COMMENTS ON LITHIC TECHNOLOGY AND EXPERIMENTAL ARCHAEOLOGY

Stone tools are now known to exist for more than two million years, ~~they being~~ the most enduring non-perishiable artifacts representing extinct cultural societies. Only within the last ten thousand years, less than one percent of human history are we able to resort to a more reliable source than ~~to media other than~~ stone artifacts for ~~in~~ an interpretation of the living habits of man. Today in only a very few remote places in the world are stone tools are still in use, and these societies ~~they~~ too will soon probably ~~be~~ replace their stone tools for the ~~in a very few years by~~ a more versatile metal counterpart. ~~It is~~ For this reason, it is imperitive that any information past or present be recorded, regarding the manufacturing and use of stone implements. It is unfortunate that existing stone age societies generally lack the mfg. sophistication of some of the lithic industries represented by those of prehistory ~~greater age~~. The most dependable ~~only recourse of an~~ interpretation of the lithic tool traditions is by an experimental archaeological approach. Experimental archaeology must be related and compared to definite aboriginal concepts of a particular technology or clusters of techniques & then used to replicate the stages of manufacture from the preforming to ~~it's inception till~~ completion. Throughout the stone age, man made his ~~the history of mans endevors in making~~ stone artifacts, ~~the lithic materials were modified into usable tools by detaching flakes by the application of force~~ by applying force to various lithic materials to detach flakes from the mass & ultimate shape & form a functional tool. The flake or blade (specialized flake) bears the positive features, while the flake scar on the core has the features of the negative characteristics. Both the flake and the core may be formed into more complex tools by the removal of additional flakes ~~their being upon completion~~ when completed these are flake and core tools. To a casual ~~causual~~ observer flakes and their counterparts may look much ~~the same other than their~~ other than by noting their varying dimentions, ~~but~~ in reality flakes & flake scars they may be compared to fingerprints rather than the shape or tips of fingers. Flakes detached by the same technique all have minor differences and each will only make perfect contact with it's original flake scar. However, a change of technique will usually show major differences in characteristics of the flake and scar.

Rather than burden ~~all of those interested in~~ the flake analyst ~~analysis~~ with lengthy ~~long~~ cumbersome attribute lists at this time, I would like to call attention

Ce. 81.13.15(5)

to some of the problems of flake analysis and interpretation ~~resulting from~~ from the manufacture of stone implements. The flake or blade character is influenced by, the material, the implements used for applying force, the techniques ~~used~~, the thermal alteration of the lithic material and the ~~varying~~ skills of ~~human endever~~. ~~Flake and the corespomding flake scar is the result of applied force in order to induce fracture.~~ Flakes and flake scars ~~bear~~ features ~~usefull for~~ the interpretation of aboriginal manufacturing processes. ~~Experiments in ##~~ replicationof prehistoric stone artifacts has been usefull for a better understanding of the subttle features and characteristics of flakes and scars resulting from stone tool industries. Because stone tools have an almost universial distribution covering a vast time span and represent independent developements of multitudes of techniques, it ~~will be highly #####~~ improbable that all aboriginal ~~techniques of~~ flake and blade-making will ever be fully understood. However as the science of ~~archaeology~~ progresses ~~be able to make~~ assosiations of the same, or parallel techniques ~~that ##~~ have features and characteristics, ~~in common~~. ~~It is not to say that ####~~ ~~there is al~~ways a diredt connection between extinct societies ~~and~~ no doubt inumerable independent techniques were developed and some outright inventions ~~that~~ have no parallel. Specifio flake styles are possible by using diverse approaches to bbtainresults that are similar. Many factors ~~are~~ to be considered. One ~~must~~ evaluate the vast differences in lithic materials, for ~~ex~~ example, volcanic glass, known geologically as Obsidian , ~~having~~ a glassy luster and a chonchoidal fracture , yet as a ~~lithic~~ material ~~it has a wide range of variations of~~ workability and the tools and blades must conform with the material. There are differences in ~~the~~ elastic qualities , mineral constituents, differences in the geological age and formation can and do influence the workability of the material. impurities, inherent stresses and strains, temperatures of solifification, flow structures , gas bubbles, and the size of the material ~~have much bearing on~~ the outcome of ## the end product, ~~wether it be used for~~ flakes, blades , or ~~compound~~ flaked implements. Predominantly siliceous rocks like quartzites, flint, chert for example Obsidian as described Geologically as a Volcanic glass with a vitreous luster, black and fractures conchoidally and used aboriginally for tools.

and endless varieties of chalcedonies are even more highly variable. The worker must either modify or develop techniques that conform with the material being worked. For instance, a whole different cluster of methods and forces would have to be used on quartzites and basalts after becomming accustomedto working with a more vitrious rock like opal, ## obsidian or heated silicious material. Often the lithic material available was in limited quanity, quality, size, and variety,, which has a direct bearing on the endevors of the stoneworker. Over large geographical areas, the ideal lithic material was far from commonplace and often it was obtained from considerable distance. Discriminating stone workers, able to select from a variety of materials made the material conform with tool design intended to preform a specific function. Tools subjected repeted impact hard rigorous treatment, will have a longer lifespan if made from material that is sesistant to shock, while tools needed with a keen edge are selected to be made from a highly vitreous material. For instance certain obsidians are selected for manufacturing pressure blades because of superior elastic qualities and others not so as desireable for blademaking are satiffactory for other multiple flaked artifacts. As with iron used in ##### modern industry in its many and varied formulas, silica too used in ancient times was compounded and blended by nature, each silicious rock having certain qualities, some desireable and some undesireable. Also as with some ## metals, silicious rocks may be altered by the intentional application of heat. At some early period of time, man found that internal stresses and strains inherent in the rock could be ######## relieved, making the material more homogeneous, changeing its ###### texture from course to one of vitriousness thus ###### improveing the flaking qualities and the sharpness of the flake edge. Often ### upon being heated the material undergoes a color change, due no doubt to contained impurities, they being greater near the exterior of the heated lithic material. Uponehating the exterior or exposed surface does not change texture and only upon removal of a flake exposing a new surface can the texture change be noted.

Often in a collection or excavation we will find ~~the dorsal side of~~ an aboriginal flake & note on the dorsal side ~~will bear~~ a portion of the natural surface which does not alter ~~prior to heating~~ but the ventral side will be lustrous in contrasting with the dorsal side & then we can be assume with some authority -controlled alteration ~~and will show the contrast of textures on the ventral side~~. Also when ~~upon~~ examining flaked artifacts such as projectile points there may be a facet of the natural surface still unflaked which ~~that~~ will provide definite evidence of the aboriginal use of heat treatment. If such evidence is not obvious then one must resort to an experimental approach ~~, conducting~~ a controled heating process on the same material ~~laboratory testing~~ to assertain if the material has been altered.

Heat treatment of lithic materials is a sophisticated process, involving critical temperatures, correct duration of gradual maintaining ~~of time in maintaining~~ heat exposure, controlled cooling process ~~time of gradual heating and cooling~~, calculation of time & temp according the size of the material being altered, and allowance for the differences of materials. Until one is familiar with stone each material must be tested individually. When the correct formula has been determined for a given material, then Any deviation in control will render the material either unchanged or worthless when ~~upon exceeding critical~~ temperatures are exceeded or by ~~and drastic temperature differentials~~ rising & lowering of temps. The temperature range for ~~when~~ altering silicious minerals ~~is a lower annealing temperature of between~~ will vary from 450F to 1000F & only the trial & error method will determine the ideal temp. range. ~~450 F. to 1000 F. while~~ Basalts and obsidians respond to a much higher temperature without danger of crazing, and ~~too~~ they will withstand more rapid temperature changes than ~~will the~~ silicious rocks. One archaeological example of the use of heat treatment are ~~is the~~ Hopewell cores and blades ~~of Hopewell origin,~~ made from Flintridge, Ohio material ~~material~~. Analysis reveals that most of these are made of treated flint.

Material studies have shown that diagnostic characteristics of flakes and flake scars are influenced by the nature of the material. Inferior materials can only produce inferior tools, even tho the worker may have great skill.

The percussors & compressors used ~~to detach~~ form the stone tool ~~The tools and fabricators for detaching flakes~~ also influence the character of the detached flakes & scars and the toolmaker selects his fabricator ~~and are selected~~ to perform a specific technique or a group of related techniques. There are three major classes of flake detachment, Direct percussion, Indirect percussion and pressure. A minor technique is the combined use of ~~that of using a combination of~~ Pressure and percussion ~~and more experiment is in order.~~ ~~##########~~ Flake detachment techniques involve a knowledge ~~study~~ of Elastic limits of the material, Newton's Laws of Motion, Force, Gravity, Weight, Mass, Density, Friction, Levers, Moment of Force

,Center of Gravity, Stability of Bodies, Projectile Motion and Kinitic Energy. It is indeed a comprehensive list of factors that are mentally evaluated and ratioed in order to accomplish the controlled fracture of lithic materials. It is highly unlikely that man in his early phylogony was aware of these laws of science, but as his techniques became more sophisticated, the principals were well understood and taken advantage of.

Direct percussion: The earliest stone tools were probably products of nature, selected for their sharp cutting edges or sphereoids used as hammers of missels. Direct percussion was probably man's first approach in using intentional fracture to form tools and expose useful cutting edges. Direct percussion encompasses an unknown variety of percussion tools and techniques for using the percussors. One of the simplest is one described by Richard Gould of the Austrailians throwing the lithic material against boulders and then selecting usable flakes to be further modified or used as is. The technique is often called the Block on Block technique using a fixed anvilstone. This technique when further refined will lead to other related techniques. Considerably more control is gained when the lithic material is held in the hand and then struck on an anvilstone, the point of ## contact can then be predetermined ############ by the worker. The fixed percussor technique affords the worker more accuracy, and the degree of velocity can be adjusted and proportional to the dimention of the intended fracture and the weight of the material being flaked. Still better control of the flake or blade design may be improved by specially designing the part contacted by the fixed percussor, This point of contact is known as the Platform. There are many methods of platform preparation that have diagnostic value and influence the character of the flake or blade. A few examples of platform preparations are as follows : making the proper angle on a plane surface, isolating the platform surface, removeing the overhang from previous flake scars, grinding the surface, polishing the margin, faceting by the removal of one or more flakes and the orientation of the platform with guiding ridge or ridges.