1st Tape

TECHNOLOGICAL TRAITS

Typology ~~has formerly been concerned mainly by form~~ includes both form & surface techniques and. There are four separate typological categories inherent in classifying artifacts ~~as to~~ into types ~~as, I said~~, They are ~~the main one is~~ form, technological traits, ~~the other is~~ function, and ~~the other~~ also the is distribution in time and space. This paper will be concerned with the technological traits of the aboriginal [redacted] peoples, and their relationship to typology. ~~and what part it may play in typology will remain to~~ be seen. It would be difficult for any one person to conduct experiments on all core and flake types or to understand fully all the permutations of the features that go into the making of cores and their flakes and blades, but we can broaden our knowledge and resolve certain types by careful study and analysis of flakes, blades and the debitage resulting from their manufacture. This analysis ~~A study of cores and their flakes~~ is basic to a concept of technological studies and is ~~as~~ far too often an overlooked ~~the~~ as a factor of flake, blade and artifact analysis. It is a consideration of the debitage flakes found at the occupation site and the relating of this waste material to the stages of flaking techniques required to produce the desired size and ~~in~~ type of flake, blade or artifact. Admittedly, debitage flakes are not as glamorous as the stone tools or cores, but they can be just as interesting and can furnish information not found on the core and the artifacts. The core or artifact usually shows only the last stage of its several steps of manufacture whereas the waste flakes can give clues to the primary, secondary or intermediate steps of fabrication. The very presence of cores in tool typology is [redacted] mute? evidence of the importance of flake scar study. They are certainly not a tool unless they show functional scars, but they are of prime importance in typology for the express purpose of studying the scars and technological features to resolve the tool types of their flakes and blades. Debitage flakes can be equally [redacted] important.

In the Americas, where we have a great absence of cores, it is not only recommended but almost imperative that we resolve the core techniques by analyzing and reconstructing the cores from the flakes and blades if we are to ultimately postulate the type of core with which they are [redacted] compatible. Conceivably a shortage of raw material forced the ancient stoneworker to reduce his core to a minute unrecognizable or insignificant size and it is possible that this same lack of stone prompted the modification of these exhausted cores into tools such as wedges, scrapers, and other cutting implements. Pebble tool industries no doubt, developed because materials larger than pebbles were not available. Even though we rightfully regard cores as basic in the study of the toolmaking industry, they represent only the residue of discard debitage to the prehistoric stoneworker. He was not concerned with their weight, beauty or form and he made no real attempt to keep them uniform other than that required to successfully remove a flake or blade of the desired width, thickness and length. To the stoneworker the core was the nuclei, the waste product, and he had no thought for their regularity or uniformity. His efforts and aims were on the detaching of flakes and blades, but since his needed blade type required certain consistency in flintknapping techniques, he ultimately produced a uniform core type, In other words, the design of the blade or flake which was pertinent to different cultures, geographical areas, and economies determine the type and design of the core. This, of course, is what makes core ~~studies~~ so important and contemporaneous with the movement and age of man, ~~and~~ also points out the need for careful study of the debitage flakes and for core reconstruction. When none of the cores are found at the site, because of the nature of the material being worked and the human element of change and error involved there are many variables and, therefore, stereo types of flakes and artifacts cannot be expected but we can look for consistency. ~~There will be~~ consistent differences reflecting minor and major changes in techniques of flake and blade removal when the flakes are separated into stages of their taxonomy. Each stage will readily demonstrate the rhythms attained by the worker and there will be a greater consistency of flake types, categories, ~~simularities~~ and like attributes will show the development of patterns which will denote the phases and stages of the part they played in the development of artifact types which will greatly assist in the interpretation of their cultural traits. Because of these variations, ~~invariables~~, the flakes should not be appraised individually but rather by the manifestations of their traits and techniques. Flake tool industries are represented by residue and debitage of the various stages of development of the artifact from the initial break of the raw material to the completed implement. The quantity and size of the flaking residue will normally be proportionate to the distance from the source of raw material. Should the archaeological site be of some distance from the source of raw material, then several [redacted] stages of manufacturing are apt to be absent. This is due to roughing out, blanking, [redacted] and preforming of the artifact at the quarry. In this case the flakes representing these phases of tool manufacture will occur in the proximity of the material source. These unifacially and bifacially worked preforms found at the quarry are generally made by direct using the core technique and generally direct percussion. ~~The~~ Cores may be derived from large tabular or primary flakes, sections ~~in~~ or parts of nodular forms, or simply from parts of cobbles derived from alluvium. An occupation site located near a large quarry is ~~most~~ more likely to have flakes ~~which will represent~~ representing all phases of their particular techniques of manufacture. Populations of cores are usually limited to areas abundant in lithic materials, But when materials for flake + blade removal had to be transported a great distance to the occupation zone for flake and blade removal the core was normally consumed until there apparently only remained, ~~an~~ a bare and unrecognizable remnant of the original piece of material. In this case we must attempt to resolve the core type by relating the flakes. Flakes and blades have certain identifying characteristics which make it possible [redacted] to reconstruct the core to which they are pertinent, ~~and~~ [redacted] By the study of aboriginal cores and their flakes one will be able to resolve core types from the flakes alone. The study of the cores and their stages of development is usually difficult [redacted] for the core was designed to produce flakes and blades and, therefore, [redacted] would be consumed in the process. Unless the aboriginal was interrupted and his unfinished work abandoned or broken, it is unlikely that the evolution of the core would remain. Therefore, at best, one must generally base his conclusions on the exhausted or malformed cores and flakes. It is rare indeed to find a great population of cores such as Francois Bordes found this year at Corbiac (about 1000) of ~~the cores were found~~ in the ~~upper percoidean?~~ Upper Perigordian (Personal communication November 6, 1966).

On the other hand, most literature shows great populations of flakes and of blades with [redacted] small proportions of cores (J. Radley and P. Mellers, 1964, Proceedings of the Prehistoric Society, In Mesolithic Structure at Deepcar, Yorkshire, England. 23,000 flakes and 17 cores were found. By comparison of their diagnostic attributes, flakes are determined to be similar or the same and then one may select one or two as being representative of form and technique. Studying flakes and [redacted] ultimately relating them to various tool types will indicate the cultural ~~ethnological~~ technological

Grace I can't hear exactly what is said & don't know how to spell the place. Doug traits and modes of manufacture and will greatly assist in obtaining a sharper definition of a complex in a cultural area. The debitage flakes from the making of just a single artifact may number several hundred whereas the artifact is often considered individually without placing too much emphasis on the surface flake scars. But, even when these surface scars are evaluated they usually only cover the last stage of fabrication whereas the debitage flakes occurring in conjunction with this would give us the true picture. The flake is far more useful in determining the technique than the flake scar, for the platform and part of the original lateral edge of the artifact was removed with the flake. Although the flakes removed from the artifact can be uniform [redacted] they may leave scars on the surface that are [redacted] multidirectional. Uniformly flaked artifacts leave scars that appear to duplicate artifact types, but in reality there is no facsimile. There are duplicates in technological traits but there is no duplicate artifact, like fingerprints each is distinctive and a mold of one artifact no matter how similar would not fit the mold of another. The elements involved in manufacture are not that ~~stereo-xtyped~~ stereotyped and the human margin of variation is too great. An analysis of flakes will show a greater consistency [redacted] of form and attributes for it is only necessary to [redacted] consider one unit rather than the composite units that compose an artifact. It will be much easier for us to separate flakes into different technological categories than to type artifacts if he is to consider the surface character of the artifact with the form. The projectile point forms are probably the most consistent of the flaked artifact types, but they too vary with the whim and needs of the maker. While their dimensions are variable their mode of manufacturing is generally consistent. An outstanding and well known example of the variation in form but consistency of technique are the points found at the Bison Kill site excavated by Dr. Joe Ben Wheat. This site yielded a large population of unbroken and mint condition projectile points and was devoid of the discards and debitage usually found in zones of occupation. The flaking technique of these points was consistent and uniform with only slight variations, yet they vary in size and form. Unfortunately, we do not have enough occurrences of these finds for they are a fine example of what actually went to the fields and they furnish much knowledge regarding technology and typology because of the unique mode of manufacture of these points and because they are in mint condition. A thorough analysis of this collection should resolve the consistency of flaking techniques and the variation of form and size. The intention of this paper is to assist in separating flakes and blades and relating them to cores and techniques by interpreting their mode of manufacture for my experiments carried out over the past years have afforded a basis for some conclusive evidence regarding the mode of manufacture. These experiments are intended to shed some light on the aboriginal lithic industries and to point out that magnitude of flake study due to the vast quantities of debitage as more flake assemblages, are analyzed in different geographical regions and related to different periods of time, the need for such a study will become apparent. My attempts at replicating the flakes and cores have shown that materials, the muscular motor habits of the worker, distinctive traits [redacted], human behavior patterns, evolution and phylogeny, concious planning, traditional development, outright invention, pride of workmanship and the need for superior tools provides an insight into the lives and economy of the prehistoric people, who so skillfully fabricated stone tools necessary for their existence. Working in this very complex industry has increased my respect for the earlier workers achievements and for prehistoric man's knowledge of materials and their sources, His unbelieveable control of muscular coordination and their ability to visualize the artifact within [redacted] an irregular block of stone. The mechanical and physical problems to be overcome before a useful end product could be made and consistent precise mental calculations of angles to project [redacted] forces of variable intensities. These are just a few of the items to be considered when [redacted] appraising the past stoneworkers unbelieveable accomplishments. This text will attempt to portray the [redacted] results of these experiments and to project the need for additional research on types not yet fully understood.

Those not fully understood will be hypothecated [redacted] on the basis of conclusions drawn from varied experiments and possible techniques will be ~~osculated~~ postulated. These experiments have proven that before final judgement or analysis can be made one must replicate both core, flakes and blades in all aspects and characteristics and unless a replica of the original can be duplicated many times by the same technique, one can go far afield from theory alone. There are definite laws of physical and mechanical properties of materials, [redacted] and applied force that remain constant, and if aboriginal results and those that result from experiments are to be the same then we may conclude that techniques used will be much the same. The people who adopt the core and blade traditions most certainly recovered all [redacted] flakes and blades which conform to their needs and those found usually are aberrantly [redacted] malformed, or those which broke as they were removed from the core. Such populations of flakes other than trimming, retouch and modification debitage cannot be expected other than an accidental occurrence for the flakes were removed from the core for a functional purpose. It is from a reconstruction of these waste flakes and blade assemblages that the end product can be evaulated. An [redacted] infinite variety of core, flake [redacted] and blade forms must be considered to separate the techniques used over a great span of both time and space. It is the writer's feeling that by flake study certain types of flakes will be pertinent to only certain groups of people in certain periods of time ~~by~~ and in certain geographical areas. The first basic step of working isotropic stone [redacted] either by percussion, ~~xndxxxx~~ indirect percussion, or pressure is the ~~buildage~~ ability to control ~~and~~ the fracture of the material. The past ~~artists~~ artesians in no way struck implusive blows and only after careful preparation of surfaces and ~~xtg~~ angles was the blow delivered with controlled, calculated and meticulous precision. Before the experimenter starts to remove a flake from a core he must understand that detachment is not accomplished by indiscriminant random blows, but is the result of a ~~preceded~~ preconcieved design of the flakes. The worker must have control of muscular motor habits and deliver the pressure or percussion force with extreme accuracy. Any careless ness or miscalculations in detachment will result in a hinge or step fracture causing the artifact to be malformed or useless. The ~~xxpkx~~ superb examples of aboriginal work reveal ~~only~~ not only a bag of tricks but an intensive knowledge of materials that would lend themselves to stone toolmaking and splendid display of mental and muscular coordination.

The analysis of flakes and ~~cores~~ cores in this text will hopefully outline the variables encountered in stoneworking and show how they are overcome and controlled by different techniques. Proper flake analysis should show the development of techniques traditional with each generation and any parallelisms of development as well as other techniques which are highly specialized for particular [redacted] functions.

I recently had an opportunity to study collections at Idaho State University, Washington State University, University of Washington, University of British Columbia, University of New Mexico, Museum at Victoria B.C.?, Field School at Vernon? Arizon, University of Arizona, at Grasshopper Site, the Denver Museum of Natural History, Site at Keesey?, Colorado, and the information that gleaned from these collections ~~had~~ has been most rewarding and pointed out to me the great need for debitage analysis. Numerous ~~gx~~ technological traits and techniques were represented. ~~by~~ My method of a rapid survey of flake assemblages was: (1) to separate the flake parts, for only the ~~barren~~ aberrant ill-formed and broken material was normally abandoned and, therefore, found by the archaeologist. (2) The proximal portions of the flakes were arranged in rows with the platforms facing the sorter, for these ends provided the bulk of the information pertaining to technology. (3) Then the mid-sections and the distal ends of the flakes were also arranged in a like manner. (4) The proximal ends, those bearing the platform of applied force were then regrouped by segregating those with ~~light~~ like platform characteristics. This involves many features which will be further explained in this text.

Flake assemblages fall into two classes, those which result from flaked artifact manufacture and those which result from making flakes and blades which were to be used freshly struck or to [redacted] be modified into tool types characteristic to blades and flakes. It is not the intention of the writer to inject the meaning that there are two major cultural differences in separating the flake assemblages derived from making artifacts by the use of the core method or by the modification of flakes or blades. As both techniques can be used by a single group of people. It is only important to be able to recognize these techniques when they make their appearance. For the purpose of analyzing the assemblages all flakes and blades will be called flakes. Existing literature does, however, use terms splinters, chips, spalls, blades, Lamellar flakes, Lamellaire? bladelets, prismatic blades, flakes and blades, etc. There are numerous types of flake specializations, many now existing in collections have no terminology, yet they could have considerable diagnostic value in the interpretation of technological traits. At present the only separation of flakes seems to be blade-like forms, yet there are numerous technological techniques used to remove blades from cores. The term blades encompasses a vast array of flakes with parallel sides with their length being two times their width (Francois Bordes, Les Eyzies Conference Nov. 1964). Individual analysis of such assemblages will readily demonstrate that they fall into two technological patterns which are distinctive to that group alone. Future study will no doubt indicate certain parallelisms and traditional traits in flake stone technology. A flake and blade, a blade is a specialized flake.Industry represents specially formed flakes removed from cores. The flakes being used freshly struck/were [redacted] modified into artifacts, blade making techniques are various and involved different types of core preparation from the simplest to the most refined. Blades can be used without modification or retouched by pressure flaking. Large flakes and blades are sometimes preformed by percussion into knives, [redacted] projectile points, etc. When smaller flakes are to be modified into a projectile point, the flake is straightened by removing the bulb [redacted] of applied force on the ventral side of the flake and the distal end of the flake is also trimmed on the ventral side until the longitudinal axis of the flake is straight. This is usually done by the pressure technique. Most pressure flakes are crushed during their removal and, therefore, will pass through the sifting screen at a dig.

Cores which result from flake and blade making are sometimes utilized as core tools or can be reduced to usable [redacted] flakes. Therefore, discarded, well-defined cores cannot be expected unless there is an abundance of raw [redacted] materials near at hand. An exception to this is the microblade cores of the Artic. Some well defined cores are found here, for the worker removes microblades until they were so small there were practically no room to ~~see~~ seat his tool and, therefore, he discarded his core. So sometimes the very technique can determine whether or not cores were left at a site. Experiments in replicating the aboriginal flaked stone artifacts has indicated that they [redacted] fall into two basic classifications. Artifacts which are themselves cores, and artifacts made from flakes, and blades, removed from cores. Making artifacts from flakes is the more economical industry than the core type tool for it leaves very little waste. Flakes and blades are removed from a mass of material, core, by a ~~fine~~ applying force on a predetermined definite surface area, at a definite specific angle, with varying degrees of intensity and velocity. The surface which is to receive the applied force will be known as a platform and its design has a direct bearing on the type of flake or blade removed from the core. The raw material sometimes determines which technique will be used to remove flakes or blades. Materials must respond under the application of force in such a manner that portions of the material may be detached in any direction. This quality is known as isotropism. Removal of raw material must include control of the width, length and thickness of the flake and the applied force must follow the desired direction of the worker. The simplest form of a core is a piece of material bearing a flake scar. Such [redacted] an ~~embryotic~~ embryonic stage of core development Cores all? ~~Carsadat~~ ? would probably go unrecognized as a core, but such a core was able to provide substance for usable flakes. Most cores do have more than one flake scar. The core bears a flake scar or scars which is usually characterized by a negative bulb of force at its apex. The scar indicates the order of removal of the flake which has taken with it the platform and the bulb of force. Even though a cobble stone is severed by force from a hammerstone the portion bearing the bulb of force will be the flake part, and the half bearing the negative bulbar scar will be the core. However, normally the flake will be smaller than the core. The core is more massive than the flake because it must necessarily be heavier to provide sufficient inertia to remove the smaller flake. There is one exception to this rule and this is the absence of a bulb on either part of a severed cobble. This is accomplished by a special technique which results in the splitting of the cone of force. When the cone is split both halves will have duplicate features, This special technique occurs rarely and is usually associated with pebble cobble industries and with core rejuvenation. The use of the core as a source of blades or flakes is an indication of man's first economy for it provides quantities of usable flakes either modified or unmodified, whereas the artifact made by the core method provides only a single tool and much waste material. Since both artifacts and cores bear flake scars it is sometimes difficult for the analyst to determine whether it is a core or a tool. For example, a chopping tool is a core remnant and under certain conditions could be mistaken for a core or vice versa. A case in point is the called cores from the Shoup Site. These were identified by John Woodall as exhausted cores and, in fact, could be confused as such. But at the Lez Eyzes Conference November 1964 it was termed by both

European and American archaeologists but they were Pieceesquilles. They are, in fact, a core tool but not an exhausted core. The normal conception of the core is a mass of material used for making blades and flakes and the residue or remnant is the core. A notched projectile point couldn't look less like a core, yet a core it is. Exhausted cores or cores which have had the flake removal operation either suspended or discontinued were sometimes used as [redacted] functional tools such as pulping [redacted] planes or they were sometimes converted into hammerstones. Cores defined as having been used as a tool should be appraised [redacted] very carefully before they are typed. The leading edges should be examined for wear patterns and functional scars, for there is a similar surface produced when preparing platforms for a subsequent series of flakes to be removed. Removing the overhang left by the last series of flakes and grinding are technological traits used in certain techniques and can be mistaken for functional scars or abrasions. Core forms are endless, yet they play an important part as a diagnostic trait and demonstrate many technological differences. Many are difficult to recognize as cores when they were worked down to a small unfamiliar form. Some sites are distinctive because of the complete absence of cores, yet from flake discards we know that cores were present at the time of occupation. Generally this denotes a shortage of material and the worker reduced the core to the last usable piece of material. In this case flakes and blades will have to be evaluated and the core reconstructed from diagnostic features which the flakes and blades reveal.

"The past artisans in no way struck implusive blows and only after careful preparation of surfaces and angles was the blow delivered with control calculated in meticulous precision."

Before an analysis of a flake is made I feel one should examine the chronology of the first experiments starting from my earl~~iest~~y attempts at stone flaking. Since all man's acts are by nature inquisitive with the natural and ~~inboard~~ inward urge for ~~man~~ motivation a relationship between that of early man ~~to~~ and my experiments have certain parallelisms. In order to replicate early man's stone implements one cannot but conceive his methods without regressing into time to ask ~~themselves~~ himself what did he do and how did he do it. The methods that I have used and the methods he would or did use may not be concurrent, but their counterparts may have certain amount of similarity. Before I ~~make~~ made my first <u>eolith</u> I began by striking a piece of flint-like material with a small cobble rock in order to remove usable flakes. The first results using direct free-hand percussion resulted in battering and bruising and ultimate shattering of my piece of flint. The core as such was not recognizable, the flakes lacked uniformity or style. However, several pieces in the shattered mess did have sharp cutting edges that could have been used for tools but not recognized as such by an archaeologist. When this repeated striking with a hammerstone was continued over a considerable period of time I would accidentally remove a good flake, then by studying the conditions that brought about its removal such as the correct amount of force, the vector of angle the blow was struck, the character of the point of impact, and the surface of the stone that made the dorsal side of the flake. One could then look for the same conditions to make a replica flake. These conditions must be firmly resolved in the mind of the stoneworker before he can graduate into a class of a good eolith maker. These first futile attempts in stoneworking did, however, produce flakes and cores even though any refinement was sorely lacking. Since these first embryonic efforts to remove a flake from a core some forty years ago certain inferences may be drawn regarding core types relative to mechanical laws relating to isotropic materials. The inherent nature of these materials cause definite patterns in flakes and cores. Upon appraisal these characteristics may be related to various techniques and these techniques corresponded to certain people in time and space.

Before one can discuss cores and flakes one must understand what is happening when force is directed against a mass of flint-like material. Making of cores, blades or tools may be compared to a game of chess, or checkers, and one must keep at least one move ahead of the flake to be removed and sometimes several. Allowing a flake to step or hinge fracture will ruin the core or artifact. In spite of the best of coordination, slight miscalculations, undetected flaws in the material, a crushed platform, the slightest angle change of either the artifact or the flaking implement and the improper dampening of force can cause failure. It is doubtful if there are any perfect examples of the more complex artifacts, even the classic examples of the Danish and the Egyptians show slight miscalculations of the workers. The human margin of error makes it almost impossible to fabricate a perfect stone artifact. This statement will probably raise a few eyebrows but minute examination of specimens will reveal minor flake scar distortions or insignificant step-fractures. The making of flint tools is not the manifestations of a long line of ancestors, but the result of each new generation trying to improve the product. With an experienced teacher, and an apt and interested student basic techniques can be learned in a short time.

The following is a list of technological points to follow in flake analysis:

1. Material identification
2. Texture of Material
3. Material altered by thermal treatment.
4. Relation of material to the flakes.
5. Amount of applied force
6. The kinds of applied force.

7. Methods of applying force, percussion, list of flintknapping techniques.

8. Throwing on anvil.

9. Striking on anvil.

10. Hammerstone, free-hand.

11. Hammerstone with rest.

12. Hammerstone with rest and clamp.

13. Hammerstone with rest, bipolar.

14. Hafted hammer free-hand.

15. Hafted hammer with rest.

16. Billets or rods, free-hand.

17. Billets with punch.

18. Billets with punch and rest.

19. Billets with punch, rest and clamp.

20. Hammerstone with punch, free-hand.

21. Hammerstone with punch and rest.

22. Hammerstone with punch rest and anvil.

23. Indirect hammer free-hand.

24. Indirect hammer and rest.

25. Indirect with fixed punch.

26. Pressure free-hand unhafted, pressure free-hand hafted.

27. Pressure with rest.

28. Pressure with fixed punch.

29. Pressure with rest and clamp.

30. Pressure with short crutch.

31. Pressure with long crutch.

32. Pressure, notched tool.

33. Pressure with lever and ~~full crutch~~ fulcrum.

34. Pressure, finger held.

35. Pressure on anvil.

36. Implement use to detach the flake.

37. Size and weight of flake.

38. Primary flakes, cortex, secondary flakes.

39. Flakes with pronounced undulations or waves.

40. Flakes with little or no waves.

41. The angle of the platform in relation to the longitudinal median axis.

42. The width of the platform surface.

43. The thickness of the platform surface or the distance from the dorsal edge to the ventral edge of the platform surface.

44. Types of platform preparation.

45. The use of the natural surface for the platform.

46. Platform with prepared facets.

47. The isolation of the platform.

48. The grinding of the plafform.

49. Polishing of the platform.

50. The absence of platforms on complete flakes.

51. The platforms crushed upon removal from the core.

52. The orientation of the platform with the longitudinal axis.

53. The depth of bulb of force.

54. The presence of the lip on the ventral side of the platform.

55. The absence of the lip on the ventral side of the platform.

56. The presence of the overhang left by the bulbar scar of the previous flake.

57. The absence of the bulbar overhang showing special platform preparation.

58. The flake with diffuse bulb of force.

59. A flake bearing sharp definition of truncated cone part.

60. The flake having no cone definition.

61. The flake bearing the negative bulb on the dorsal side and the positive ? bulb on the ventral side, the Chapeau de Gendarme.

62. The presence of the eraillure flake on the bulbar part of the flake.

63. The absence of the eraillure flake scar on the bulb.

64. The presence of the radiating fissures on the bulb of force.

65. The absence of fissures on the bulb of force.

66. The nature and occurrence of fissures on the lateral margins of the flake.

67. The terminations of the lateral margins on the flake.

68. The length of the flake.

69. The width of the flake.

70. The thickness of the flake.

71. The uniformity of the three dimensions, length, width and thickness.

72. The expansion and contraction of the flake from the point of applied force to termination.

73. The character and direction of the flake scars on the dorsal side of the flake.

74. The curve or straightness of the flake.

75. The flake termination by feathering.

76. Flake termination removing a greater mass at the distal end of the flake rapidly expanding as it leaves the core.

77. Flake truncation by ~~flaking~~ flexing.

78. Flake truncation by snapping.

79. The flake truncation by hinge fracture.

80. The flake truncation by step fracture.

81. The flake truncation by notching or special severing.

82. The intentional modification of the flakes.

83. The flakes bearing functional flake scars on lateral edges.

84. The flakes bearing ~~dull~~ dulled or ~~abraided~~ abraded lateral edges.

85. The flakes that show rhythms + consistency of patterns + techniques.

~~85. The flakes that show the rhythms and consistency of patterns & techniques.~~

1) Material Identification: The first step in the appraisal of flake assemblages is an evaluation of the material from which the flakes were made. Postulate the distance of the material from the source, what are its diagnostic qualities, how does it compare to materials from other well-known sources, how many varieties are represented in a site. The currence of material may be indicated by the unaltered outside surfaces found on the dorsal side of the primary flakes. The natural surface may denote bruising, abrading and cratering typical of alluvium. Natural surface can indicate that the material was quarried or natural breaks found in ledges, loess, all zones bearing the mold markings of a vesicular cavity. Organic replacements will indicate the material formed in sedimentary deposits. Concretions of flint will indicate the whereabouts of limestone and dolomite. These are but a few of the clues found on flakes that may indicate the currence and aid in locating the source. Detailed studies of material that were used in lithic industries hold much information regarding the movements of man through time and space, as each material bears impurities that are characteristic to that material alone. Such a study will ultimately aid in resolving the moving by man of these materials from their source to their final destination and their paths followed even though cultural tool forms are not in evidence. See materials paper.

2) Texture of Material: The texture of the material is a most important con-

sideration when one is determining the quality of the [redacted] modes of manufacturing. The quality of the artifacts cannot exceed the quality of the material, regardless of the knappers skill. The materials range from the glassy to the granulose and the more granular varieties can result [redacted] in only inferior types of flakes and artifacts. The [redacted] techniques must be adapted to the materials fine definition of flake attributes are usually erased in the coarse-grained rocks. The platforms crush more easily and the flakes or blades will collapse before they terminate at the distal end of the core. The flakes haven't the resistance to end shock and a greater amount of applied force is necessary to remove them from the core. The use of direct percussion with a hard hammerstone to concentrate the connetic? energy to a confined area is usually necessary to fracture the coarse-grained materials. The more vitreous the material the greater the control, the [redacted] sharper the cutting edge. A decreased amount of force is required to remove a flake of equal area compared to the granular material. Vitreous material has elastic qualities not found in the granulose rocks allowing the flakes to bend without breaking. I [redacted] do not intend to [redacted] imply that coarse-grained materials are not important to the economy of many ethnic groups, for they did play an important part. Sometimes they were even preferred to [redacted] some of the more vitreous rocks because the flakes struck from the coarse texture rocks were most useable for certain functional needs. Such flakes serve admirably for sawing, [redacted] carving, forming materials of wood, bone, antler shell [redacted] and soft stone. These materials may be severed and shaped with surprising and astonishing speed not found with coarse-grained materials which is not when using a tool made of the more vitreous materials. A simple field test should be done by actually flaking questionable material before any final decisions are made regarding the workability of a particular mineral.

3) Material altered by thermal treatment: Certain siliceous materials will respond to an artificial vitrification by the application of heat. The change occurs upon the temperature being slowly raised to around four or five hundred degrees. There was a former paper by Crabtree and Butler in *Tebiwa* that this was slight in error. The material will withstand considerably more heat than this but the change actually starts taking place above noted temperatures. Material is then slowly cooled, different materials require different temperatures to effect the alteration. All materials do not respond to the same heat. The alterations of these materials is an exacting practice requiring a thorough knowledge of the material being altered (Crabtree and Butler, *Tebiwa*, Vol. 7, 1964). In order to determine if the flakes has been altered one must examine the flake very careful before a final judgement. After heating the surface of the material remains unchanged and one must remove a test flake from the mass to determine the alterations. In order to be positive thermal treatment was practiced a flake of suspected material must be found which bears a flake scar on the exterior surface, the dorsal side

that still retains materials or original texture prior to heating. The ventral side of the flake or flakes removed from the piece of altered material will have the distinctive lusterous character pertinent to thermal treatment which is not present on the original surface. Should a flake be detached after all the surface of the treated core has been removed, then it will be lusterous on both dorsal and ventral surfaces. A flake such as this is not reliable but only suspect as there are few materials that have natural vitreous luster, however, they are limited. Occasionally, abandoned heat-treated flakes will be noted which will still retain their original luster, but occasionally close examination will reveal small flake scars on their margins which show the change of luster. The small flake scars may be the result of the aboriginal testing the material to see if the heat application was sufficient. A simple field test is accomplished by removing a small flake and then examining the scar to determine the difference in texture. If the material is heated over a long period of time, the trace minerals will be subject to oxidation causing yellows to become red and other color changes depending on what mineral impurities were present in the material being heated. Flakes will be observed which have been overheated resulting in crazing, potlidding, and occasionally complete disintegration. These are relative infrequent considering the exact control necessary to preform this alteration.

4) Relation of material to flakes: The character of the flake has a direct relationship to the material being used very glassy rocks and well defined

attributes and characteristics that greatly assist in flake analysis. Each feature is quite obvious. These features are not readily found in the more granular materials. The knapper must make the techniques to suit the material and the tools used to remove the flakes must also conform with the materials. Flakes made from tough granular to naceous? materials naturally require a greater amount of applied force than the vitreous material and, therefore, the impact area must be of sufficient size to withstand the additional force necessary to dislodge the flake. The platform on the proximal ends of the flakes will be larger when simple direct percussion is applied with a hard hammerstone. Normally, upon using the coarse textured materials there is not the careful platform preparation which is applied to the vitreous rocks. The freeing or isolation of the platform in the granular rocks reduces the amount of material that will receive the force and increases the chance of its collapse. No amount of skill can transform a granular textured material into the refined artifact which can be made from vitreous material, but the lack of skill can reduce high quality material to an inferior artifact.

5) <u>Amount of applied force</u>: The amount of applied force may be related to the area measured on the ventral side of the flake, or the flake scar itself. The amount of the force is also contingent to the type of material being fractured. The more granulose the material the greater the amount of force required to dislodge the flake. The amount of force must be carefully controlled and the mind