

THE POTENTIAL OF LITHIC TECHNOLOGY

Since the 1962 Great Basin Western Typeology Conference organized and chaired by Dr. Earl Swanson and held at Idaho State University, there has been an accelerated interest in lithic technology. Following this meeting, Dr. Marie Wormington instigated a Lithic Technology Conference which was sponsored by the National Science Foundation and held at Les Eyzies, France in November 1964. Fourteen anthropologists from both the old and new world attended the session and they ultimately agreed that technological approaches were vital to the assessment and evaluation of international stoneworking industries. It was here that Dr. Wormington coined the term "lithic technology" which now covers research and experimental approaches to all fields of stone implements.

Prior to this time there were many who struggled unsuccessfully to promote interest in lithic technology but their success was minimal. But now we are evaluating their published works of such technologists as Bouche De Perthes, Louis Figuier, Sir John Evans, Coutier, Halvor Skavelem, Andres Kreigh, Henry Osborn, H. Holmes Ellis, W.H. Holmes, Louis Leakey, ~~Francois Dugas~~, ~~Sussanov~~ and the fine but little known work of the lithic analyst, Dr. Ludvig Peiffer. Their research and experiments have contributed substantially to our knowledge of the unlimited and independent development of the techniques of the stone tool industries. We all now realize the potential of experiment as an approach to a more thorough understanding of the processes and stages of forming stone implements.

Many times I have asked myself - "What is the purpose of lithic technology and experimental archaeology and what impact will it have on our knowledge of the stone age?". One answer always persists - it is a useful aid in the interpretation and understanding of the fossilized remains of human behavior patterns of prehistoric societies.

Olduvai
Dr. Lewis Leakey's excavations at Olduvai dates man the toolmaker at 2 million years & his son Richard's excavations in Ethiopia, may even extend the time beyond this date.
~~Prior to the last ten or twelve thousand years, intentionally modified stone is generally the only nonperishable evidence of mans' existence. A recent find in at Olduvai proves that man the toolmaker existed as long as 2 million years ago which means that tools of stone, ~~which~~ ^(over) have predominated for at least one-half of one percent of mans time on this universe is represented by artifacts 99.5 percent of human history and may be extended to the ~~8~~ ⁸ ~~thousand~~ ^{thousand} find other than stone tools. Until the innovation of fired clay in the form of ceramics beyond this date since the excavations at Ethiopia by Dr. Leakey's son.~~

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This means that 99.5 percent of all human history is covered by the Stone Age and places the burden of interpretation of stone implements on the lithic technologists.

Following this meeting, Dr. Marie Worrington instigated a Lithic Technology Conference which was sponsored by the National Science Foundation and held at Las Vegas, France in November 1965. Anthropologists from both the old and new world attended the session and they ultimately agreed that technological approaches were vital to the assessment and evaluation of international stone-working industries. It was here that Dr. Worrington coined the term "lithic technology" which now covers research and experimental approaches to all kinds of stone implements.

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Prior to the last ten or twelve thousand years, intentionally modified stone is generally the only non-perishable evidence of man's existence. A general idea in Ethiopia with dates of approximately four million years now reveals that less than one-half of one percent of man's time on this universe is represented by artifacts other than stone tools. Until the innovation of fired clay in the form of ceramics

and the rare exceptions of bone and antler, only unusual quirks of nature allowed the preservation of wood and fiber implements. Therefore, in order to extend the history of man, the student of human occupation and its time span must ~~rely~~^{rely} to a great extent on stone implements, broken tools, and the lithic debris of the workshop. The novice lithic technologist may sometimes be confused between man-made tools and nature facts. The elements can sometimes modify stone to the point where one wonders if it is a product of man or nature. This is why actual experience in forming stone artifacts will provide additional information about both the finished artifact ~~the also~~ the waste products involved in their manufacture. Experiment enables one to resolve ~~this~~^{enable him to distinguish between man-made & nature facts} ~~question~~ and to note the unlimited subtle varieties of techniques used through time and geographical distribution and to resolve the consistencies and diversities of technological patterns. Some tools exhibit simple techniques and other incorporate combinations of techniques, while still others are formed by rare and exotic flintknapping methods. Learning even simple techniques is time-consuming and there are no short cuts. The worker must preconceive each fracture and then formulate ratios of velocities, inertia, Yield, volume of percussor ~~and~~, area of fracture and relate these to the resistance of the material to be fractured. There are no words to ~~express~~^{explain} the ~~amounts~~^{necessary} of force, the angles involved and the everchanging conditions encountered during the reduction of the raw material to the finished artifact. Flintworking can in some ways be compared to the game of golf - there are no words to tell the golfer how hard to strike the ball, at what angle, which club to use, etc which will assure him of winning the gold cup.

Another wide-open field for the lithic technologist is the study of the raw lithic materials used by prehistoric man, which can also tell us something of his life style and behavior patterns. ^(over) Presently there is keen interest in the transportation of obsidian from in situ occurrences. Obsidian was highly esteemed by prehistoric man as a stone tool material but its natural occurrence is often limited and restricted to geologically recent volcanic areas. But in non-volcanic areas the aborigine made fine implements of other stones and found highly siliceous materials very responsive to flaking control. For the mineralogists archaeologist, the horizons are unlimited for his study of the evaluation of the mineral constituents, in situ sources, natural transportation, gravitation-whether by water or glaciation, and the nature of alluvial deposits. When we find stone in a region which does not conform with that geological

This can be an important part of our study of the movement of man.

area, we can safely assume it has been transported by man. The quantity of aboriginally worked material found in a given site will often depend upon the quality of the stone and whether it is native to the region or has been transported. This may afford the archaeologist the opportunity to pinpoint by triangulation the known or unknown sources of material.

suggested to aid in the study of

Lithic materials used ~~in conjunction with the formation of~~ artifacts is a wide open field for study. By that I mean ~~other~~ lithics used as abrasives, for sawing, grinding and polishing. These are very important to the process of manufacturing. Also lithic materials suitable for pecking were carefully selected by the toolmaker and these have yet to be oriented archaeologically. *MOST OF*

The student of lithic technology must also become familiar with which stone will respond to thermal alteration, for we now know that past artisans heated these materials for better flaking control. *as flint which Denis de Sonneville Bordes has noted as a solution to determine alteration* Visual examination of the raw material is not enough. One must experiment with each material on an individual basis and note its response to heat temperatures, color changes, heating and cooling times, etc. Some materials will change color and texture while others will only alter in texture and still others will not respond to the heating process. There is a wide range of critical temperatures and each material reacts differently to varying temperatures, duration of heat exposure, color changes, water content and other idiosyncracies. Some material even become more crystalline when subjected to heat. The ideal method of alteration is a sophisticated process and the aboriginal ~~method~~ *technique* of exact temperature control is still unresolved by experimenters. The working quality of quartz crystal, basalt and obsidian are definitely improved by thermal alteration yet there is little or no visual change. The current issue of "Tebiwa" contains a comprehensive account of thermal treatment by Barbara Purday and is recommended to all interested in heat treatment of stone.

We now face the definite possibility of dating surface material which has been intentionally altered by man. Dr. John Fremlin, a noted British nuclear physicist, has been achieving excellent results in dating firepit rocks by using new thermoluminescence approaches but during his research he was unaware that siliceous materials were intentionally altered by man to improve their flaking qualities. It is hoped that his tests will help us date surface artifacts. (personal communication). Another approach to dating surface finds is the knowledge that altered flintlike materials have a tendency to revert to their original

velocities, proper support or inertia of the objective piece, direct or arclike blows, condition of the surface receiving the impact and other factors too numerous to mention. amount force imparted with each
 The ~~size~~ of/~~the~~ blow must correspond with the velocity, collision, impact, dampening - all of which are factors in successful manufacture of stone implements. These are but a few pertinent factors necessary to replicate archaeological specimens. And replication can contribute pertinent information on the behavior of lithic materials.

Another enigmatic part of experimental archaeology is the matter of function. Functional analysis based on experiment will eventually contribute much useful information about the effectiveness, manner of use, and the tasks the tools performed. The results of functional experiments will be many and varied and the results will largely depend on the skill, judgement and reason of the person conducting the experiment. Unsuccessful experiment may be just as significant as the ~~su~~ccessful result and the overall appraisal of many individuals/ experimenters doing the same task will yield better understanding of functional endeavors. ~~Today~~ Today, our typology uses functional names to identify many stone artifacts. For instance, such terms as scrapers, side scrapers, end scrapers, scrapers on flakes and blades, thumbnail scrapers, ^{ONE} hand scrapers, ^{TWO HAND SCRAPERS} ~~drills, awls~~, etc. Functional experiment will soon convince one that a thumbnail scraper would be somewhat inadequate to flesh the hide of a bull buffalo. Yet at the Lindenmeier site the Folsom people left an abundance of these objects and the extinct large bison was one of their staples which makes for an interesting problem of function. Don't forget that a so-called scraper is also a very useful cutting tool. Experiment may show that scraper-like objects could be used to perform a variety of tasks - some for definite purposes and others as multipurpose tools. Richard Gould and Norman Tindale have observed the Australian aborigine using similar hafted objects as hand adzes and they used these to work very hard wood with much skill and precision. Such observations give us the last of the factual information of using stone implements. Unless functional processes are accounted for ethnographically, functional experimental results will be largely personal theories and, therefore, open to debate. The results will be proportional to the skill and ingenuity of the experimenter. When it comes to functional interpretations of the endeavors of prehistoric cultures we are, indeed, babes in the woods. For instance, a present day carpenter would be hard put to build a spiral

taircase with wooden block planes of his own making. Yet these tools were commonplace
 hundred years ago and are bewildering to the present day mechanic. Many manual
 manipulative skills today require only the movement of a lever or the pressing of a button
 to accomplish the task. It is, indeed, a challenge to successfully imitate the past work
 accomplishments with stone tools and ;yet it may be the only way to provide an incite into
 the workings of the past. The future of prehistoric technology is, indeed, vast with no
 foreseeable end. One has only to examine a human skull replica made from rock crystal by
 prehistoric man and the ancient monolithic construction of the Peruvians to realize our
 ignorance of the manufacturing skill of the prehistoric lithic technologist.

Research is essential but it should not be totally independent or self-serving. It is
 well to exchange and compare experiments and results with other research lithic technologists
 and thereby arrive at an acceptable technique for a given replica. The hundreds of
 techniques devised by prehistoric man are, to us, a lost art and no one man can ever
 consider himself an authority or expert in this field. It will take the combined effort
 of all experimenters for many years to ultimately approach the skill of our ancestors.
 Remember ^{early} ~~each~~ culture ^{6 ARE} was limited to ^{a few} ~~one or two~~ techniques while latter day lithic
 technologists are trying to resolve techniques from Olduvi to the last of the stone age
 This puts us at a distinct disadvantage and we need to work together to cover this vast
 time span.

It is gratifying to constantly receive letters and reports from the attendants of our summer
 field school. Some have turned their research into specialized lines - such as blademaking,
 pressure flaking, thermal alteration etc. but all are willing to exchange ideas and tell of
 their results. This makes for a healthy future for lithic technology and a chance for each
 of us to learn from the others failures or success.