AN INTERPRETATION OF THE LITHIC INDUSTRIES

During the past 36 years, I have attempted to duplicate the flint artifacts of the primitive peoples of the earth. A study of these past masters leaves only a feeling of the greatest of admiration for them. It is hoped that my pursuits of these past artisans can establish more definitely a cultural standing of these many different groups, who used stone prior to metal. In their work, cultural as well as individual characteristics are shown, even to whether the person fabricating the implement was right or left handed.

I will attempt to give a summary of my experiences in the treatment of flint and other stones.

As a boy, I visited the Indian caves and camp sites in search of arrow-points and artifacts. No doubt, hundreds of boys are still searching for such relics today. Some of the pieces found were damaged and broken, and I tried to repoint and renotch them. The result was only a cut hand or a specimen more badly damaged than before. It was a challenge that I haven't given up yet. Today I feel that I have duplicated shapes and flaking in replica of general world types. Still one finds a few pieces that may have been the only one the flint worker manufactured or the only one the Archaeologist has as yet found.

One often hears of the thermal method of fracturing stones for arrowpoints. I have attempted every method known to produce such a result and have yet to see anything that even closely resembles an artifact. The fact that the flint contains an excess of water causes it to fracture and fire check when heat is applied directly, thereby causing the stone to be worthless for the manufacture of tools. I do find that when placing a medium sized piece of stone about nine inches in the earth under a household fire, and leaving the stone there for about ten days to cool gradually after the fire has been extinguished, that the re-touch or pressure work is thereby made much easier. This process changes the molecular structure and reduces the micro crystals in size, giving the stone greater flexibility. I believe most of the fine re-touch and ripple flaking of flint was accomplished after such treatment. But I have yet to see a point, which gives any evidence of having been actually shaped by the so called method of thermal fracturing. The fact that a point can be produced in from three to five minutes from the pressure or percussion method, certainly disproves the long drawn out so-called heat fracture method.

After giving up the thermal method of shaping I had better results pounding on the flint with a hammer or other rocks in the Indian fashion. Out of a box full of flint pieces, I would perhaps get a couple of flakes that were triangulate in shape. Then, by using a nail, I could take off a few short broad flakes. The result would be something that would resemble in shape alone an Indian arrowhead. Occassionally an accident would happen and I would get a long flake going to the center of the stone--more cut hands and blistered fingers as well as much consternation as to what actually happened and why. After a number of years at this, I was able to produce a reasonable facsimile of some of the Eastern points - - little more than pointed rocks, but with most of the original surface removed. These were still thick and clumsy compared with some of the beautiful obsidian points made by the Indian. I would then compare my work with theirs and try different methods of holding - using a vise, holding in the hand, placing on a rest, and placing on an anvil and striking with another stone.

It was during this time and a result of the above experiments, that I learned something of the fracture of flint. I believed I had finally solved the objective - not to try only to make an arrowpoint in shape, but to make the type of flaking that suits the need. This brought me to the thinning problem. For I found that one must bring off the flake in the center and then pick it up from the other side. However, thinning will be taken up later.

I started with the percussion work, as this did not take quite the same amount of physical effort. First the instrument. It had to be a tool with resiliency, as my previously used steel hammer had crushed and shattered the stone causing stress lines which resulted in the stone breaking in the least expected and most undesired spots. I tried many materials - steel, iron, brass, lead, stone, horn and wood. I found that stone horn and wood were the most effective.

The stone percussion instrument must be in accordance with the nodule being cleaved or the artifact being worked on - in other words, your instrument should be in proportion to the size of the material. The working stone must be of a hard sandstone, granite, basalt without vesicles, i.e. a stone without a cleavage plane. If the stone is too hard, it will break and shatter, cutting the hand of the operator. Certain types of wood may be used on obsidian and very fine grained flints. When wood is used, there is almost no shattering of the stone, and if the platforms are carefully prepared it is very desirable for thinning and shaping.

Deer or Elk antler (not Buffalo horn) is perhaps the best all-around material for both percussion and pressure work. It has just the proper resiliency to carry a long flake without shock and will not crush the platform before the flake is removed. The platform will slightly imbed itself into the horn and the weight of the tool and the inertia will detach the flake without destroying the artifact. There is much to be said about the method of striking a blow and the accuracy one must develop.

The material used in arrowpoints is of prime importance. To the primitive man, choice material was probably their most cherished possession, in fact it was life,itself. This is proved by the known fact that obsidian was transported from the Rocky Mountains and Mexico to the upper Mississippi Valley. It is a fact that material of choice quality has been transported hundreds of miles from the original quarry site. Good material is indeed hard to find. Almost no two materials work exactly alike, but the same principle is always used. The difference is noted in the flexibility of the stone and the amount of force needed to detach the spall or flake. There is indeed a wide variation. The variation - exempting flaws and imperfections - is caused by the crystallization. As an example, opal and glass to granite and quartsite. The larger the crystal structure, the less the flexibility and the easier the stone will crumble under force.

As far as I have been able to determine, freshly mined flint and surface flint do not vary in workability. Some flints weather and check on exposure, that is if they are in large pieces and he changes of temperature cause stresses and strains to be set up in them which makes large blocks of surface material unsuitable for the manufacture of large blades. Small flakes found on the surface work just as well as freshly mined stone.

There is a great deal of work to be done on the variations of flints as to texture structure and workability. Most are almost pure silica, and a very small amount of foreign material will change the crystalline structure.

It is difficult to say which material is most desirable. It depends entirely on what type of artifact is to be made. Obsidian, opal and the very glassy lustrous flint will produce the best cutting edge but they do not have the toughness of stone with a satiny or more granular surface. When making a drill or scraper, toughness is required; while the cutting edge is of prime importance in making prismatic knives.

THERMAL TREATMENT USED IN PREPARING STONES FOR WORKING

I use a heat treatment in preparing many flints for percussion or pressure work. I have used this phase of treatment for certain flints for the past several years. In my study of the North American primitive, the use of the thermal treatment of stone was quite widespread, going back as far as Folsom man. The purpose of this is to alter the crystalline structure of the stone into a less crystalline material. The stone then requires less pressure and has more flexibility for manual work. - for example in making ripple flaking (knives etc) and prismatic flaking (Folsom). I use a sand bath for a slow heat over a period of a week or two. The temperature used is about 400 degrees. Stones placed under a household fire with an inch or two of earth or sand separating - depending on the nature of the material - will suffice. This method probably gives rise to the common fallacy of heating and dropping water on the stone to produce an arrowpoint. No doubt there is some reason for such a wide spread belief, just the lack of close observation of the complete procedure used in the manufacturing of the artifacts.

In the past a great deal of work has been done on the shape of artifacts and almost nothing on the method of removing the desired type of flakes in relation to the piece of working material.

When one masters the art of flaking and can produce a flake of desired size, shape and thickness, he can then reproduce,at will, any chipped flint artifact.

For example - if one has a large nodule of flint, the first procedure is to cleave the stone to establish a working platform, for if the stone is left round, it is impossible to remove flakes. One must use the correct weight of tool in relation to the size of nodule (see notes on tools) to prevent bruising a fine nodule. Just striking the stone with disregard to angle and weight of hammer stone may make the working material entirely useless. ONE BLOW AT THE PROPER ANGLE WILL CLEVE THE STONE. Repeated blows with the wrong kind of hammer weight and material will ruin it. To compare, imagine a diamond clever using and ordinary hammer and placing the stone on an anvil, hoping the stone will break exactly where he wishes.

He, instead, must use a definite formula - studying flaws, inclusions and s trength, to produce a perfect break. This also applies to flint. AN ANVIL CANNOT BE USED, as one will get a compression rather than a clevage effect. The anvil method gives two sources of force. It is difficult enough to control one as well as establishing stresses and strains and producing a shattering effect.

The force applied must be a follow through - more of a pushing motion, not a rebounding blow. If the tool rebounds, the tool was either too light or was held at an improper angle. The proper angle is at about a 45 degree angle. One should examine the stone carefully for pits or flats to use as a platform for the initial break. The stone may be supported in the hand, on the fleshy part of the leg, top side of the thigh, or placed on soft ground and one end held by the foot. The support should be at the center-held at the opposite end and the blow is struck similar to breaking a stick of wood across the knee. This cleved or quartered may be used in the flake method of manufacturing tools, projectile points, knives, scrapers, drills, etc.

When there is a shortage of material and a large tool is desired such as a ceremonial blade or ax, the core method is used. There is no way of telling whether the flake or core method was used when examining the primitive artifacts. My method of core flaking is fillustrated below.

The flake method is very much the same except instead of thinning a core, the flake may be detached to make it the proper thickness.

The principle used here is to remove irregularities and to straighten the flake, for example: There are no two flakes exactly alike. No set rule can apply, but each in itself is a definite mechanical problem with its own solution. Certain forces, stresses and strains bring various results and for each there is a reason. The secret of flint working is to produce the right kind of problem and to get the right answer.

After a blade is worked out by percussion, if so desired, it can be retouched by pressure. This method is used on final retouch for large blades and entirely on small projectile points, drills, etc. - excepting the removal of the flake from the nodule. All the principles used in the percussion work are applied here only on a smaller scale with more precision and accuracy, as well as longer and more regular flakes being removed resulting in a sharper and more regular blade. The notching would also be more difficult with a hammer stone. Again it is to produce the type of flake desired for the work - proper thickness, width and length. Of prime importance is the working tool. One of proper resilliency, such as copper, bone or horn. A working tool which is too hard will slip. It must, therefore, be soft enough for the stone to imbed itself in to prevent slipping.

The next step is the platform. By the use of the platform, the angle is controlled to a degree and also a proper seat for the tool is established. The thickness of the flake depends on the position of the tool on the platform. Therefore, the platform must be made the proper width and bredth to prevent crushing. If a long thin flake is desired, the proportions of the amount of stone to be removed and the thinness of the edge will not withstand the pressure needed to detach the flake desired so the platform is polished to prevent crushing. The width is proportional to the pressure and the point of application of the pressure.

In the principle of flint working, the Hopwellian flake knife industry is in many ways similar to the fluting of the folsom point. The same method could be employed were it not for the stickler that when a core is reduced in size, the flake will sever the core in two pieces. For example, to remove the long slender ribbons of flint from a nucli, one must develop the sense of touch or muscular control. The pressure downward must be proportional to the outward pressure. The outward pressure must be considerably less than the downward pressure. One of the characteristics of flint is the concoidal fracture. It is this characteristic we must attempt to get away from. We must attempt to control this characteristic. Pressure or percussion at a point results in a cone. The concoidal flake is but half a cone. The uppermost portion is called a bulb of percussion or a pressure point. The natural result of a blow upon the edge of the flint is a concoidal fracture. It is this natural mechanical tendancy that we must attempt to overcome. A flake removed by a blow has a heavy bulb with the undulating ripples radiating from the point of impact. We find, that with pressure, these undulations are decidedly less. I have found that these may be controlled by the right application of pressure. My contention is that flints and obsidians are resillient and have a flexibility to the nth degree. I can demonstrate and show examples of this.

The rippling or undulations do not occur in a very thick flake to any great degree except at the very distle end of the flake. For each ripple there is a vibration or a springing of the flake as it is removed. They can be made with the ripples by using too much outward pressure without enough downward pressure. Another principle is the follow thru, not unlike the swing of a golf club. As the outward pressure starts a crack, one follows with downward pressure to remove the long narrow flake. This is very difficult to explain, but after one works flint manually for a time he develops the feel of the parting of the platform from the core and follows thru. I had an assistant who watched my application of pressure on a piece of black obsidian and he could observe the crack follow through ahead of the flake. In cutting glass, after it is scored, one may see the crack follow thru. This is also similar to cutting a groove in a piece of wood, inserting a wedge, and then striking the blow on the wedge. You will observe that the crack follows ahead of the wedge. By using this principle, a flake can be removed many times the area by the use of the pulling and pushing, rather than by just pushing.

Another phase of flint fracture is the striking of a heavy nodule of flint or obsidian with an iron hammer. The cone has the undulations traveling around its circumfrance. For example - the stone is compressed at the point of impact, the major mass remaining in place, leaving the undulating rings around the cone. This characteristic is true with nearly all semi-plastics.

In the manufacture of stone artifacts, it is not entirely feel, touch or even patience, but definite mechanical formulas for the proper fractures and their control. There is a different formula for each and every flint working technique.

The glassmaker of the past melted sand and ash and hoped for the best results. The modern manufacturer of fine optical glass consults his chemists for definite complex formulas. So must we classify our earliest contemporaries in relation to their knowledge and accuracy of their flint-working formulas. Some were hit-or-miss, some were past masters of the flint-working industry. We must give them their step on the ladder of culture - not from our theories - but an interpretation of their formulas.

The secret of working flint by either pressure or percussion is to obtain the type of flake desired for the particular phase of work being done. To do this, the pressure controls the size of the flake. The surface of the piece, the shape are also controlled, And the platform and the thickness of the flake.

Properties of flint pertaining to the lithic industries are as follows: A non-plastic perfect elastic. Flexibility directly proportioned to the size of the micro crystals making up the homogeneous mass. Heat treatment increases flexibility by reducing in size the crystals which make up the stone.