raw materials, there should be a separate set of data in columns 32-51 that describes the class named in the preceding column 31; repeat as many times as there are identified classes of raw materials.

VAR A-1, Catalog Item Number (nested within Field Specimen Number and Material Identification): justified from the right, with zeroes in empty spaces.

0001-99: Undifferentiated lot of material, presumed in the preliminary sort to include all items not identified as core or core fragments, or tool or tool fragments. The Number 0001 will always be used for undifferentiated lots of material. Numbers 0002-0099 are used for undif ferentiated lots when debitage occurs in more than one P.L. of an F.S.

0002-..n: Tools and tool fragments, and core and core fragments, each given an individual number in sequence; justify from the right with zeroes in empty spaces.

NB: The catalog number written on the bags (in the cases of lots) or on the artifact or vial (in the case of an identified tool or core) will consist of:

5MT2191 .33 .3 .18

Site # F.S.# Item #

Material Identification

Table 3, continued.

VAR A-2, Point Location Number: justified from the right with zeroes in empty spaces; if no point location is recorded for the lot or item recorded here, fill in with zeroes.

VAR A-3, Temporal Designation: this is to be outlined in the future, and not assigned during initial recording of the item; categories will be defined later after temporal parameters of the FS have been determined by C14, archaeo-mag, &/or seriation of stratigraphy, ceramics &/or lithic tools.

VAR A-4, Material Identification

0: Unidentifiable

1: Coarse; includes coarse and fine granitics, coarse sandstone, diorites, and coarse quartzite. Grain size is usually .25 mm or larger.

2: Finely granular or detrital but not metamorphosed; silicified fine sandstone, shale, siltstone, claystone. Grain size usually ranges between .25-.125 mm.

3: Finely granular or detrital, metamorphosed or highly silicified; includes extremely fine quartzite, siltite, argillite, fine rhyolite, fine basalt. Grain size is usually .25 - .125 or smaller.

4: Highly siliceous, usually cryptocrystalline; includes chalcedony, chert, silicified wood, agate, quartz crystal, obsidian, rhyolite. No grains detectable.

VAR A-5, Quantity of items included within VAR A-1 type (this should also be completed for the class "unidentifiable" within VAR A-1): justified from the right with zeroes in empty spaces (e.g., 46 items would be recorded as "00046").

VAR A-6, Total weight of items included within VAR A-1 type (this should also be completed for the class "unidentifiable" within VAR A-1): in grams, rounded off to nearest whole gram, justified from the right, with zeroes in the empty spaces (e.g., 243 grams would be recorded as "00243").

VAR A-7, Quantity of items included within VAR A-1 type that have weathering or depositional rind/cortex present anywhere on their surface: justified from the right with zeroes in empty spaces (for the class "unidentifiable", record all zeroes here). This does not include patination occurring after flake removal or internal fracture weathering.

VAR A-8, Quantity of items included within VAR A-1 type that have intact striking platform remnants: justified from the right with zeroes in empty spaces (for the class "unidentifiable", record all zeroes here).

VAR A-9, Quantity of items included within VAR A-1 type of material type #4 that are obsidian.

SUBROUTINE B: TOOLS/CORES

All items that have been given individual numbers (Catalog Item Numbers 2...n within each Field Specimen) should be individually described within the following variables B-1 through B-18.

Table 3, continued.

B-1, Catalog Item Number (nested within Field Specimen Number and Material Identification): justified from the right, with zeroes in empty spaces (see SUBROUTINE A, VAR A-1, for breakdown).

3 VAR B-2, Point Location Number: justified from the right with zeroes in empty spaces; if no point location is recorded for the lot or item recorded here, fill in with zeroes.

2 VAR B-3, Temporal Designation: this is to be outlined in the future, and not assigned during initial recording of the item; categories will be defined later.

VAR B-4, Lithic material class.

00: Indeterminate even as to major class (as specified in 01-03)
01: Igneous material, indeterminate, or other igneous not specified below
02: Sedimentary material, indeterminate, or other sedimentary not specified below
03: Metamorphic material, indeterminate, or other metamorphic not specified below.
04: Granitic, coarse (igneous - even blend of feldspar, biotite, hornblende, quartz, often pinkish)
05: Granitic, fine
06: Sandstone, coarse
07: Sandstone, fine
08: Quartzite, coarse
37: Diorite
09: Basalt, coarse
10: Shale, not baked
11: Baked shale
12: Siltstone (not metamorphosed, silt sized)
13: Claystone
14: Felsite
15: Andesite
16: Rhyolite
17: Metarhyolite
18: Slate
19: Quartzite, medium
20: Basalt, fine
21: Quartz
22: Quartzite, fine
23: Opalite
24: Siltite (metamorphosed siltstone)
25: Argillite (metamorphosed claystone)
26: Agate
27: Chalcedony (can see through it - very pure)
28: Chert, clastic (cruddy stuff, dirty chert)
29: Chert, fossiliferous
30: Chert, oolitic
31: Chert, banded
32: Chert, not otherwise specified here
33: Chert, chalcedonic

Table 3, continued.

34: Silicified wood
35: Vitrophyre ("ignimbrite"), black, opaque, like obsidian, but with a more grainy texture.
36: Obsidian

NB: Specific definitions of these material classes, based on the petrologic literature can be found in part B of DEFINITIONS section which is in TABLE 5. "Chert" as used here includes all opaque sedimentary silex materials variously labeled as "chert", "flint", "jasper" and the like.

VAR B-5, Lithic material color: keyed to Munsell in TABLE 5.

00: Indeterminate
01: Clear
02: Clear with yellow inclusions
03: Clear with yellow and red inclusions
04: Clear with red inclusions
05: Clear with red and black inclusions
06: Clear with black inclusions

(OTHER VALUES MAY BE ADDED TO THIS IN THE FUTURE, ARRANGED APPROPRIATELY IN TERMS OF HUES)

10: White
11: White with red, yellow and black
12: White with red

20: Cream
21: Dark variegated
22: Dark variegated with brown, gray

26: Light variegated
27: Light variegated with light purple
28: Light variegated with orange, red
29: Light variegated with brown (tans), gray
30: Yellow
31: Light yellow
32: Light yellowish green

35: Yellow brown
36: Dark yellow brown

Table 3, continued.

40: Brown
41: Dark brown
42: Light brown
43: Very pale brown
44: Grayish brown

50: Orange
51: Light orange

60: Red
61: Light red (pink)
62: Grayish red
63: Brownish red
64: Dark red
65: Purple
66: Light purple

68: Variegated red, purple, blue

70: Blue

75: Blue green
76: Grayish blue green

80: Green
81: Light green
82: Dark green
83: Light gray green
84: Dark gray green
85: Olive
86: Grayish olive

89: Dark blackish green

Table 3, continued.

91: Light gray
92: Smokey gray
93: Dark gray
94: Gley/light gray green
95: Gley/gray green
96: Gley/dark gray green blue
97: Gley/light gray green blue
98: Gley/gray green blue
99: Black

VAR B-6, Lithic material, specifically identified.
00: Material not specifically identified; indeterminate
01: San Andreas chert
02: Brushy Basin chert
03: Pedernal chert
04: Jemez obsidian
05: Palm wood
06: Tecolote chert
07: Washington Pass chert
08: Government Mountain obsidian
09: Morrison green (to purple) quartzite/chert
10: Brushy Basin siltstone
11: Mancos siltstone
12: Cedar Mesa "jasper"
13: Burro Canyon (oolitic) chert
14: Dakota(white) quartzite
15: Burro Canyon (white) quartzite, coarse grained
16:
17:
18:
19:
20:
21:
22:
23:
24:

VAR B-7, Item Weight, in grams (to nearest .1 gm): justified from the right, with zeroes in empty spaces.

VAR B-8, Item Condition
0: Small fragment, unidentifiable as to orientation or body part
1: Medial section, broken across midsection and/or longsection so as to include part of only one longitudinal edge
2: Medial section, broken across midsection and/or longsection so as to include part of both lateral edges
3: Terminal section, unidentifiable as to distal or proximal orientation (estimate no more than 1/3 of original size)

Table 3, continued.

4. Terminal section, distal fragment (estimate no more than 1/3 of original size
5. Terminal section, proximal fragment (estimate no more than 1/3 of original size
6. Medial and terminal section (estimate 1/2 or more of original size), unidentifiable as to distal or proximal orientation
7: Medial and distal section (estimate 1/2 or more of original size)
8: Medial and proximal section (estimate 1/2 or more of original size)
9: Apparently complete (or nearly so) tool or core (though it may have been reworked)

VAR B-9, Thermal alteration evidence

0: Indeterminate (should rarely be used)
1: Burned (evidenced by potlids, crazing, "smoky" color, and/or chemical breakdown; more intense than annealing)
2: Not burned, no evidence of annealing
3: Annealed (evidenced by color change and/or luster, but not burned)

VAR B-10, Culturally significant adhesions

0: Indeterminate (as if acid-bathed, burned, etc.)
1: No adhesions
2: Pigment only
3: Only organic material other than specified in 4 and 5 below
4: Resin or resin-like substance (dark, organic, greasy) only
5: Fibrous organic substance only
6: Pigment plus some organic material

VAR B-11, Item facial designation (dorsal/ventral), for general reference

0: Indeterminate
1: Arbitrary, with no traditional or technical criteria present for reference (many cores and cobble tools may go here)
2: Traditional laboratory designtion, based on using the labeled face as "ventral"
3: Identifiable technical features allow orientation according to ventral face or struck face

VAR B-12, Item thinning stage evaluation, dorsal face; a reflection of energy invested in the cross-facial thinning of a piece.

0: Indeterminate
1: Unthinned core or nodule of raw material
2: Unthinned flake of raw material, with cortex
3: Unthinned flake of raw material, without cortex
4: Edged piece, i.e., first stage of reduction as a major part of shaping the whole piece and setting platforms for piece thinning (Callahan 1975), with cortex remnant (edging w/some thinning)
5: Edged piece as in (4), without cortex
6: Primarily thinned piece, "blank" (most prominent ridge/humps have been removed; prepared individual platforms)

Table 3, continued.

7: Secondarily thinned piece, "preform"
8: Shaped piece, where the thinning also provides significant edge regularity but is not highly stylized (e.g., point, special knife form, well-made uniface, biface, burin)
9: Highly stylized shaped piece, e.g., very well-made projectile points, crescents

VAR B-13, Item thinning stage evaluation, ventral face
0, 1-9: Same values as for VAR B-12

VAR B-14, Item EU shaping stage, general evaluation (the focus of energy is edge retouch)
0: Indeterminate
1: No "retouch" or special acute edge shaping
2: Unifacial edge shaping only, some edges
3: Unifacial edge shaping only, all edges
4: Both unifacial and bifacial edge shaping, though each type is in a discrete area; some edges only
5: Both unifacial and bifacial edge shaping, though each type is in a discrete area; all edges
6: Bifacial edge shaping only, some edges
7: Bifacial edge shaping only, all edges

VAR B-15, Core form (item may or may not have been used as a tool)
0: Not applicable; not a core
1: Item is a core, but is so fragmentary as to make form determination impossible
2: Bipolar core, as when struck between hammer and anvil
3: "Sliced" core, as when flakes are taken off end like slices of a loaf
4: Prepared multiple platforms, random or irregular form
5: Prepared multiple platforms, bidirectional only
6: Prepared multiple platforms, discoidal form
7: Prepared multiple platforms, Levallois-like form
8: Prepared platform area, polyhedral (unidirectional) form, only worked around part of the total circumference of the platform area
9: Prepared platform area, polyhedral (unidirectional) form, worked around the total circumference of the platform area (may be more or less regular, and large or small in size); would include forms such as Mesoamerican blade core, microblade core, etc.

VAR B-16, Tool morpho-use for (general, traditional)[a]; each item is to be identified within one of the following classes:
00: Not a tool; not applicable
01: Tool too fragmentary to determine form
02: Used but apparently unworked flake
03: Core, not used for other purposes
04: Used core, apparently not deliberately shaped, thinned or edged as a tool (e.g., used as a hammerstone, chopper, mano, etc.)
05: Thick uniface, with minimal edging; scraper plane
06: Thick biface, shaped but with minimal edging; chopper or hand axe, hoe

Table 3, continued.

07: Denticulate, usually a "retouched" serrated flake
08: Beak, usually a "retouched" flake, triangular form, very strong, probably a more massive piece, i.e., core
09: Notch, usually a "retouched" concave-edged flake
10: Thick side-worked uniface (including "retouched" flakes), without accessory form(s)
11: Thick end-worked uniface (including "retouched" flakes), without accessory forms(s)
12: Thick end-and-side worked uniface (including "retouched" flakes), without accessory form(s)
13: Thin side-worked uniface (including "retouched" flakes), without accessory form(s)
14: Thin end-worked uniface (including "retouched" flakes), without accessory form(s)
15: Thin end-and-side worked uniface (including "retouched" flakes), without accessory form(s)
16: Thin biface without obvious haft element; "knife"
17: Thin biface with haft element; "knife"
18: Crescent, either unifacial or bifacial
19: Drill, side notched (usually reworked projectile point)
20: Drill, expanded base
21: Drill, other
22: Burin, not on an otherwise worked form
23: Burin, on worked unifacial form
24: Burin, on worked bifacial form
25: Graver, not on an otherwise worked form
26: Graver, on thick unifacially worked form
27: Graver, on thin unifacially worked form
28: Graver, on bifacially worked form
29: Projectile point, triangular without basal notch
30: Projectile point, triangular with basal notch
31: Projectile point, stemmed without basal notch
32: Projectile point, stemmed with basal notch
33: Projectile point, lanceolate without basal notch
34: Projectile point, lanceolate with basal notch
35: Projectile point, deeply corner notched with strong stem (Hayes and Lancaster form a)[b]
36: Projectile point, corner notched with expanding stem (Hayes and Lancaster form b)[b]
37: Projectile point, corner notched with basal notch
38: Projectile point, side notched with short stem, no basal notch (Hayes and Lancaster form c)[b]
39: Projectile point, side notched with long stem, no basal notch
40: Projectile point, side notched with short stem, with basal notch
41: Projectile point, side notched with long stem, with basal notch
42: Projectile point, unidentifiable

NOTE: "Accessory form(s)" as used here have to be technological rather than use-altered. A utilized, non- retouched edge does not constitute an accessory form.

Table 3, continued.

VAR B-17, Item condition as modified by analysis; for each of the following subvariables, record the presence or absence of analytical modification using the following values (if originally marked as unmodified, this can be amended if the piece is later altered)
0: Indeterminate
1: No modification
2: Modification

VAR B-17a - Chipped to check material identification
VAR B-17b - Accidental breakage in field or lab
VAR B-17c - Carbonates removed with acid or mechanical means
VAR B-17d - Organic materials removed for (protein) residue I.D.
VAR B-17e - Thermoluminescence analysis
VAR B-17f - Hydration analysis cut
VAR B-17g - Silastic mold made
VAR B-17h - Thin-sectioned
VAR B-17i - Destroyed for trace mineral analysis
VAR B-17j - Trace mineral analysis without destruction

VAR B-18, Item illustration status: for each of the following subvariables, record the presence or absence of illustrations in that mode (if originally recorded as not illustrated, the record can be amended if later photographed or drawn); use the following values:
0: Indeterminate
1: No illustration
2: Illustrated

VAR B-18a - Black-and-white photo taken
VAR B-18b - Color print photo taken
VAR B-18c - Color slide taken
VAR B-18d - Cross and/or longitudinal section outlined or drawn
VAR B-18e - Facial view (at least one) drawn

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[a]This classification is intended to be comparable to other Southwestern lithic descriptions, and is based on a rather qualitative assessment of form and intended use, using traditional class names in many instances. When put with VAR B-12, 13, and 14 it should provide more technologically and functionally valid statements about tool form and probable use. Definitions for these terms can be found in the DEFINITION section of TABLE 5.

[b]These descriptions of forms A, B, and C were defined by Hayes (1975) as temporally significant in the Mesa Verde sequence.

Table 4.
Non-Flaked Lithics Preliminary Sort Outline

NUMBER OF SPACES	VARIABLES AND VALUES

9,6,2 VAR 01-03, Same as in Table 3.

2,4 VAR 04-05, Same as in Table 3.

SUBROUTINE A: UNDIFFERENTIATED NON-FLAKED ITEMS

The undifferentiated lot of non-flaked lithic items should now be spread out and separated into the following form classes (VAR A-1); all further description of things within this subroutine is in terms of this form class identification. For each identified class of items, there should be a separate set of descriptive data entered on the record forms as described for Flaked Lithics Analysis Subroutine A in Table 3 (p.2).

VAR A-1, Catalog Item Number (nested within Field Specimen number and Material Identification); justified from the right, with zeroes in empty spaces.

0001-99: Undifferentiated lot of material, including unidentifiable manufacturing fragments, fossils, gizzard stones, paint, minerals, and the like (this material is described as a lot within SUBROUTINE A). The number 0001 will always be used for undifferentiated lots of material. Catalogue Numbers 0002 through 0099 will only be used for undifferentiated lots of material when the F.S. unit has been subdivided into P.L. (point location) units, thereby potentially causing the separation of undifferentiated material present into more than one lot.

0002...n: Tools and tool fragments, worked ornamental stone; a set of things, such as beads in a necklace, may be identified as an additional lot of material separated out of the undifferentiated "0001" lot and given a single catalog item number here (all items or specialty lots given a single item number are described within SUBROUTINE B below) - justify from right with zeroes in empty spaces.

VAR A-2, Point Location Number: justified from the right with zeroes in empty spaces; if no point location is recorded for the lot or item recorded here, fill in with zeroes.

VAR A-3, Temporal Designation: this is to be outlined in the future, and not assigned during initial recording of the item; categories will be defined later.

VAR A-4, General form identification (see below for values).

Table 4, continued.

VAR A-5, Quantity of items included within each VAR A-1 class; justified from the right with zeroes in empty spaces, and all zeroes if the form class is not represented within the lot being described.

VAR A-4 columns	VAR A-4 form class value	VAR A-5 columns
.....1:	Curated fossils, unique stones	
.....2:	Paint materials (limonite, hematite, etc.). .	
.....3:	Shaped pieces (not building stone) with . . . no stylized form, including debitage (cultural debris: sandstone flakes, chunks).	
.....4:	Incised building stone	
.....5:	Shaped, not incised, special purpose building stone	
.....6:	Other cultural materials in lot, other than 1-5 above	

SUBROUTINE B: TOOLS, ORNAMENTS, SPECIALTY LOTS

All items or specialty lots that have been given individual numbers (catalog item numbers 2...n within each Field Specimen) should be described within the following variables B-1 through B-14. Specialty lots are assumed to have all identical or nearly identical members within the lot, and hence can be described as a typical individual member for this subroutine.

VAR B-1, Catalog item number (nested within Field Specimen Number and Material Identification); justified from the right, with zeroes in empty spaces: SEE SUBROUTINE A, VAR A-1 FOR BREAKDOWN

VAR B-2, Point Location Number: justified from the right with zeroes in empty spaces; if no point location is recorded for the lot or item recorded here, fill in with zeroes.

VAR B-3, Temporal Designation: this is to be outlined in the future, and not assigned during initial recording of the item; categories will be defined later.

VAR B-4, Item Condition (not a size indicator)

1: Small fragment, indeterminate as to tool type
2: Fragment, but with characteristics of production and/or use apparent
3: Complete or nearly complete item.

VAR B-5, Lithic Material Class

00: Indeterminate, even as to major class as specified in 01-03
01: Igneous material, indeterminate, or other igneous not specified below
02: Sedimentary material, indeterminate, or other sedimentary not specified below
03: Metamorphic material, indeterminate, or other metamorphic not specified below

Table 4, continued.

04: Concretion
05: Chalk
06: Talc
07: Limestone
08: Travertine (paint or ornamental material, silica matrix which forms in sheets, dark colored or dark green)
09: Pumice
10: Undifferentiated tuff
11: Volcanic breccia (or scoria)
12: Welded tuff, not vitrophyre
13: Siltstone
14: Claystone
15: Shale, not baked
16: Baked shale (red or orange)
17: Schist
18: Marble
19: Calcite
20: Syenite
21: Quartz latite
22: Quartz monzonite
23: Quartz, massive
24: Quartz, crystal
25: Granite, coarse
26: Granite, fine
27: Felsite
28: Gneiss
29: Amphibolite
30: Greenstone
31: Breccia
32: Basalt, coarse
33: Gabro (igneous, similar to granite but w/smaller crystals, occurring here as dark grey or black)
34: Basalt, fine
35: Conglomerate
36: Sandstone, coarse, carbonate matrix only
37: Sandstone, coarse, silica matrix only
38: Sandstone, coarse, both carbonate and silica matrix
39: Sandstone, medium, carbonate matrix only
40: Sandstone, medium, silica matrix only
41: Sandstone, medium, both carbonate and silica matrix
42: Sandstone, fine, carbonate matrix only
43: Sandstone, fine, silica matrix only
44: Sandstone, fine, both carbonate and silica matrix
45: Quartzite, coarse
46: Rhyolite (extrusive igneous, like granite, but w/smaller crystals
47: Diorite
48: Andesite (extrusive igneous, light colored)
49: Quartzite, medium
50: Slate
51: Metarhyolite
52: Quartzite, fine
53: Siltite

Table 4, continued.

54: Argillite
55: Tachylyte (volcanic glass w/basaltic composition)
56: Selenite
57: Lepidolite
58: Azurite
59: Malachite
60: Jet
61: Chert
62: Chalcedony
63: Onyx
64: Serpentine
65: Turquoise
66: Silicified wood
67: Vitrophyre (ignimbrite-rhyolitic black obsidian)
68: Obsidian
69: Gilsonite (looks like solidified tar)

VAR B-6, Lithic material, specifically identified
00: Indeterminate, specific material not identified
01: Brushy Basin siltstone
02: Morrison green (to purple) quartzite/chert
03: Brushy Basin chert
04: Mancos siltstone
05: Mancos shale
06: Burro Canyon (oolitic) chert
07: Dakota (white) quartzite, fine grained
08: Burro Canyon (white) quartzite, coarse grained
09:
10:
11:
12:
13:
14:
15:

VAR B-7, Item Weight, in grams: justified from the right, with zeroes in empty spaces. Record weight to nearest whole gram.

VAR B-8, Thermal alteration evidence
0: Indeterminate
1: Burned (evidenced by potlids, crazing, "smoky" color, and/or chemical breakdown; more intense than annealing)
2: Not burned, no evidence of annealing
3: Annealed (evidenced by color change and/or luster, but not burned

VAR B-9, Culturally significant adhesions
0: Indeterminate (as if acid-bathed, burned, etc.)
1: No adhesions
2: Pigment only
3: Only organic material other than specified in 4 and 5 below

Table 4, continued.

4. Resin or reslin-like substance (dark, organic, greasy) only
5: Fibrous organic substance only
6: Pigment plus some organic material

VAR B-10, Item production technique: record only those techniques whose traces are still apparent on the item.
0: Indeterminate
1: If absent
2: If present

VAR B-10a - Flaking
VAR B-10b - Grinding
VAR B-10c - Pecking
VAR B-10d - Drilling
VAR B-10e - Fine grinding/polishing

VAR B-11, Item production stage evaluation
0: Indeterminate
1: Original nodule, without further manufacture
2: Minimally shaped item
3: Well-shaped item, but not stylized (e.g., does not have ornamental, non-utility attributes)
4: Stylized

VAR B-12, Item use damage evaluation: for each of the following subvariables, record the presence or absence of use damage evidence using the following values:
0: Indeterminate
1: No damage evident
2: Use damage evident

VAR B-12a - Grinding/abrasion (mat of fine striations)
VAR B-12b - Striations (individually visible, coarse)
VAR B-12c - Battering
VAR B-12d - Polish
VAR B-12e - Flaking (any size scars)
VAR B-12f - Pecked
NOTE: Be sure you are recording use damage and not evidence of production.

VAR B-13, Item morpho-use form (general, traditional): each item is to be identified with only one of the following classes:
00: Indeterminate
01: Anvil/nutting stone
02: Unworked hammerstone
03: Worked hammerstone (not a maul)
04: Polishing stone
05: Composite polishing/pecking stone
06: Lightning stone
07: Unspecialized pounding stone (serves as pestle)

Table 4, continued.

08: Composite chopping/polishing stone
09: Shaped stone slab
10: Unshaped grinding handstone (mano)
11: Shaped grinding handstone (mano) with triangular cross-section
12: Shaped grinding handstone (mano) with cross-section other than triangular
13: Ungrooved abrading stone
14: Grooved abrading stone
15: Loomblock
16: Grinding netherstone, unspecialized
17: Grinding netherstone, shaped slab metate (without accessory surface)
18: Grinding netherstone, shaped slab metate with secondary grinding surface
19: Grinding netherstone, shaped trough metate without accessory surface, indeterminate as to whether trough ends are open
20: Grinding netherstone, shaped trough metate without accessory surface, both ends of trough closed
21: Grinding netherstone, shaped trough metate without accessory surface, only one end of trough open
22: Grinding netherstone, shaped trough metate without accessory surface, both ends of trough open
23: Grinding netherstone, shaped trough metate with accessory grinding surface, indeterminate as to whether trough ends are open
24: Grinding netherstone, shaped trough metate with accessory grinding surface, both ends of trough closed
25: Grinding netherstone, shaped trough metate with accessory grinding surface, only one end of trough open
26: Grinding netherstone, shaped trough metate with accessory grinding surface, both ends of trough open
47: Grinding netherstone, too fragmentary to determine type
27: Shaped mortar/bowl
28: Shaped pestle
29: Pallet without raised border
30: Pallet with raised border
31: Maul, neither grooved nor notched
32: Maul, notched
33: Maul, grooved
34: Axe, neither grooved nor notched
35: Axe, notched
36: Axe, grooved
48: Notched/grooved tool, indeterminate as to type (axe or maul)
37: Tchamahias
38: Button
39: Toggle
40: Bead
41: Pendant blank

Table 4, continued.

42: Pendant
43: Necklace segment, not a bead
44: Bracelet
45: Effigy
46: Perforated disk
49: Ornament indeterminate

VAR B-14, Item condition as modified by analysis; for each of the following subvariables, record the presence or absence of analytical modification using the following values (if originally marked as unmodified, this can be amended if later the piece is altered):
0: Indeterminate
1: Modification
2: No Modification

VAR B-14a - Chipped to check material identification
VAR B-14b - Accidental breakage in field or lab
VAR B-14c - Carbonates removed with acid or mechanical means
VAR B-14d - Organic materials removed for (protein) residue I.D.
VAR B-14e - Thermoluminescence analysis
VAR B-14f - Hydration analysis cut
VAR B-14g - Silastic mold made
VAR B-14h - Thin-sectioned
VAR B-14i - Destroyed for trace mineral analysis
VAR B-14j - Trace mineral analysis, not destroyed

VAR B-15, Item illustration status: for each of the following subvariables, record the presence or absence of illustrations in that mode (if originally recorded as not illustrated, the record can be amended if later photographed or drawn); use the following values:
0: Indeterminate
1: No illustration
2: Indeterminate

VAR B-15a - Black-and-white photo taken
VAR B-15b - Color print photo taken
VAR B-15c - Color slide taken
VAR B-15d - Cross and/or longitudinal section outlined or drawn
VAR B-15e - Facial view (at least one) drawn

Flaked lithics: Those items that have been primarily manufactured by percussion or pressure flaking, with no subsequent manufacturing abrasion except for edge scrubbing as part of platform preparation or haft edge dulling. This would include flaked cores that are used as hammerstones, or axes or hoes that are subsequently abraded from use without specific production by grinding. It would not include items that have primary flaking to shape the core, then deliberate pecking and/or grinding to shape the piece (as on a grooved maul).

Non-flaked lithics: Those items that have been primarily manufactured by abrasion (pecking, grinding), with or without some initial flaking of the core. This also includes those items that have been selected for their natural shapes and used without further manufacturing, e.g., river cobble hammerstones. It also includes "miscellaneous" items such as paint materials, curated fossils, incised or specially shaped building stones, and ornamental stone.

This separation of items by manufacturing technique separates out some single-use categories between the two production classes -- flaked hammerstones go into one group, unmodified cobble hammerstones go into another. However, the use class information can later be recombined in describing tool use and tool kit distributions, and the basic production system information is not lost within the data bank.

A detailed glossary of the terms used in Tables 3 and 4, and the techniques used to evaluate attribute values on the collected artifacts, should be part of the Laboratory Manual.

Final Analytical Sort Format and Design

A detailed statement of the various analyses, including their terminology, method, and techniques, is not provided in this paper. However, some general comments about the analyses designs should be made now, so that the details of the Preliminary Analytical Sort can be evaluated within the context of the whole research program.

Projectile points. All whole or fragmentary projectile points should be described and analyzed if possible, and their description should include material, general form, production techniques, use modifications, reshaping data, and design features. A description of form alone is insufficient for analysis of point types -- such classes should be based on technical attributes since the latter often serve as constraints to the design system.

Use of an Employable Unit approach to projectile point use analysis is recommended, since points in general frequently serve for uses other than as ballistic items (e.g., for cutting). The techniques used to shape haft notches in points is frequently as culturally diagnostic as the resultant shapes -- both should be evaluated even if the technical inferrences are more difficult to make.

Flaked debitage. Cores and core fragments will be individually but

but minimally described during the Preliminary Analytical Sort, but flakes will only be characterized as materially defined lots within provenience units. Detailed analysis of samples of flake debitage, selected to reflect various temporal and spatial units, must be completed in order to answer many of the production system questions outlined in Table 2.

Flaked tools other than projectile points. Flaked tools and fragments will also be individually but minimally described during the Preliminary Analytical Sort, and classified within relatively traditional morpho-use types. A sample of the non-projectile point tools needs to be further selected to reflect the various temporal and spatial units, for more detailed use analysis. A partitive analytical model, based on definition of "employable units" on tools, is suggested for tool use analysis of the Dolores flaked lithic assemblage. This model is based on a detailed evaluation of those segments of whole artifacts that appear to have been deliberately shaped and/or damaged by use, to more thoroughly understand the multifunctional nature of most flaked stone tools. This initially appears to be a most appropriate analytical model for the Dolores assemblage, since the lithic production system appears to be most pragmatic and relatively unstylized -- flakes seem to be produced from irregular cores, made and used near their original depositional environment, and then appropriate shapes selected for use rather than being more systematically reduced and designed. In such a system, traditional tool classes tend not to reflect the range of tool uses of a social unit -- they mask the range of activities for which "utilized flakes" are used. A more specialized description of tool segments, no matter what the general form of the whole implement, should provide much more information about tool use and design (or lack of such) for the Dolores lithic assemblage than would a more traditional holistic analysis.

Non-flaked lithic items. The expected assemblage of non-flaked lithic items is expected to be relatively small for the Dolores project this first year, small enough that time and staff should be available for detailed description and analysis of production, use, and design systems applied to abraded, ground, grinding, and battered stone implements and ornaments there. A detailed analytical outline has not been prepared for these materials, but should be developed within a framework of general behavioral analysis.

LITHIC MATERIALS ANALYSIS

One major goal of the first year's lithic analysis on the Dolores Archaeological Program should be definition of bedrock outcrops, worked areas, and petrographic characteristics of lithic raw materials within the project area. This is in some ways part of the general "catchment analysis" set up for the program, but needs more specific attention from the program lithics analyst. Some good definition of raw materials is available from the Chaco project in New Mexico, and has been adapted for the Salmon and Mesa Verde projects over the past few years, but much of this information is probably only minimally applicable for the Dolores area. The Dolores River drains a broad area of Jurassic and Cretaceous sedimentary formations on the west and northwest side of the La Plata Mountains, as well as some igneous intrusives in places such as Groundhog Mountain and Lone Cone (Haynes, Vogel, and Wyant 1972; see also Bush and Bromfield 1966; Bush, Marsh, and Taylor 1960; Cross and Ransome 1905; Cross, Spencer, and Purington 1899; Eckel 1949; Vhay 1962). Preliminary review of the lithic assemblage coming from the McPhee and nearby prehistoric sites indicates that the original inhabitants were making good use of the Dolores River gravels for raw materials, as well as the nearby eroded Cretaceous deposits. These need analysis.

Thus, it is recommended that the lithic analyst spend a significant amount of time and energy in location and identification of lithic resources within the project area. This effort should involve an initial review of the published literature and review of any file material from the area that might be available through the U.S. Geological Survey in Denver or the geology programs at the Colorado School of Mines or the University of Colorado. Geologists working with the Bureau of Reclamation and possibly with the U.S. Soil Conservation Service in the area should be consulted, and their aid in locating new sources recruited if at all possible. Petrographic descriptions of thin sections of archaeological and bedrock specimens should be made as soon as possible, for future reference. Ten to twenty thin sections each of archaeological and modern material should be made. This is more critical than is detailed archaeological assemblage description at the initiation of the Dolores Archaeologiocal Program. Since most of the raw material will be detrital or chalcedonic silicates, materials that are difficult to analyze for trace minerals, it would be best to concentrate initially on good petrographic descriptions. If at all possible, some good descriptions should be made with the aid of the transmission electron microscope, for more detailed description of non-silicate materials within sections. Obsidian or vitrophyre materials may be submitted for trace mineral characterization (e.g., by neutron activation analysis, x-ray fluorescence), and if possible they should also be analyzed for hydration evaluation.

As part of this materials analysis, local rockhounds should be

interviewed about regional materials. San Juan Gems, on State Highway 184 just north of Cortez, is owned by Mr. Sanchez who has many years of rockhounding experience in the area. He should be approached for aid, as should any one else who may be able to provide information pertinent to the project area.

Analytical Personnel and Facilities

Obviously, there are problems with the initial establishment of the curatorial and analytical laboratory for the Dolores Archaeological Program. However, these will undoubtedly be resolved as time and supervisory personnel are available.

A basic list of necessary laboratory furniture and facilities has been prepared for the Dolores Archaeological Program, but some items necessary for the lithic analysis outlined in this report are listed here.

a. Stereoscopic binocular microscope (e.g., Bausch and Lomb StereoZoom 7) that will go to 200-250X, with Nicholas and ring illuminators, 20X eyepieces, and camera adapter; flaked lithic use analysis is generally done with magnification in the range of 30-60X, but recent work by Lawrence Keeley has demonstrated the value of microscopic investigations at the 200X range with special lighting and any newly purchased microscope should have the capacity to be adapted to Keeley's analytical system.

b. Stereoscopic binocular microscope (e.g., Bausch and Lomb StereoZoom 7, Series S) with an extended horizontal arm and cast base, for analysis of large ground stone tools especially -- the Dolores Archaeological Program will definitely need at least two microscopes for the variety of analyses taking place in the laboratory, and it would probably be better if there were at least two different types for variable analytical capabilities.

c. Top-loading balance with digital readout, about 2500 g capacity, and at least 2 stainless steel weighing pans; suggest the Mettler E2000 -- this is an expensive piece of equipment, but is extremely efficient in providing a digital readout and greater consistency among various lab personnel.

d. Heavy duty balance, with a capacity of up to 25 kg, for weighing heavy ground stone items especially.

e. Two Munsell Soil Color Charts (ca. $40) and two Geological Society of America Rock Color Charts (ca. $5).

f. Small laboratory items such as at least 3 good quality sliding metric calipers, 3 contact goniometers, 3 contour gauges (for profile and edge reproduction; Formagage made by Penn Industries, Box 8904, Philadelphia, is 5 in wide and 4 in deep with 32 pins per inch), several stamp tweezers (for holding small tools), a good supply of small self-sealing plastic bags for protection of individual small items.

A few comments of laboratory techniques are in order here, even though the lab is not yet established. As the collection system is presently organized, large bags of flaked vs. unflaked lithic artifacts are collected in the field and labelled in terms of Field Specimen numbers. Individual items are rarely separated in the field, though occasionally (as in the case of projectile points) they are put in small bags within the larger specimen sacks. This means that there will be considerable edge damage to these items while they are being transported from the field to the lab, and are carried around within the bags in the lab. If any detailed microscopic analysis of edge damage patterns is to be considered for these materials in the future, there must be some way in which "bag wear" damage is minimized, if not avoided altogether. This may have to be ignored as a problem during the first year's work, but should be recognized as an analytical constraint within the research design.

Consideration of edge damage should also be included in the first artifact sort and washing procedure -- edges should not be bounced around on table and/or counter tops any more than is minimally necessary, and they should be washed with care. Some consideration should also be made about possible organic residues on tool edges -- some items may better be left unwashed and maintained in relatively sterile conditions, but later subjected to chemical analysis of grinding or cutting surfaces. Any analysis of amino acid residues can be done only on items collected under sterile (i.e., humanly untouched) field conditions, and some items may be selected in the field for such a program.

For those tools that are not being specifically saved for residue analysis, there should be a careful but thorough cleaning program established. Non-abrasive brushes (e.g., soft toothbrushes) should be used to thoroughly clean off tool edges, and acid baths should be used to remove carbonates. Care should also be taken not to dissolve away any fine edges of chalky or limey tools, or of only minimally silicified sandstones or quartzites. Labels should be applied to tools neatly and carefully, covering as little of the tool face as possible. It is preferable to use white ink for writing labels on dark materials, rather than laying down a white background and then using a black ink script over that -- the more of the tool face that is covered by the background, the more technical information one has trouble discerning. Certainly, background matte or shellac cover should <u>never</u> be allowed to slop over tool edges since that masks use damage and platform preparation evidence.

As mentioned earlier, a laboratory manual with a detailed description of laboratory methods and techniques should be prepared as soon as possible. Within this, the lithics analyst should include an illustrated glossary and description of specialized analytical techniques, and keep up-dating the notebook as new information is gained or techniques are modified to fit new conditions.

SUMMARY

The Dolores Archaeological Program is designed to provide a major contribution to Southwestern American archaeology in specific, and to the general study of agricultural settlement subsistence systems. Lithics analysis has traditionally not been emphasized in the Southwest, and the D.A.P. provides an opportunity to develop a model research program in Southwestern lithics analysis as part of an integrated approach to the study of human adaptations.

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APPENDIX 2
LITHICS LABORATORY PROCEDURE MANUAL

When the lithic artifacts enter the lithics lab, the flaked and non-flaked material will already be in separate bags for each F.S. unit and each point location. The following instructions will pertain to both types of lithic bags. If in the the process of analysis of a bag, the observers find an artifact that belongs to the other lithics category, they should remove it and put it in a bag with the other category (i.e., move from non-flaked to flaked bag for that F.S.). If a new bag has to be generated, the Laboratory Supervisor should be notified. The movement of materials through the laboratory is illustrated in Figure 3.6, flow diagrams for flaked lithic materials and non-flaked lithic materials, respectively. A description of procedures to be accomplished by individual technicians is as follows.

1. Procure F.S. bags from laboratory Supervisor. Get only one or two boxes at a time. You will be doing either flaked or non-flaked lithics for at least a two-week period. At the end of each two weeks you may switch to the other category.

2. Fill out provenience information on analysis form. Open bag and separate items to be run through Subroutine A (debitage) from those to be run through Subroutine B (tools).

If you have an F.S. bag with point location artifacts in bags for amino acid testing (F.S. will have "amino acid" written in red in the lower right hand corner), do not open it. If the acid test equipment is not yet set up, then make whatever observations you can by looking through the bag. Leave blank any variables you cannot describe, rather than crossing them out.

3. Analyze Subroutine A materials first. For flaked lithics you will be looking for platforms and cortex. Be sure you understand these categories, as well as the difference between fine-grained and detrital. If you have problems here or at any other point in analysis, don't hesitate to consult with another analyst or the lithics task specialist.

4. When you first pick up a tool to run through Subroutine B you should automatically ask yourself three questions:

- What is it (mano, axe, notched flaked, etc.)?
- How was it manufactured?
- What kind of use damage is present?

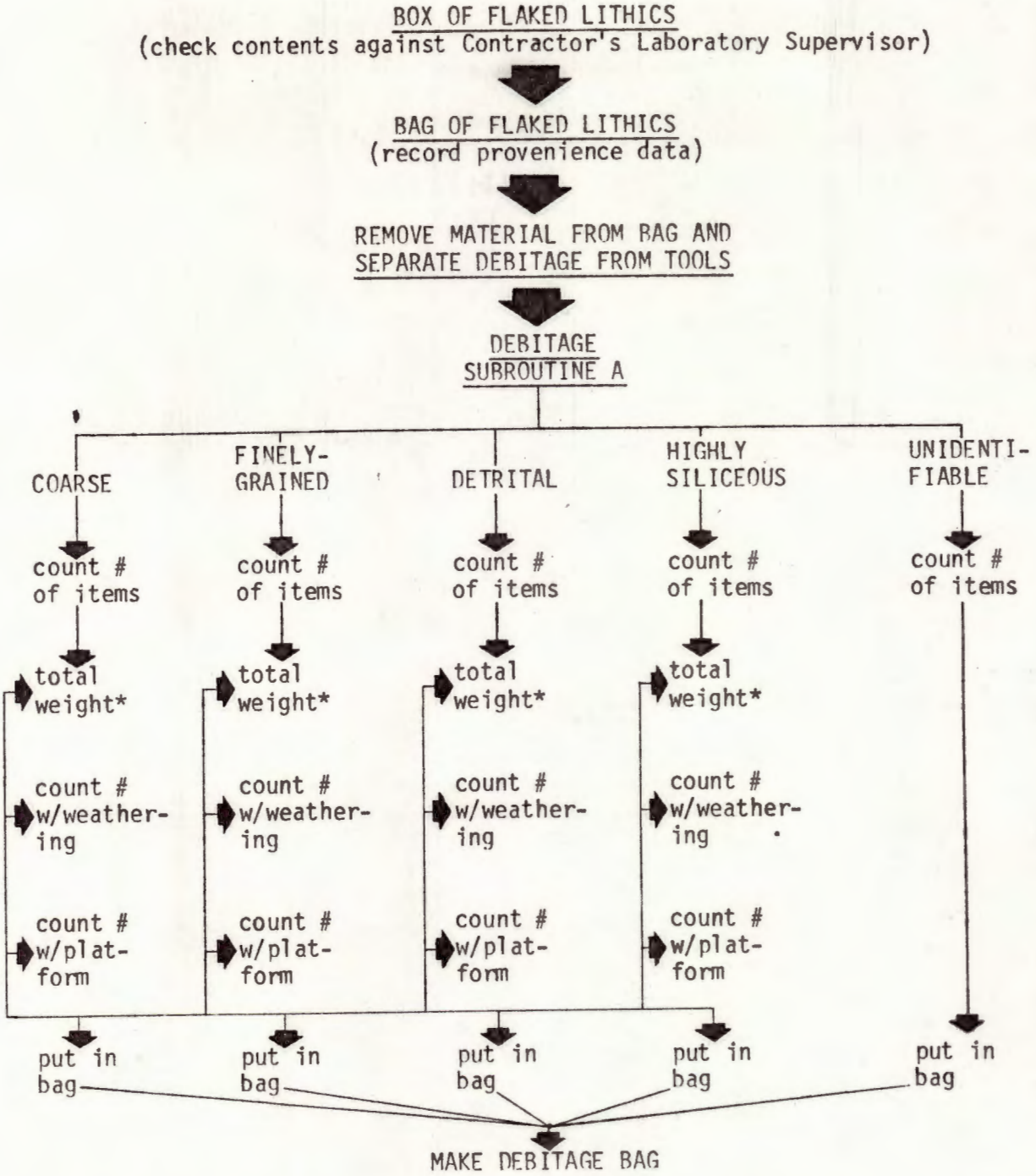
The answers to these questions will get you through 80% of the preliminary analysis in short order.

When doing rock material and specific material identification don't hesitate to consult the type collection if you have any doubts about an item: that is what it is there for.

If you have to label a flaked lithic item in order to identify a ventral face, label the ventral face with a "V" using a crowquill pen and India ink (or white-out on very dark rocks).

On the Flaked Lithics Morpho-use Form List, Values 10-15 are listed "without accessory form(s)." An accessory form here is defined as any working edge that was deliberately manufactured. A utilized, non-retouched edge does not qualify as an accessory form. If you find

Figure 3.6: D.A.P. lithics laboratory flow diagram for flaked lithic materials and for non-flaked lithic materials.



*record weight in grams, averaged to the nearest whole gram

Fig. 3.6

BOX OF FLAKED LITHICS
(check contents against Contractor's Laboratory Supervisor)

↓

BAG OF FLAKED LITHICS
(record provenience data)

↓

REMOVE MATERIAL FROM BAG AND
SEPARATE DEBITAGE FROM TOOLS

↓

TOOLS
SUBROUTINE B

↓

ASK THESE QUESTIONS:
What is the tool type?
What material is it made from?
How was it made?
How was it used (use damage)?

↓

B1. record unique catalogue item number

↓

B2. record point location. If none, enter zeroes.

↓

B3. leave blank

↓

B4. record material type that best describes material

↓

B5. using Munsell color charts enter color name that best describes item's color characteristics

↓

B6. if you can identify material as a specific known source type, identify here

↓

B7. weigh item and record weight to nearest .1 grams

↓

B8. determine how complete the item is and record the value that best describes what portion of item you have

↓

B9. determine if item has been annealed, burned, or is not burned (nor annealed)

↓

B10. examine item for presence of organcic or pigment material adhering to its surface.

↓

B11. determine if you can identify a dorsal and ventral face of the artifact based on characteristic attributes (Value #3), or if you have to arbitrarily designate one face as ventral by marking it in ink with a "V". Usually only cores will get Value #1.

↓

Fig. 3.6

B12. determine the thinning stage evidence present on the dorsal face. An edged worked item that shows signs of use damage is considered a finished tool and should go in Value #8.

B13. repeat same examination for the ventral face

B14. (see Glossary) - indicate the value that best describes the particular combination of unifacial and bifacial preparation. In varibles B12 and B13 the face was the unit of observation. In this variable the edge is the unit of observation.

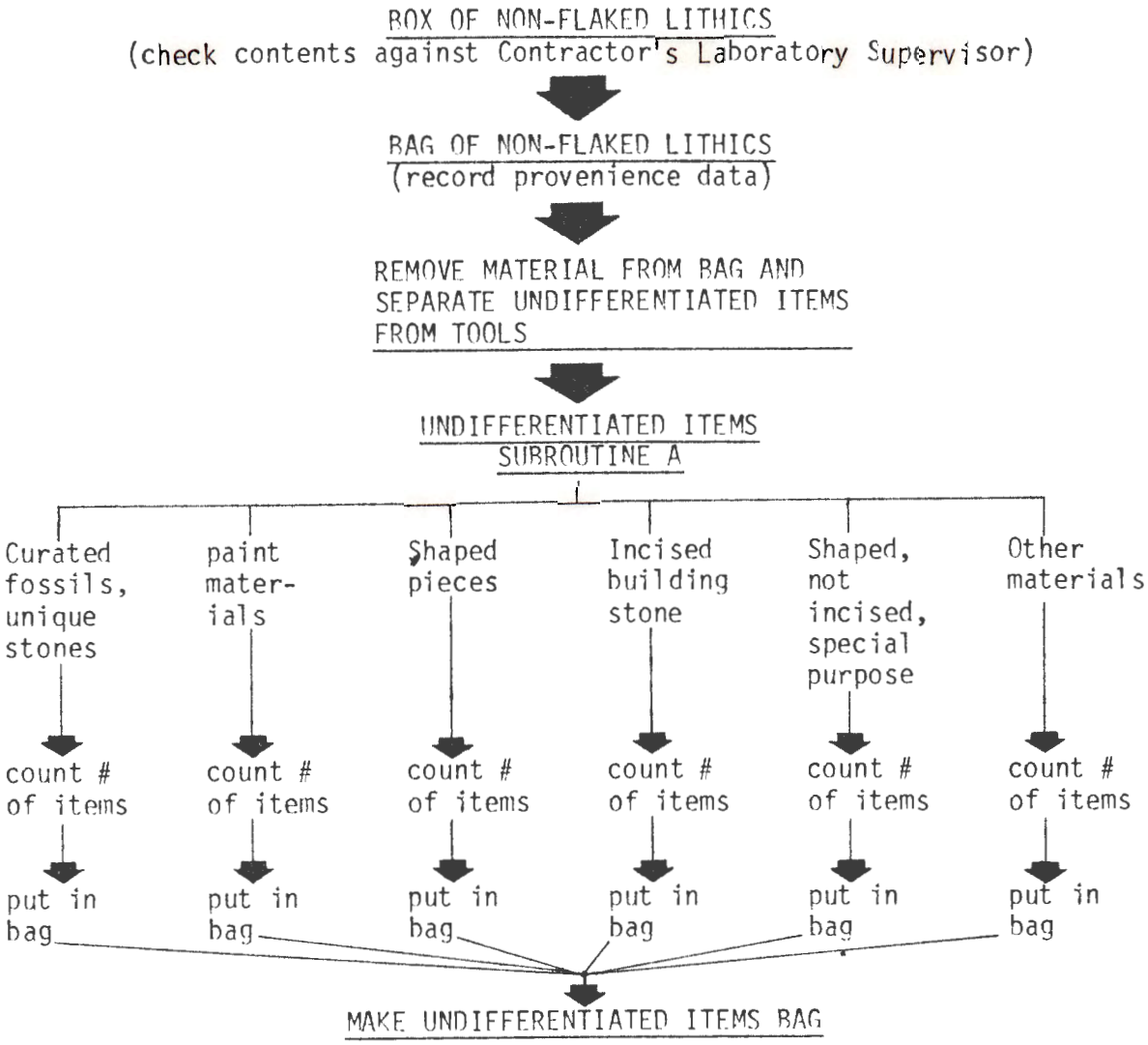
B15. indicate the type of core the item is, based on its shape. If item is not a core, put "zero" here.

B16. indicate the type of tool you think the item is, or is a fragment of. Indicate the tool type that best describes all the attributes of the item.

B17. if artifact has been altered or subjected to the listed types of analysis, indicate here

B18. if artifact has been photographed, indicate type here

Fig. 3.6


BOX OF NON-FLAKED LITHICS
(check contents against Contractor's Laboratory Supervisor)
BAG OF NON-FLAKED LITHICS
(record provenience data)
REMOVE MATERIAL FROM BAG AND SEPARATE UNDIFFERENTIATED ITEMS FROM TOOLS
UNDIFFERENTIATED ITEMS SUBROUTINE A
Curated fossils, unique stones
paint materials
Shaped pieces
Incised building stone
Shaped, not incised, special purpose
Other materials
count # of items
count # of items
count # of items
count # of items
count # of items
count # of items
put in bag
put in bag
put in bag
put in bag
put in bag
put in bag
MAKE UNDIFFERENTIATED ITEMS BAG

BOX OF NON-FLAKED LITHICS
(check contents against Contractor's Laboratory Supervisor)

BAG OF NON-FLAKED LITHICS
(record provenience data)

REMOVE MATERIAL FROM BAG AND
SEPARATE UNDIFFERENTIATED ITEMS
FROM TOOLS

TOOLS
SUBROUTINE B

ASK THESE QUESTIONS:
What is the tool type?
What material is it made from?
How was it made (manufacturing techniques)?
How was it used (use damage)?

B1. record unique catalogue item number

B2. record point location. If none, enter zeroes.

B3. leave blank

B4. determine how complete the tool is an record the value that best describes the portion of the item you have

B5. record material type that best describes rock material

B6. if you can identify the rock material as a specific known source type, identify it here

B7. weigh itema nd record weight to th nearest gram

B8. determine if item has been annealed, burned, or is not burned (nor annealed)

B9. examine item for presence of organic or pigment materials adhering to it surface

B10. indicate the types(s) of techniques you think were used to make the tool. Be careful to differentiate between production technique and use damage.

B11. determine how well-shaped the item is, i.e., how much it has been altered from its natural condition in order to make it functional. If it has shaping that seems not to really be functional, but stylistic, then is is called "Stylized."

B12. indicate the type(s) of use damage you think are present on the item. Take care not to confuse use damage with production technique damage.

B13. indicate the type of tool you think the item is, or is a fragment of. Indicate the tool type that best describes all the attributes of the item.

B14. if artifact has been altered or subjected to the listed types of analysis, indicate here

B15. if artifact has beeen photographed, indicate type here

one of these tool types with an accessory form, then list the tool with the accessory form value; i.e., a thick side-worked uniface (#10) with a graver on it would be coded as a graver on thick unifacially worked form (#24).

On the Non-flaked Lithic Morpho-use Form List you will find reference to accessory surface on Values 17-26. Accessory surface means a surface that was a secondarily produced or utilized surface on a netherstone. If there are two separate grinding surfaces on a netherstone, the one with the least amount of production and/or use would be classified as the accessory surface.

When filling out the analysis form remember that the first artifact analyzed under Subroutine B for each F.S. will have Catalogue Number 0002, the second, 0003, etc. Catalogue Number 0001 will always be reserved for Subroutine A materials, even when there are none.

5. After preliminary analysis of the F.S. bag is completed, repackage artifacts:

a. Re-package Subroutine A lithics together in a single bag and put in a slip of paper with Catalogue Number 001 on it. If there are a lot of items, use tissue, cotton, or several bags to separate them in order to minimize any "bag retouch" that might affect intensive analysis.

b. Place each artifact analyzed under Subroutine B into a separate bag along with a slip of paper with that artifact's catalogue number on it. Each of these separate bags will then be placed into the F.S. bag.

6. A shelf area will be designated for storage of F.S. bags that have been analyzed until they are sent to be catalogued by the Bureau of Land Management. When you put a box on the shelf, mark it:

Preliminary Analysis Done By _____
(initials and date)

To assist you in becoming familiar with the technical terms used by the lithics laboratory, a glossary is included in this manual (Table 1). Please be familiar with the terms listed before you are assigned regular tasks in the laboratory.

The lithics and ceramic labs have access to five zoom microscopes, three scales, four illuminated magnifiers, four opti-visors, several Kellner scale lupes, streak plates and several bottles of HCl. All this equipment was purchased to improve the quality of our observations of artifacts. Use any equipment you need as often as you feel is necessary. When the Mettler scale or the microscopes are not going to be used for a while, cover them with the dust covers. At the end of the day put all equipment (except scales) back into the storage cabinet. If the optical equipment needs cleaning, use only air brush and/or lens tissue.

Table 5.
D.A.P. Lithics Laboratory Glossary of Lithic Terms.

ABRADING STONE

An object made from a grainy material (sandstone, basalt, quartzite) known for its frictive qualities, which facilitates the sharpening or sanding of bone, antler, wood and soft stone. Often the impression left by the friction creates a depression in the surface.

ANNEALED

To have heated a piece of stone or other material to a point at which its properties favoring conchoidal fracturing are at or near their optimal level, and then to have allowed to cool slowly. The properties resulting from annealing can be a change in color, a concentration of pinkish hue around the cortex, an overall pinkish or greenish cast to the piece or an unusually high amount of luster for the material concerned.

ARTIFACT

An object which has been altered physically or spatially through human intervention.

AXE

A chopping tool which is usually subrectangular to ovoid in plan view; with or without lateral grooves or notches to facilitate hafting; manufactured by flaking and/or pecking or grinding. There can be one or two working edges called bits (where the two faces meet to form a sharp edge).

BATTERING

Damage that occurs on a stone implement due to striking it against another object. Battering damage can consist of hinge flake scars and relatively deep bulb scars along with crushing which can result in cone shaped bruises.

BEAD

A circular or oval piece of material that has been drilled or pierced to facilitate stringing.

BEAK

Any three sides on a stone artifact which converge and fortuitously form a thick point.

BIDIRECTIONAL CORE

Stone nodule that has been reduced through a technique whereby flakes are struck from two directions only.

BIFACE

An artifact which bears flake scars that originate at the edges and result in the reduction and shaping of both the dorsal and ventral faces.

BIFACIAL

A descriptive term for flaking patterns that are produced on a stone artifact through the process of reducing (thinning) the piece or sharpening and shaping the edges by flaking both faces along a common edge.

BIPOLAR

Technique of resting a core or lithic implement on an anvil and striking the core with a percussor. (Crabtree 1972:42).

BLADE

A particular type of flake that is very long in relation to its width and thickness. The classic definition states that the total length of the flake must be at least twice the width. Blades have dorsal ridges running down the length of the flake.

BLANK

A stage in the process of bifacial reduction of a stone tool where there is a minimal amount of energy invested in the production of the tool. The physical characteristics of a blank include prepared individual platforms and absence of prominent ridge forming flake scars that extend into the center of the piece.

BRACELET

A circular or ovoid band of material with an inside diameter suitable for placing around a wrist or arm. The band may be continuous or have a break in the circumference. Common materials are bone, stone, wood and shell. Production technique may be drilling, abrading, carving and/or flaking.

BURIN

A chisel-like implement derived from a flake or blade; or the modification of other implements by using the burin technique to remove the edges parallel to their long axis and/or transversely or obliquely. Generally forms a right angle edge on one or both margins. (Crabtree 1972:48).

BUTTON

A piece of material drilled or pierced with two or more holes. Usually occurs in a disc shape and was probably fastened to a garment.

CONE OF FORCE

A term used to describe the circular, concentric patterns that occur when a concentrated force is applied to a piece of material that is cryptocrystalline or microcrystalline in nature. If the impact is received at a 90° angle on the face of a piece, the force will be represented as a true cone, but if the force is applied to an edge of a core at an angle less than 90°, only a cross section of a core will be present. This cross section, which results from a "flow" of energy through material, creates concentric ripples on the removed piece (the flake) and the opposite or negative impression on the parent piece (the core). Cone of force is also referred to as bulb of force.

CORE NUCLEUS

A mass of material often pre-formed by the worker to the desired distinctive shape to allow the removal of flakes or blades. Piece of isotropic material bearing negative flake scars. (Crabtree 1972:54).

CORE

A mass of lithic material fabricated for the purpose of the production of flakes. The piece should have some evidence of negative flake scars and platform areas.

CORTEX

A rind formed on the surface of a nodule due to extensive alteration of its chemical, molecular and physical properties. Visual and textural indications of the alteration due to this degree of weathering reveal a difference in color from the matrix material and the rounding and smoothing of the piece. Cortex is usually a result of a very long exposure to the elements. (Also see "patination.")

CRESCENT

A term used to describe the physical shape of a tool that has been flaked unifacially and/or bifacially to form a semi-circular piece which is similar to the shape of a crescent moon.

DEBITAGE

Residual lithic material resulting from tool manufacture or core reduction. Represents intentional and unintentional breakage of artifacts either through manufacture or use. Consists of flakes, chunks, or blocky pieces that usually represents the various stages of production of the raw material from the original form to the finished form. (Crabtree 1972:58).

DENTICULATE

Tooth-like serrations on the margin of an artifact, similar to those of a saw. (Crabtree 1972:58).

DISCOIDAL CORE

Bi-convex core having flakes or blades removed from the parameters and usually on both faces. (Crabtree 1972:59).

DISTAL

A term used to describe that part of a flake which is opposite the bulb of force and platform. On a tool the distal end is the pointed end.

DORSAL

A term referring to one of the two possible faces of a flake. The dorsal face is that part of a flake that was the outer surface of a core before it was removed. Dorsal faces may exhibit negative flake scars and ridges from previous flake removal and/or some amount of cortex.

DRILL

A bifacial or unifacial implement with a long narrow rod-like blade that has steep-sided edges. Drills usually show signs of wear at the distal point and on the edges near the point. These wear striations are perpendicular to the long axis of the tool. Drills may be reworked points or knives.

EFFIGY

Sculpture in wood, rock, ceramics, etc., depicting an animal, person, or figure.

EMPLOYABLE UNIT

That segment or portion (an edge, E; projection, P; facial arris, FA; or facial surface, FS) of an implement that would provide a continuous work surface without reorienting the entire implement when that implement is used against another material to perform work. (Knudson 1978:4).

FLAKE

The piece which has been detached from the parent material due to a concentrated application of force. Flake characteristics include a point of force application on the platform remnant which received the removing blow, and a bulbar projection that dissipates into concentric rings emanating from the point of force application.

FLAKED LITHICS

Any lithic material that is the product soley of flake removal. This includes both the flaked item itself and the flakes that are the by-product of core reduction, biface or uniface production or alteration. Items that fall into this category are: flakes, cores, unifaces, bifaces, drills, gravers, spokeshaves, denticulates, knives, projectile points, retouched flakes, perforators, etc. (see Knudson 1978b:24).

FLAKING

Process of removing small pieces of material from a mass of lithic material such as cores, bifaces and unifaces by pressure, percusison, indirect percussion or the combination of pressure and percussion.

GRAVER

A sharp pointed projection formed on an implement by localized and sometimes alternate retouch. Gravers frequently manifest striations and/or microspalling at or near the tip due to wear. It is generally assumed that gravers were used to incise organic materials and soft stone.

GRINDING

Grinding refers to the action performed to wear down a surface or edge and it also refers to the result of abrasive friction on a stone implement. Evidence of grinding can be any combination of smoothing, striations and/or polish on the surface or edge.

HAFTING ELEMENT

Design feature on an implement that facilitates attachment of a shaft or handle of some type. A hafting element can be a groove, notch, or a ground edge on the base of a bifacially or unifacially thinned piece.

HAMMERSTONE

An unworked chunk or cobble of stone that is used as a percussion implement for detaching flakes from a core and/or re-arranging a grinding surface to make it more abrasive. The features present on a hammerstone can include hinged and deep flake scars with rounded platform areas as well as pitted scars.

ISOTROPIC MATERIAL

Materials having the same properties (e.g., elasticity, conductivity, etc.) in like degree in all directions. Typical of amorphous, non-crystalline structured substances and of crystals of the isometric system.

KNIFE

An implement such as uniface, biface, or flake that has low angle cutting edge and striations, polish, silicon sheen, and/or organic residue which indicate the cutting activity. The implement may manifest evidence of a hafting element.

LANCEOLATE

A long, pointed biface with edges that expand from the long axis as they are traced from the distal end toward the midsection at which point they either continue parallel or become slightly converging as they approach the proximal (basal) end of the piece.

LEVALLOIS CORE

A discoidal core that has had flakes removed by the Levallois technique. After forming the discoid a substantial platform area is prepared along a segment of the perimeter. From this point several large flakes are removed from across the face of the core. This technique allows the percussion removal of flake implements requiring little or no modification. The flakes removed are plano-convex and are characterized by intersecting flake scars on the dorsal face.

LIGHTNING STONE

Cobble or pebble composed of massive quartz which usually shows signs of abrasion on one or more surfaces. The friction of two lightning stones being rubbed together creates light without heat.

LOOMBLOCK

A large sandstone block approximately 30-40 cm long with one or more holes in which the end of a wooden stick could be held. Shape is generally rectangular with rounded corners and the upper surface is sometimes slightly convex. (Woodbury 1954:153).

MANO

A block or slab-like piece of stone, subrectangular, or ovoid in plan view, which may be conveniently held in one or both hands. It has one or more flattened surfaces which show evidence of being modified by grinding action against a metate. When shaping is in evidence (McCormick 1976:1) the production techniques employed were chipping, battering, and pecking. The material is often of sandstone or quartzite and occasionally of basalt and other porous materials.

MATERIAL SOURCE SAMPLE

A sample of lithic or ceramic material from a specific source locality, e.g., a quarry or outcropping of chert, sandstone, quartzite, etc.

METATE

A relatively large, thick slab or block-like implement that is generally considered to have been used as a "netherstone" in conjunction with a mano. One or both surfaces should show extensive patterned utilization wih any combination of striations, grinding, or pecking. The wear and the roughening of the use area eventually form a concave surface. Metates are often manufactured from sandstone slabs that have been broken along bedding planes which require only a minimal amount of breaking and/or chipping to round the piece (McCormick 1976:6).

MORTAR

A slab, block, cobble, or bedrock with a relatively deep spheroid or basin-shaped depression pecked and/or ground into the surface (McCormick 1976). A mortar serves the netherstone position in conjunction with a pestle.

NECKLACE

A circular band, chain, or string of items (e.g., beads) that is of such a dimension that it could be worn around the neck of a person.

NETHERSTONE

A grinding stone upon which the grinding action is performed using an abrader (e.g., mano or pestle). All metates are netherstones.

NON-FLAKED LITHICS

Any lithic artifact that is the product of either some process other than flaking or the product of both flaking and some other process of reduction. Other processes are pecking, grinding, polishing, drilling, and battering. Most items in this class are made from coarser grained rock that are flaked lithics, or rock with marginal or no conchoidal fracture properties. Items that fall into this category are: HAMMERSTONES, AXES, MODIFIED POUNDING STONES, MANOS, MORTARS, PESTLES, PALLETS, METATES, MAULS, SHAPED STONE SLABS (pot covers, griddles, etc.), ANVIL STONES, BUTTONS, BEADS, PENDANTS, EFFIGIES. (see Knudson 1978:24).

NOTCH

A concave area on a flake or tool edge produced by the removal of one or more flakes unidirectionally or bidirectionally. This includes basal indentions to facilitate hafting.

OCHER (OCHRE)

Finely disseminated or pulverized iron oxides with or without a blending agent present. Yellow and brown ochers are usually some form of limonite, while red ocher is usually hematite.

PALLET

Tabular or slab-like implement with signs of utilization on one or both faces, usually appearing as a flat or slightly concave pecked and/or ground and striated surface. Pallets were usually shaped to a subrectangular outline by breaking, chipping, pecking, and/or grinding. Pigment may be present on a face. A pallet is usually of a size that could be easily held in the hand.

PECKING

A percussion technique used to form overlapping superimposed cones which create a roughened surface, as in the working surface of a metate; also serves to shape a tool, such as rounding the corners and edges of a mano, or creating grooves to facilitate hafting (e.g., grooved axes).

PENDANT

An exotic or shaped piece which has some element present that would indicate that it was hung from a necklace or bracelet such as a hole drilled through the piece. There can be evidence of grinding, polishing, cutting, and/or further modification such as incising or painting.

PESTLE

A relatively long, cylindrical implement with rounded ends which may be conveniently held in the hand. Wear patterns include fine to coarse striations due to grinding, polishing, and light pecking on one or both ends. Pestles were presumably used in connection with mortars.

PIGMENT

A substance which has been prepared or used in its natural state to make coloring material for paints of various types. Mineral pigments are usually ground up into a powder for use. Organic pigments may be ground up and/or boiled and dried to produce powder. Examples of pigment are hematite, azurite, malachite, gypsum, and bee weed. Traces of pigment can be present on manos, mortars, pestles, and pallets.

PLANO

A term used to describe the ventral face of a flake. When used in conjunction with the term plano/convex the dorsal face is curved and the ventral face is flat.

PLATFORM

The surface area receiving the force necessary to detach a flake or blade from a core. A remnant of the core platform is often present on a flake and appears often as a flat surface. The platform normally contains the point of impact which serves as a point of origin for the bulb of percussion.

POLISH

A shine on a surface or edge of a tool that results from friction with abrasive materials. Polish can be present on a mano, metate, polishing stone and on flakes as a result of platform preparation.

POLISHING STONE

A small, smooth stone with portion(s) of one or more surface(s) ground or abraded to a very smooth, polished facet. Very fine striations may be present on the polished surface and the luster of the stone should be higher on the utilized surface than the rest of the stone surface (McCormick 1976:9). Most polishing stones are believed to have been used to put a polish on ceramic vessels while some large stones were used to polish floors and walls.

POLYHEDRAL CORE

A unidirectional core bearing multiple blade scars which produce a shape that is cylindrical (Crabtree 1972:84). The flake or blade scars form many planes around the edge that emanate from the platform.

PREFORM

A preform stage is a shaping and thinning stage of biface manufacture. Preforming denotes the first shaping of an object after the "blank" stage of preparation. An unfinished, unused form of the proposed artifact without refinement, with irregular edges and no means of hafting. Billet and/or pressure flaking stage. "Trade blank" stage.

PROJECTILE POINT

A spearpoint, dartpoint or arrowpoint (Crabtree 1972:86). A pointed biface or uniface that has some sort of hafting element which facilitates its attachment to a handle or spear shaft. The function can be either as a projectile or a cutting implement.

PROXIMAL

An orientation description which when applied to a flake is the point of origin from which it was struck. On a bifacial tool the term refers to the rounded end if the piece has both a pointed and rounded end, or the end exhibiting a hafting element.

RETOUCH

A flaking technique used to straighten, sharpen, change the working edge angle and/or make the artifact more regular in form. Generally involves the use of pressure flaking in one or more stages (Callahan 1973:131). Usually follows percussion preforming except on "retouched flakes." Before precision pressure work may be accomplished one must first remove all irregularities on the objective piece by a primary retouch and then do a secondary retouch.

RING

A circular band of material with an inside diameter suitable for placing on a finger. Common materials are bone, stone, wood, and shell. Production techniques may be drilling, abrading, carving, and/or flaking.

STRIATIONS

Lines, ridges, and furrows left on a surface of an artifact as a result of abrasion with another (harder) material.

STYLIZED

An implement might be considered stylized if the production stage of the artifact suggests an expenditure of energy and achievement of form (e.g., specialized flaking patterns, shaping and notching) that surpasses the goal of creating simply a functional piece. Often such stylization becomes recognized as a hallmark of cultural and/or temporal specificity such as Clovis, Folsom, and Bitteroot points.

TERMINAL SECTION

On a flake the terminal sections are where the bulb of percussion originates and the opposite end.

On tools the terminal sections are where the lateral edges meet to form a point, hafting element or rounded area.

TCHAMAHIAS

A ground and/or polished blade-like tool made of hard, fine grained material, tapering from a narrow butt to a broad, thin cutting edge. (Woodbury 1954:165). There is evidence that Tchamahias have been used as hoes, paint grinding slabs, skinning knives, and in ceremonial context.

THICK BIFACE

A preliminary sort category used to describe an artifact which has been reduced though the removal of flakes from across the dorsal and ventral faces. The flake scars should emanate from all or most of the edges. The thickness of a 2 to 1 width/thickness ratio can indicate a step in the process of piece reduction as well as a finished, relatively crude tool.

THICK UNIFACE

A preliminary sort category used to describe a thin piece of isotropic material, usually a flake, with intentional flaking only on one face of an edge(s). The maximum width of the piece is roughly greater than twice its thickness.

TOGGLE

An elongated cylindrical object with a hole running through its midsection perpendicular to its long axis or with a notch ringing all or part way around its midsection in order to secure it to a piece of material so a fastening loop or ring can be pulled over it. Functions similar to that of a button.

TOOL

An instrument, fortuitously shaped or manufactured, that is found to be useful or necessary in the performance of some task or operation. Instrument used to perform work (alteration) on some other object (organic or inorganic).

UNIDIRECTIONAL CORE

A core from which all the flakes have been removed from one direction only.

UNIFACE

Stone artifact bearing intentional flake scars emanating from either the dorsal or ventral face. It is possible to have a unifacial artifact with flake scars emanating from both the dorsal and ventral face if the flaking is in discreet and separate areas.

VENTRAL

A term used to describe the orientation of a flake in terms of its relationship to the core prior to removal. Ventral refers to the face of the flake which was once a part of the inner matrix of the core. Characteristics include a bulb of force and ripple marks emanating concentrically from the point of impact.

WORKED HAMMERSTONE

Tool used to apply force to the objective piece in the knapping process. Usually shows evidence of battering and striations and may have negative flake scars. Most use on edges. It has been intentionally worked in order to produce a certain area or type of surface that would facilitate the removal of flakes from a core or to shape a tool such as a mano.

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APPENDIX 3

REFERENCE LIST FOR REDUCTIVE ANALYSIS LABORATORY

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