

Route 1, Box 39
Kimberly, Idaho 83341

2-7-72

Mr. Elwood S. Wilkins, Jr.,
Rt. 2
Newark, Delaware 19711

Dear Mr. Wilkins:

Thank you for your letter of Jan. 12 and the interest you have expressed in thermal treatment. I am also pleased to learn that John Whitthoft is interested in the experiments.

Your work in identifying aboriginal lithic sources and the color changes induced artificially will be a substantial contribution to the profession. Aboriginally, the color changes are incidental to the ultimate structure change of the stone other than the induced pleasing aesthetic values. However, the color changes can be used as a criteria for the mineral compounds contained in the material and could possibly give an index of time element or the amount of applied heat. The study of the aboriginal's selection of suitable minerals from the quarry to the campsite or area of function will become increasingly important and could tell us a lot about the habits and movement of man in his quest for lithic material.

I have found that there is a considerable color spectrum represented by a variety of mineral salts which change in different degrees when subjected to diverse heat temperatures. The amount of time the stone is subjected to heat will often influence the amount and penetration of color change. The kind of heat - oxidizing or reducing - will also affect the color change. The most common change - as you know - is the iron compound of yellow altering to different tones of red. But please do not stop here because there are many other color changes to be considered. In the case of Arkansas novaculite, for instance, some whites will turn dark and, again, other dark materials will turn light. Purple will often disappear; smokey shades will often fade or turn amber, etc.

You will find that some stones have different degrees of permeability of the mineral and some siliceous minerals such as the layers of fortification agate will be impermeable. Some layers will absorb coloring agents or natural mineral salts in different degrees, depending on the permeability; while others will not. It may be of some use to study some of the old German methods of dyeing stone which was successfully accomplished in Idar Oberstien. They changed the natural colors of gem stone by first soaking them in certain mineral salts and chemicals and then heating them. You may uncover some useful clues if you could find their recipes. I am sorry that I am not familiar with the flints you mention, however, I have altered and worked some of the Ohio flints which respond very well to the treatment.

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The heating of certain siliceous rocks makes them more elastic and the worker can manufacture sharper edges because the material has been made less granular and more vitreous (flassier). I can not fully answer your question about what takes place microscopically. However, many years ago I had tests made at the Battelle Institute, Columbus, Ohio with one of the first electronic microscopes and, at that time, the results indicated that the crystals were reduced in size. There is still much work to be done before all of the changes can be evaluated.

Barbara Purdy has made an introduction of controlled experiments on heat treatment using primarily Florida materials. I feel that the temperatures used in her experiments were excessive and the micro-cracks which resulted were due to a breakdown of the materials. She feels that they are due to impurities. I find that quartz crystal - pure silicon dioxide - will flake much like glass after the thermal treatment. Often the growth planes of the crystal are eliminated. I also find that the working quality of obsidian and ignimbrite are improved by thermal treatment.

I could go on and on about the questions and problems yet unanswered about thermal treatment but am leaving this to you, Barbara, Cynthia Irwin-Williams and others who have facilities to provide some of the answers. Bordes tells me of a man bringing him some altered flint and when Bordes tracked down the source he found that it was formed under a thick layer of basalt and, therefore, was altered naturally. So we have to think of that.

A rule of the thumb is that the vitreous material is easier to work and control the flaking and this was probably the cause of pre-historic man altering certain materials. The more granular the material the more heat is required to affect alteration and the more vitreous the stone, the less heat is required.

Please keep a log on temperatures used and the results. Also always remove a fresh flake after heating to note the change in texture and degree of vitreousness.

I am very interested in your work and would like to keep in touch and learn of your results and hope that you will publish your findings.

Sincerely yours,

Don E. Crabtree

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