A suggested list for appraising materials follows:

1. Material: On page 6, Part II, is a compiled list of various kinds of lithic materials including some seven groups and sub-classes. This list is far from complete and includes only those materials with which I am familiar.
2. Minerals: Minerals are made up of many -ites and the complete list and breakdown will have to be left to the qualified mineralogists.
3. Chemical Composition: This represents the proportion, the arrangement of, and the relation to, the different elements and compounds involved in the materials useful for the flaked stone industry.
4. Refractive Index: This index is an accurate method of indicating the reflection and absorption of light in solids. The refractive index should be much the same in degree as texture, however, texture is only relative while the refractive index has a numerical value. Various minerals may have different light-absorbing values that would have no bearing on texture.
5. Color: Color is an excellent aid in the initial sorting of detritus, debitage, flake assemblages and accumulations of material rejects discarded by people of the Stone Age. Certain distinctive colors do afford a key to the points of origin even though the textures do not always remain the same.
6. Source: The importance of material source has been previously discussed. The character of external flakes and discards can contribute much information regarding the source (also see No. 15, Cortex).
7. Geographical area: The geographical area deals with the spatial distribution of material from known quarry sites and the transportation and trade routes of certain (special) materials. If the distribution

is great, it would seem to indicate a material of special quality for the flaked tool industry.

8. Geological Occurrence: Geological occurrence can be useful when the material is found in place. Certain attributes, types of crystallization, textures, colors and qualities may be a direct result of the geological nature in which it was formed. The finding in situ of a deposit of usable material will aid in a more accurate identification of material in question than will a flake found on the surface.

9. Light Transmission: Light transmission is an important identifying feature being useful in determining the colors by a transparency rather than a reflected light. If a thin flake is moistened, or a thick flake broken to a sharp edge, and then held toward a bright light, one can see the degree of translucency as well as the mineral structure. Wetting of the surface also serves to bring out the true color of the reflected light and, at the same time, aids in revealing the structure which may be characteristic of that particular material. In the field, it is often difficult to determine the difference between ignimbrite and obsidian. But, if the thin edge of a flake is held toward a bright light, the difference may be noted. Ignimbrite is generally opaque, or has a very uneven distribution of coloring matter in the form of granules, while obsidian has a uniform distribution of color with different degrees of translucency.

10. Texture: Texutre is the most important key to the workability of lithic materials as it indicates the degree of crystallization. Textures range from the very glassy or vitreous to the more granular rocks. It can indicate: how much force is necessary to remove a flake, whether it can be flaked by pressure or percussion, the sharpness of the edges, and whether flakes of uniform dimension can be detached without the platforms

or the flakes collapsing. The finer the texture, the greater the control in making flakes, blades and tools.

11. <u>Edge Character</u>: The edge character of a flake can denote how useful the material would be as a cutting implement and also its degree of texture. The finer the texture, the sharper the flake. Tools made of the fine-textured materials are useful for cutting soft materials, such as leather, flesh, cordage, etc. Finer-textured materials are also ideal for pressure flaking and where a sharp edge is needed for knives, blades, and projectile points. For tools that will be subjected to rough usage, a material that has a coarse edge will be more satisfactory as it has more toughness. Coarse textured materials, such as quartzites and basalts, are excellent for designing a tool meant for forming and cutting bone, antler and wood. An illustration of the differences of a sharp edge and a coarse edge is the conversion of a cryptocrystalline quartz by the use of the thermal treatment. For example: agate, in its natural state, has an irregular edge and this is the result of the size of the micro-crystals. In its natural state, it has much toughness well suited for making tools which do <u>not</u> require the removal of long, regular flakes to produce an extremely sharp edge such as drills, perforators, scrapers, etc. which are designed to withstand twisting, shock and general severe treatment. However, if a thin, well-formed knife with a razor edge is needed, one can be made from the same piece of agate if it is altered by heat-treatment from its original form to a material that has a very sharp cutting edge and is easily pressure flaked. The sharpness of the edge will indicate a fine texture while the rough edge will indicate a coarse textured material.

12. <u>Resistance to Shock</u>: This resistance is one of the qualities of stone that only the stoneworker of the past and a few present-day experimenters can fully appreciate. It is a paradoxical quality that is not entirely

understood. The resistance to end shock is more noticeable in the technique of removing blades from a core, for one finds that certain materials can be compressed when struck by a hammerstone or a billet and will then expand without breaking the blade. Some materials do not have this resistance and, when a blow is delivered at the proximal end of the blade, there seems to be a transmission of force thereby causing breakage. At present, this resistance is confined to certain [redacted] groups of materials and this is apparently due to the intertwining of the microcrystals of the cryptocrystalline group. The quality of toughness is directly associated with the resistance to shock and this quality prevents platforms which receive the impact of the blow from collapsing. Flint has this quality but it is not found in volcanic glass (obsidian). Of all the minerals I have worked with, nephrite jade has the greatest resistance to shock and is the toughest. Jade is not in the list of lithic materials because it is not one of the stones that can be flaked. It is mentioned only as a point [redacted] of reference. Toughness is the quality of flexibility without brittleness or yielding to force without breaking.

13. Elasticity: This is the property or ability to return to its original form when the force is released. It is this quality that is related to end shock, the ability to recover without fracturing. Elasticity is included to avoid any possibility of confusing this meaning with flexibility.

14. Flexibility: This [redacted] is a term meaning the quality to be bent, or pliancy, or not being stiff or brittle. It is this quality that allows a person to control and guide a flake over a curved surface. If it were not for this property of flexibility, there would be no convex or double-convex artifacts. Different materials have different degrees of flexibility. Heated cryptocrystalline minerals and volcanic glasses have this flexibility

to a greater extent than the coarser textured minerals. It is difficult for one not familiar with stone working to fully understand this property, but a flintknapper can control the flexing to an amazing degree.

15. Cortex: This is the exterior surface of the mass before it has been shaped into a tool. Most materials have a natural surface layer that is sometimes sufficiently distinctive to be useful for identifying places of origin.

Cortex (the natural or unflaked surface) is used to identify materials useful for toolmaking. Examples are: the partly silicifed surface, or the incompletely mineralized exterior of nodules or masses of flint whether from chalk or limestone deposits; the bruised, abraded or naturally polished materials found in alluvium, glacial till or naturally transported deposits; surfaces retaining the impressions of cavities, voids, fissures, crevices and joints where silica-charged solutions may be deposited or the external surface impressions left by organic materials that have decomposed and their voids or casts replaced by siliceous materials.

Is this a sentence? No it ain't!

16. Homogeneity: Denotes material in which the composition and the physical state are uniform throughout. Consisting of identical or closely similar material which may be a single substance or a mixture whose proportions and properties do not vary.

17. Heat-treatment: Whereby siliceous materials are subjected to the controlled thermal treatment and are, therefore, artificially altered, by man, to change their original structure to one that will lend itself more favorably to the production of certain stone implements. This process will be described more fully in a separate article.