

A basic step in determining and interpreting working techniques of artifact manufacture is an understanding of the proper stone for toolmaking and reconciling the relationship of techniques to material. This is essential because the type of material used has a direct bearing on methods of manufacture; poor material restricting and fine material allowing the toolmaker to control the thickness, width, length and uniformity of the flakes. When one is able to control the four dimensions - thickness, width, length and curve - when removing a flake, he can then produce almost any tool he may need. Further a working knowledge of the stone is essential to the knapper, as any variation in its quality requires a different method of flaking.

This text will attempt to describe and explain which materials are used in the toolmaking industry, to resolve what type of stone is adaptable for flaking and to clarify some of the working problems related to material which confront a flintknapper. My analysis of lithic materials is based on thirty years of experiments in stone working and may differ from the mineralogists'

definition for our purpose is not the same.

What are lithic materials? Ideal lithic materials are kinds of stone with the necessary properties of texture, elasticity, and flexibility. They must be of an even texture and relatively free of flaws, cracks, inclusions, cleavage planes and grains in order to withstand the proper amount of shock and force necessary to detach a flake of a predetermined dimension. When the required amount of force is applied to a properly prepared platform, a cone is formed and, therefore, portions of the stone can be removed producing flakes with a very sharp cutting edge. There is a relationship to isotropism and conchoidal fracture but the final results depend on the surface and the conformation of the material. The termination and shape of the flakes are controlled by the desires and ability of the person applying the force and, therefore, do not always resemble the shell-like or conchoidal fracture.

Synonomous names are sometimes used to describe the same material. For instance, slate is sometimes described as metamorphosed clay, metamorphosed sandstone called quartzite, salicified sandstone called quartzite, hornstone called flint, flint called chert, chert called flint, green jasper called bloodstone, etc. When speaking with other flintknappers, i.e.

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~~we refer in general terms to the materials of which artifacts~~
~~are made~~ ^{we} and want to encompass the entire field of adaptable
 working ~~materials~~ minerals, we generally use the words "lithic
 materials", "flint-like materials", or simply "silex". The
 word silex has the advantage of unifying a single group of
 isotropic materials but the disadvantage of not indicating, by
 name, the differences of character, texture, color, etc. There-
 fore, we sometimes qualify these terms by describing sources
 such as "French flint", "Grand Pressigny flint", "Swedish flint",
 "English flint", "Flintgridge, Ohio flint", "Danish flint",
 "Oregon obsidian", "Idaho Ignumbrite", etc. This gives immediate
 identification of material and conjurs up a quick mental picture
 of the minerals and the problems or bonus qualities contained
 therein.

The stoneworkers first concern in choosing working material
 is quality of texture and this is governed by the fineness or

coarseness of the micro-crystalline structure of the material.
*Certain materials will allow the platform to collapse, leaving a
 dull edge. Others have not sufficient strength or flexibility to
 permit detaching a long thin flake and will break off short
 causing multiple steps & large fractures. pag 2 insert*

difficult it is to ~~work~~ remove regular and uniform flakes. But,
 conversely, the platform prepared on coarse material will

collapse more readily than that fabricated on finer textured material.

Each source of stone has certain attributes of which the worker is aware. For example: When Dr. Francois Bordes and the writer were doing some experimental work at the University of California at Berkeley, materials for our project were from many and diverse locations, i.e. Southern France, Northern France, Indiana, California (2 locations), Oregon and Idaho, representing seven widely separated sources. After a week of working, the materials were almost entirely utilized and the resulting array of flakes were comingled in one big heap. Yet, if any single flake had been given us - and this happened - we could identify its origin without error. This serves to emphasize the fact that after the toolmaker has worked with a given material, he will be able to identify its peculiar properties.

A toolmaker's ~~other~~ means of identifying good lithic materials are:

texture, luster, surface character, cortex (rind), color, transparency, sound, flexibility, sharpness of ~~the~~ removed flakes and, perhaps most important, ~~is~~ the amount of resistance to the necessary force required for detaching a flake. The degree of luster is used as a guide by the toolmaker to determine if the stone will permit him to regulate the amount of force necessary

to remove a flake of a given dimension, and is one of the most useful attributes for determining workability. Variations of luster include glassy, waxy, greasy, satiny to dull, matt, flat, sugary, fine crystalline, medium crystalline, coarse crystalline and sandy.

Most sources of lithic materials produce a stone that is identifiable through special qualities recognized by the stoneworker. When choosing material, he will determine the homogeneity of the mass, appraise the texture and luster, ~~and~~ and choose the raw material of appropriate size to produce the size and type of finished tool he desires. A myriad of bright colors is desirable, but color in most instances, does not indicate workability of stone. When making an appraisal of the workability of flint-like materials, one may first tap the stone (lightly to prevent brusing) and listen to the sound of the tapping. If the stone gives off a dull sound, one can expect undetectable cracks, fissures and planes of weakness. However, if the stone has a sharp ring, the chances are good that the material will be of working quality. One may then remove a test-flake, or cleave the stone to examine it further. If this shows the material to be free of crystal pockets, foreign deposits and shows the right

luster, then the worker assumes the stone will lend itself well to the manufacture of an artifact. The final outcome, of course, will depend on the skill of the worker.

If the material is secured from pebble and cobbles alluvial deposits, they may have lost a great deal of their identify due to pounding and rolling in the water. However, this rolling and pounding gives a clue to the workability of the stone. The projections and irregular edges receive the greatest portion of the impacts and each time the stone bumps against another cobble, a distinctive bruise is produced. Each of these bruises is actually a cone. The multitude of cones are superimposed at random and intersect one another, reminiscent of the surface of the moon - or similar to what we laughingly call "goose bumps". This type of surface enables one to identify ~~the~~ ^{which} cobble ~~that~~ has the desirable working properties. ~~Stone~~ ^{Cobbles} lacking this type of surface can be assumed to be granular and unfit for the manufacture of stone artifacts.

Often reference is made to a large thick biface, irregularly surface-flaked on unsuitable material as "crude heavy biface", "crude percussion work", or "crude pressure work" whereas, in reality, the worker was a skilled craftsman to have produce any

type of tool considering the poor quality of the stone. A stoneworker will always relate the quality of the workmanship to the material. Poor material showing skilled and controlled surface techniques indicates good workmanship. Good quality material skillfully worked also denotes good workmanship. But we cannot reverse this procedure and assume that any artifact showing controlled work denotes good material. We must keep in mind the human factor of finding good work on ^{both} good stone and poor work on ^{both} good material; ~~and good work on poor stone and poor work on poor material.~~ Also a factor in analysis is that some do not recognize thermally treated stone and they may be viewing this heated stone and calling it good flint whereas it could actually be inferior stone improved by heat treatment. When we do find poor work on quality stone then I think it is safe to assume that we are viewing unskilled work unless we find, on inspection, that the worker was merely performing good material which was later to receive the refined techniques. We can relate techniques to material but we cannot relate material to techniques. Because of the close relationship of material and techniques, we must be careful to judge character of material before we appraise the quality of the work.