COMMENTS ON USING THE LOW OR OBTUSE ANGLE OF STONE TOOLS AS A CUTTING EDGE

The interpretation of the diverse functional uses of stone tools has long been a theoritical enigma. What materials was ancient man forming, altering or modifying with his stone tools and at what angle did he hold the working tool. Were they held just in the hand when performing these tasks or were they affixed to a handle or holding devise, adhered to other ~~materils~~ materials, or lashed to stocks and shafts? Many stone artifacts have been placed in typological categories which imply function. Some are correctly typed because of actual observation and ethnographic accounts. Other functions are based on theory which places like implements bearing certain technological characteristics into useful typological categories. As a result, artifacts not conforming with these categories are said to be non-diagnostic and are often discarded as debitage and lithic debris, flakes, exhausted cores and general manufacturing by-products.

The use of the obtuse angles on artifacts as a working edge has generally been overlooked or ignored. Recent functional experiments indicate these low angles provide additional diagnostic traits. Careful study of the obtuse edge on artifacts may reveal functional scars and wear patterns. We know from experiment and archaeological evidence that the acute angle on a flake or blade is a very adequate cutting edge for yielding materials, but have failed to consider the functional value of the obtuse angles of more than ninety degrees and less than one hundred and thirty degress.

Functional experiment reveals that the obtuse angle on stone tools can perform tasks impossible to complete with stone tools having edges of ninety degrees or less. The innovation of functionally using the obtuse angle has been a revealing experience and has opened the door to further experiments to understanding the diverse function of stone artifacts.

Experimental results show that the obtuse angle on stone tools made of material as fragile as obsidian can be used to remove spiral shavings with accuracy and control from dry bone and the tool will still retain its cutting edge. The use of the obtuse angle on stone tools provides a clue to the elaborate carving of lintles of extremely hard wood (sapodillia) used in temple construction by the Maya in the Yucatan. Using the obtuse angle of the stone tool may well explain the modification of such resistant materials as bone, horn, antler and ivory. When the acute edge is used to form this type of resistant material, the tool will break or the edge will dull before the task is completed.

Problems developed during the functional experiments regarding the effective and efficient use of the obtuse angle as a cutting edge and were only resolved by replicating the prehistoric cutting implements and then experimenting with diverse functional techniques. After comparing the results of functional abuse on the replica with the original artifact, the edges were checked for similarities of wear patterns and compared with those found on aboriginal tools. It is imperative that the experimenter have his replica with a fresh edge and duplicate angle as the genuine tool and, after the functional experiment, the replica should bear the same striations, the same degree of polish and the same use flake scars as the aboriginal artifact.

It is necessary to functional experiments that the worker use the same materials for modification as those available aboriginally, whether they are being gouged, planed or chopped. Some implements having acute angle edges - like the obsidian blade - require light force for cutting soft materials and the thumb and index finger furnish sufficient force for light cutting tasks. But when the obtuse angles of tools are used for cutting, more force is required - much the same principle as our modern tools. Different materials react differently - a low angle can be used to erk softer materials while a steeper angle is used to work more resistant material. Any functional experiment must consider the brittle nature of the stone tool. They cannot be twisted, used in a levering way, and one must be familiar with their strong and weak areas. The stone tool must be kept in alignment with the opposing resistance of the material being worked. Skill in using any hand tool requires practice and reason which demands continued experiment. Even after the experiments yield good results, they may not compare to the work of a skilled aborignal workman.

One use of the obtuse angle as a cutting edge is the blade scar ridges on a polyhedral core. These parallel blade scars are slightly concave between the ridges, leaving the ridges as a very ~~fine~~ SATISFACTORY low angle working edge. The core is used as one would use a draw plane - holding the proximal and distal ends of the core with the right and left hands. Whereas the draw plane can only be drawn toward the user, the low angles on the polyhedral core can be used as a plane in both a forward and backward motion. The polyhedral core is drawn at a slight angle rather than at right angles as one would use a plane. When used in this fashion, the depth of the cut may be accurately adjusted by a slight change of angle of the bearing surface. The obtuse angle of the cutting edge is far stronger than a ninety degree edge. It is astounding how a material as fragile as obsidian can possibly remove spiral shavings on dry bone, but such is the case. When soaked antler is worked, shavings three inches long may be removed with a single pass of the core. I know of no single edged metal tool which will remove material with the speed and rapidity of the obsidian core tool. The cuts are very clean and smooth with no bruising of the surface being planed. When the core planer is used on very hard wood, the finish is excellent and the core can be used to make surfaces flat. Surpising, too, is the durâbility of the edge. Use flake scars are usually due to holding the tool at the wrong angle or contamination of the material being planed rather than from function. When the low angle of the core is used repeatedly on resinous wood, resin will build up and impare the cutting action. Then the resin must be scraped off or removed with solvent or a new blade detached from the core to expose two new sharp cutting edges. Or the entire polyhedral core can be rejuvenated by removing a series of blades around the perimeter to expose new low angle cutting edges.

The surprising and excellent results of using the low angles of a core as a shaping and forming tool for antler, hard wood and bone prompted me to look for similar angles on other artifacts for cutting experiments. Similar experiments with both burin blades and cores resulted in only moderate success. Using the ~~core~~ burin core in the manner of an engraving tool resulted in the core slipping and its corners breaking after a few passes - generally when the tip was lifted upward to terminate the cutting action. After a minimum amount of work on hard material, the right angle edges of the burin core would crush due to micro step flake scars forming on the margin causing the edges to crush. However, if the burin blade was removed at more or less than a 90° angle to the margin of the core, both acute and obtuse angles were formed on the core's edge. The acute angle was excellent for working soft woods and the obtuse angle was good for forming more resistant materials. Failure to adequately use an angle of 90° or less is probably due to a lack of understanding of the proper use of the many prehistoric styles of burins.

The natural facets on quartz crustals can also be used as forming tools but are not as efficient or effective as the artifically made obtuse angles on cores and other tools. The natural facets on the crystal are plane surfaces, while those made by removing a blade or flake from a core leave concave surfaces between the obtuse angles giving a sharper cutting edge. If the crystal is made into a blade core by removing blades longitudinally, the obtuse angles of the blade scars are a far more efficient cutting tool than the natural facets. However, a quartz crystal from Bandarawela Celon showing bruises on the natural obtuse angles may well be the result of function. (Illustrated in "The Stone Tipped Arrow", Bridget Allchin, Fig. 30, No. 34, Barnes & Noble, New York, 1966)

Another functional experiment was the use of a strangulated blade. Archaeological specimens from the El Inga site in

Eucador were brought by Carl Phagan to the 1970 Lithic Technology field school. We made replicas of the originals from obsidian. Archaeologically, the strangulated blade has been functionally categorized as a spokeshave. We attempted to use it in the manner of a modern spokeshave by placing the concavity of the blade on a wooden shaft and pulling the ventral side of the blade toward the worker. This removed only a slight amount of wood and left a very irregular cut on the shaft. If additional pressure was applied to the blade, it would break. We then noticed striations on the ventral side of the El Inga specimen between the two opposing concavities which comprised the strangulation. These striations gave us a clue to the manner in which the implement was held and used. The striations indicated that the slightly convex ventral side of the blade was placed flat on the wooden shaft being shaped. The convex surface acted as a bearing and aided the adjustment of the depth of the cut being made. When we used the strangulated blade in this manner, it made a flat smooth cut and required little force to remove a clean shaving. Both concavities serve well as cutting surfaces. The opposite concavity on the blade permitted the worker to tilt back the blade to terminate the cut. When used in this manner, the blade did not break because little force was necessary to remove shavings from the material being formed.

Further functional experiments with the strangulated blade showed that the angle of the cutting edge of the blade could be made acute for soft materials or obtuse for cutting harder materials. But if the cutting edge is too acute or is used improperly, use flakes were removed from the ventral side of the blade rather than the concave portion of the strangulation.

Many tools other than blades exhibit a low angle which are simple and rapid to made or resharpen. Often by a simple removal of a single flake a new working edge is exposed. It is possible to mismnterpret this single sharpening flake as a tool whereas it is only a reconditioning or resharpening flake.

Other aboriginal artifacts have been noted which exhibit the use of the obtuse or low angle to perform various functional tasks.

I had the good fortune to examine a number of obsidian polyhedral cores collected in a preliminary survey in Guatamela at Papalhuapa site by Dr. Robert Heizer. This site, when excavated, should contribute much new and exciting information about technology and general stoneworking and show all stages of blademaking since the raw material was in the near proximity. The cores from this site showed multiple use features other than a source of blades. The blade scars on the cores were dulled which indicated they could possibly have been used as ~~possible~~ planes, wedges, reamers, drills, anvils, pointed percussors for making soft stone figures and some could have been sectioned to be used as preforms for ear plugs. A preliminary report has been published of this site by John A. Graham and Robert F. Heizer, "Notes on the Papalhuapa Site", Guatemala, 1968, Contributions of the University of California Archaeological Research Facility, Papers on Mesoamerican Archaeology, University of California, Berkeley.

Through the courtesy of Dr. Junius Bird I was given a collection of six obsidian polyhedral cores from Oaxaca, Mexico 1970 and all cores showed signs of function[illegible] on the ridges of the blade scars.

Obsidian polyhedral cores from the Metro excavations in Mexico, D.F. were shown to me by Dr. Jose Louise Lorenzo in 1970. Again, the cores showed apparent use of blade scar ridges, including one core showing that the distal end was used as a drill until the core had become completely cylindrical.

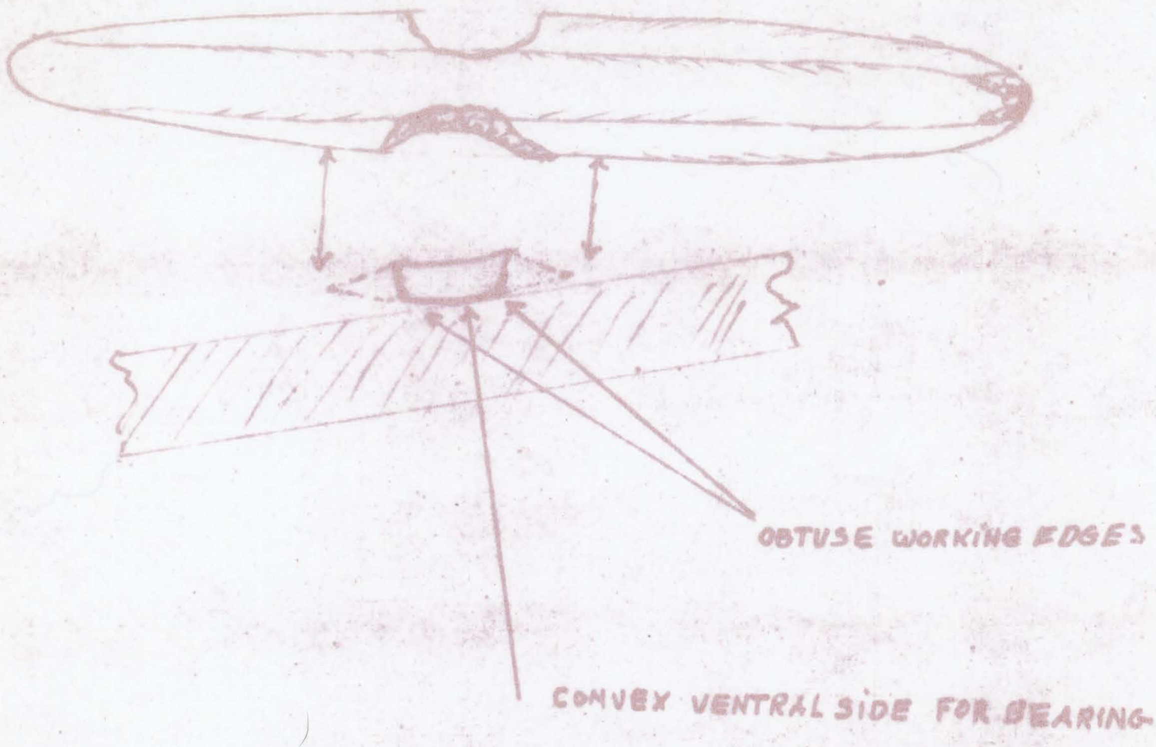
Through personal communication with Dr. Denise de Sonneville Bordes (1970) I learned that she has noted evidence of functional scars on the dorsal ridges of blades from the Upper Paleolithic of Southern France..

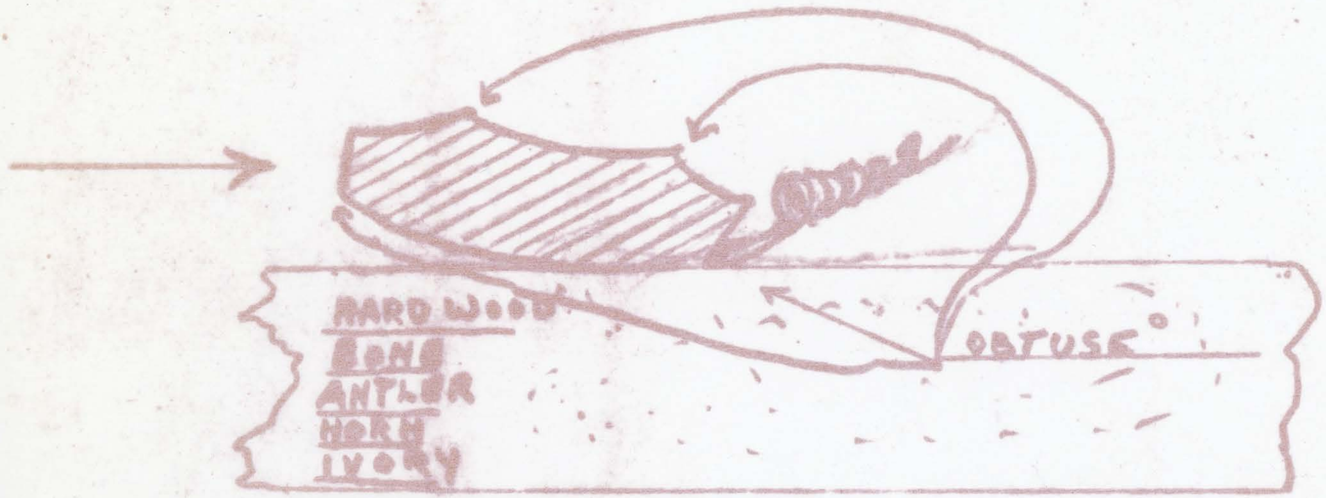
Personal examination of a blade from the Clovis site at Murray Springs, Arizona (1969) showed intensive wear and polish on the dorsal ridge while the lateral margins were still quite sharp. This suggests that the ridge was used as a cutting implement before the blade was detached from the core and when the ridge became dulled was detached from the core to expose two fresh useful ridges. The core with multiple low angle ridges would have been an ideal implement for rapidly xhapin shaping the shaft wrench made from the long bone of a mammouth found at Murray Springs. (Science, Jan. 12,1968, Haynes & Hennings)

Obsidian polyhedral cores from Teotihuacan, Puebla, Colima, and on the coast in the State of Nayarit were personally collected by the writer and bear evidence of use of the blade scar ridges.

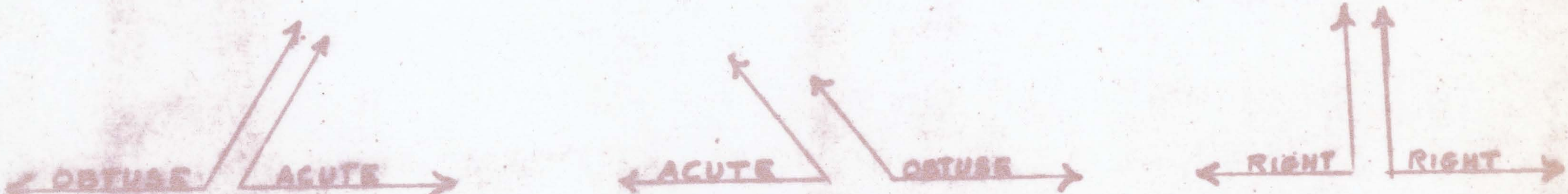
Occasionally cores are noted which are not exhausted for further blade detachment but the ridges bear evidence that they were used for shaping tools while they still retained their size.

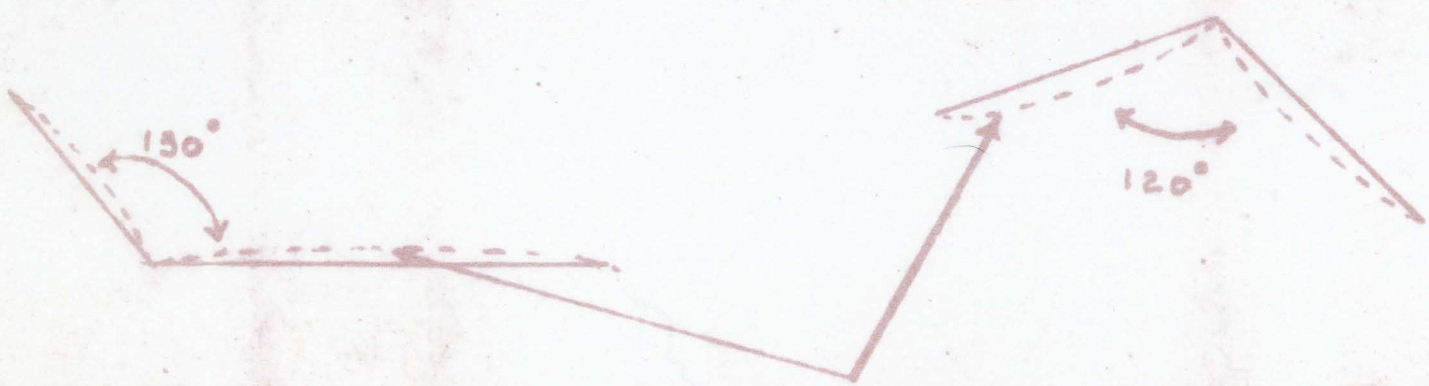
In conclusion, limited experiments, limited examination of paleolithic implements indicate that more lithic debris should be retained and intensively examined and not discarded as non-diagnostic. It is entirely possible that definite technological traits, characteristic modes of use, manners of holding or hafting, and the nature of the material being worked can possibly be defined by this lithic debris and we may find multiple-purpose implements. It has been a revelation to find that for some tasks a thin, sharp acute-angled edge will not perform as well as a low-angled edge.


OBTUSE WORKING EDGES
CONVEX VENTRAL SIDE FOR BEARING

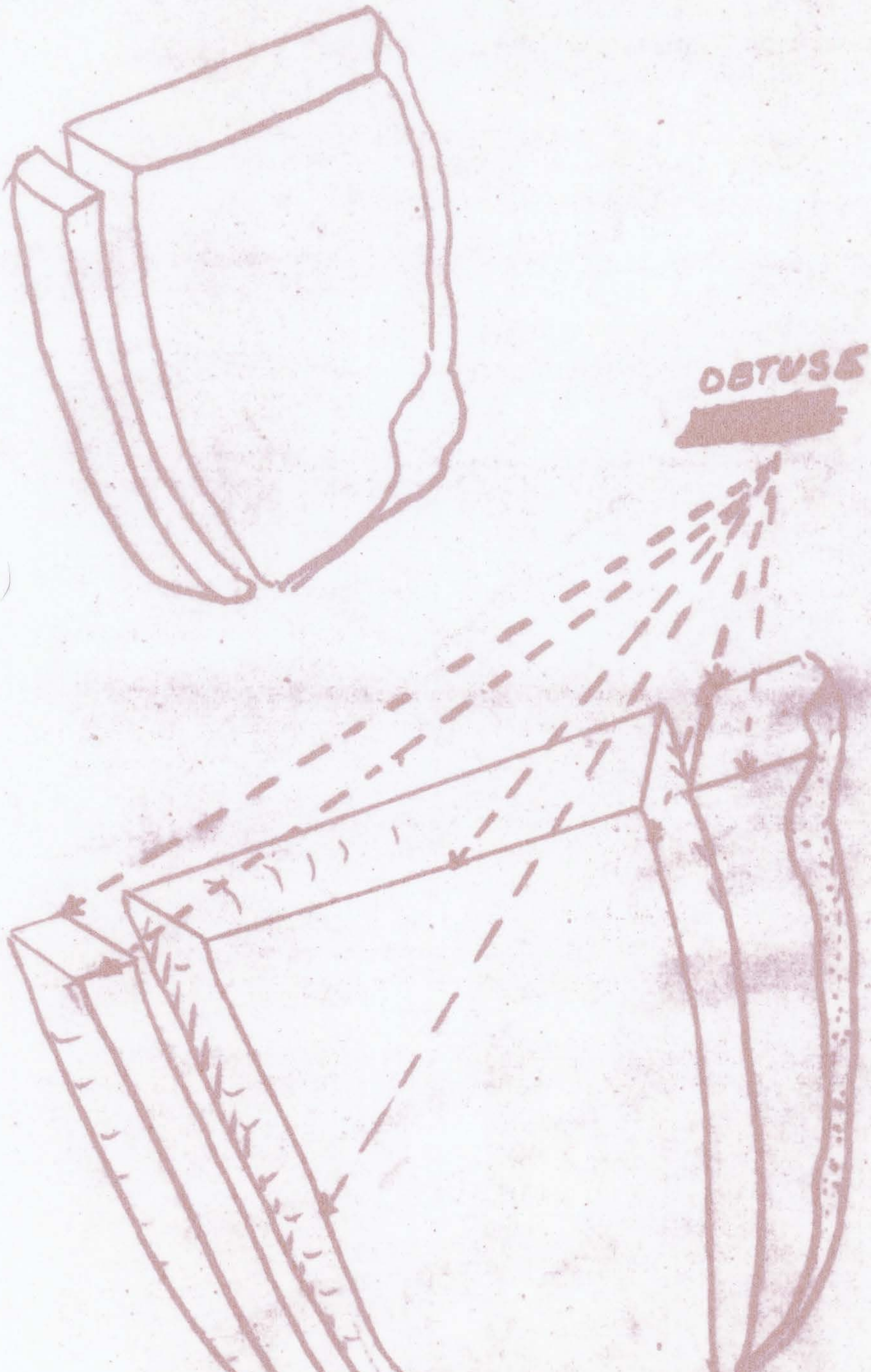


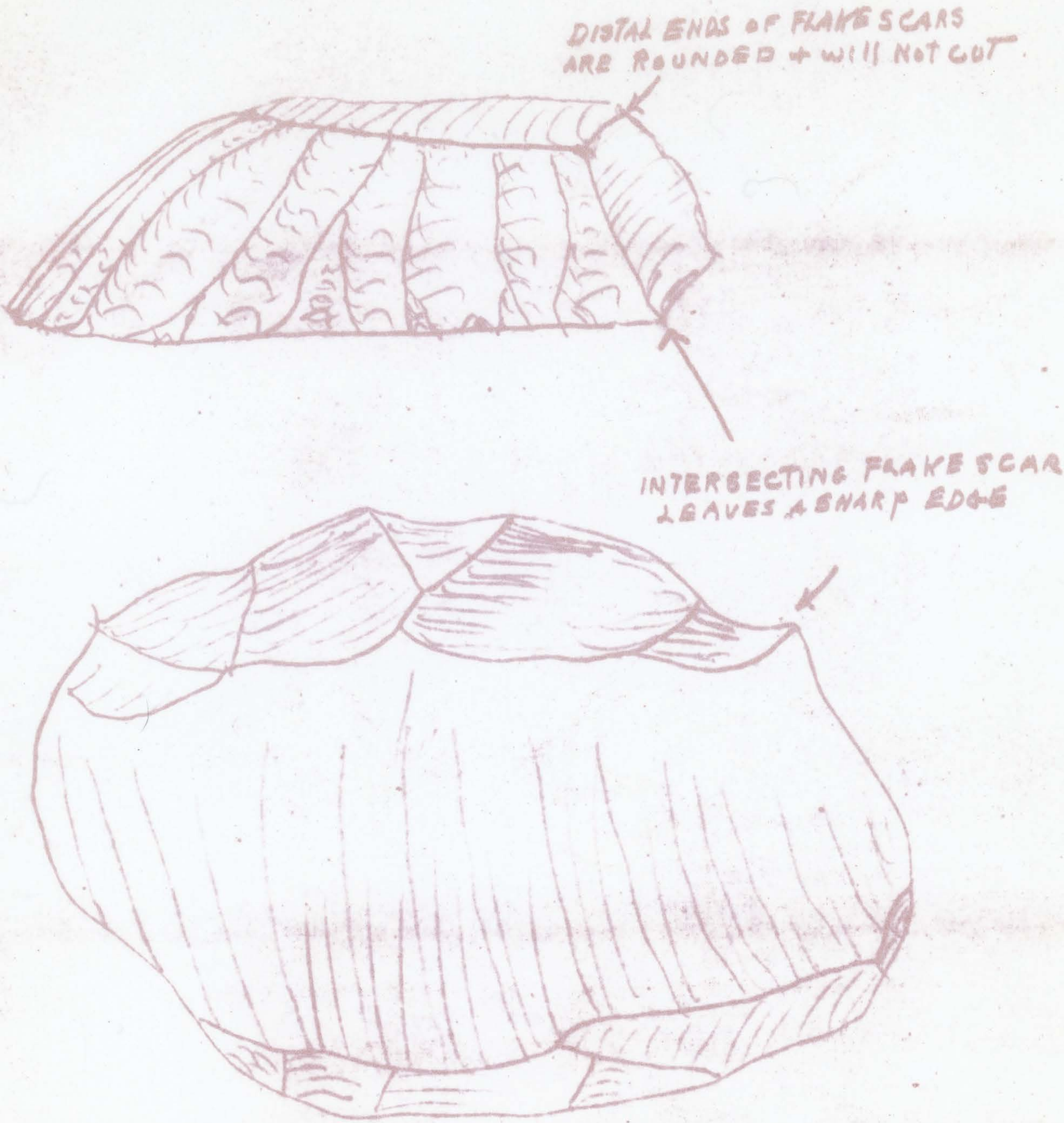
ACTION OF STRANGULATED BLADE

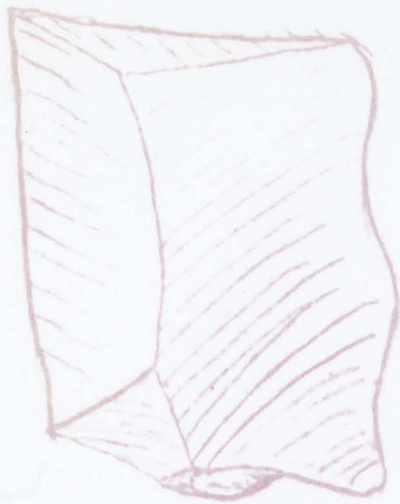




NEGATIVE FLAKE OR BLADE SCARS


OBTUSE


DISTAL ENDS OF FLAKE SCARS ARE ROUNDED + WILL NOT CUT
INTERSECTING FLAKE SCAR LEAVES A SHARP EDGE



RED DOTS OBTUSE ANGLES