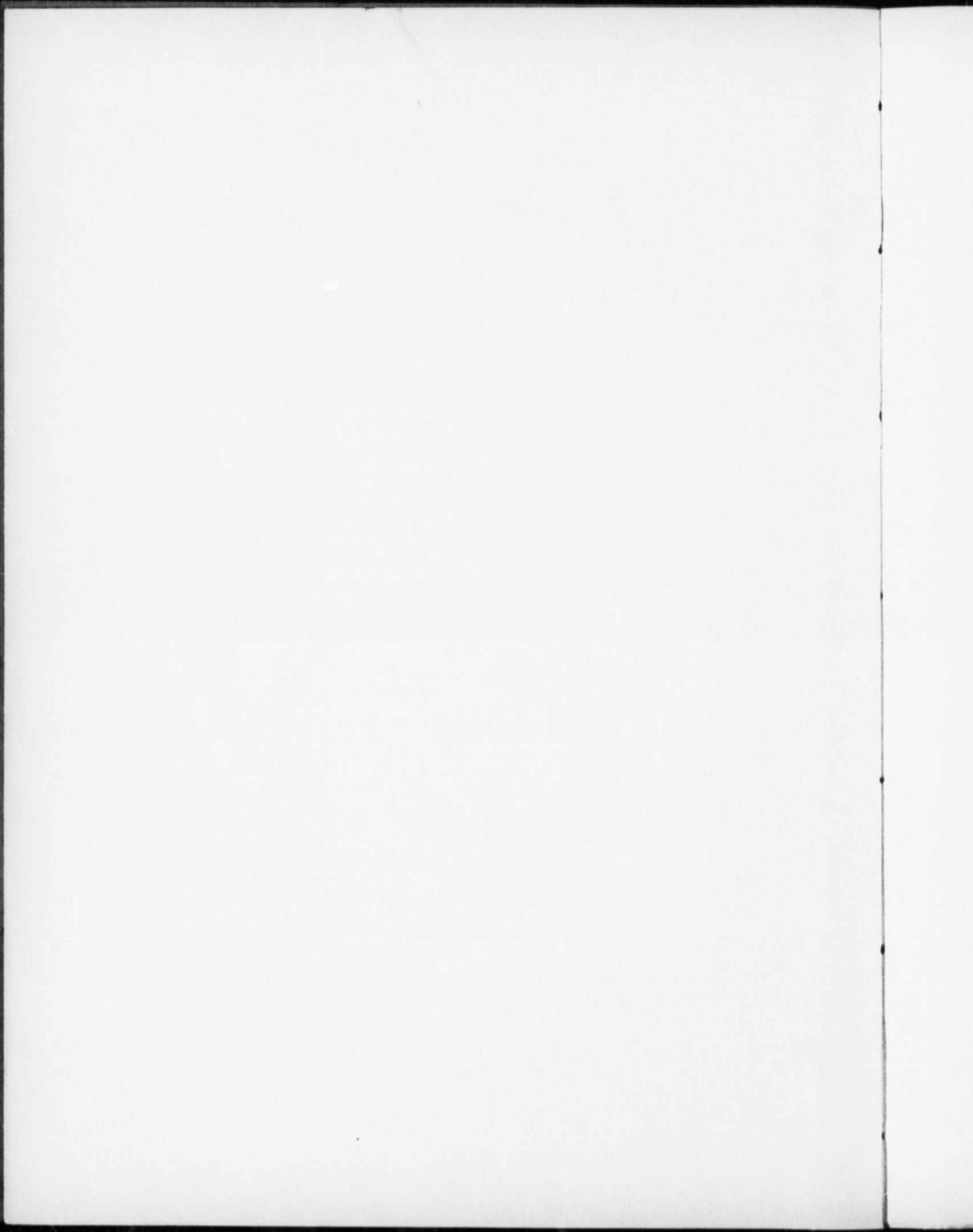


THE FASHIONING OF FLINT.

By FRANK EAMES

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Archæology, while demanding as much of the student as any exact science, must accept from its devotees certain conclusions arrived at after the last thread of circumstantial evidence has been disentangled in an honest effort to determine its value. Such conclusions add much to the sum of human knowledge, if supported by clear reasoning upon a solid basis of fact.

If we were to reject the testimony of those who make such obscure subjects their life work, we must at once become rank and case-hardened skeptics—hurlers of criticism, lacking in knowledge intensified, and lacking in appreciation of those devoted to the science of historical reconstruction.

Unfortunately the aboriginal peoples of the northern portion of the Western Hemisphere have left as the only written records of their arts or modes of existence merely a few crude pictorial attempts on skin, all of which are modern. As a consequence we must base our historical inferences upon evidence obtained from the study of what remains to us of their primitive weapons, tools and utensils.

By the title for this paper the writer has no intention of creating the impression that he is about to lift the curtain that has so long hidden the activities of primitive man; he is particularly desirous that his statements, outside of quotations, should be taken rather as suggesting that the native people of this continent employed more than one method in the working of flint into a finished artifact.

To accept the theory that the flaking method was employed exclusively, is to imply that there is no need for further investigation. Much has been said and written upon this subject. Different opinions have been advanced, which still seem to leave this interesting topic an open question.

A Mr. C. A. Willoughby placed an article with the publishers of a very popular magazine twenty-five years ago in which he asks the reader to visit—in imagination—an ancient arrow-maker's "shop."

"Seated upon a mat, beautifully dyed in divers colours, in front of his round, bark-covered lodge, and surrounded by a circle of stone chips, we find him employed. He is naked to the waist, and encircling his neck is a necklace of many strings of finely wrought beads, made from shells, intermingled with those of copper, hammered from native ore. By the arrow-maker's side is a leathern pouch, filled with flakes of precious stones, and in his hand he holds an implement of bone or horn and which he 'values above all price and will not part with.' Let us watch him as he works. Taking a flake from the pouch at his side, he places it in his left hand, which is protected by a piece of leather. He holds it down with two or more fingers of the same hand, and, placing the bone punch against a point on the convex side, with a sudden pressure he flakes off a chip below each projecting point that is pressed. The flake is then turned and chipped in the same manner from the opposite side. This process he repeats till a perfect arrow-head is obtained.

"Sometimes a "striker" was employed by these artisans. Sitting in front, with a mallet of hard wood, this man struck a chisel on the upper end, flaking off a chip as already described. As they worked both the holder and striker sang, and the blows of the mallet were given in time to the music.

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This, or a similar method, was probably employed in the manufacture of all the chipped arrow-points found scattered over our broad land."

Mr. Willoughby, referring to the chert workings of the Licking and Coshocton Counties, Ohio, states further: "In the neighbourhood are also found the finishing 'shops,' which are marked by smaller fragments and by unfinished and broken implements. Here the flint was fashioned into commercial form, which consisted of disks worked as near to the size of the finished implement as possible, for convenience in transportation. It is also probable that many spear-points and arrow-points were finished here.

"Stone hammers were used in finishing these disks. Another tool employed by the more skilled workman was a bar of wood with a cross-piece at the top and a pointed bone or piece of ivory inserted at the other end and bound in place with rawhide cords. The operator when at work, placed the cross-bar against his chest and the point of the instrument at the edge of a flint block, the staff being held with both hands. A sudden pressure would throw off a flake of the required size."

Mr. Willoughby's interesting exposition of flint-working by means of a flaking tool is in accordance with the views of most Archaeologists; no doubt this was one of the methods employed, since, I am informed, certain native people now existing will make for a trifling sum, a beautiful arrow-point from a fragment of broken glass "while you wait."

My informant stated also that in a certain part of Ireland similar operations are performed in which flint is substituted for glass. Lest this should appear to set aside all doubt upon the subject, it should be noted that in both cases the work performed is confined to shaping or serrating the edges of specially chosen pieces of suitable thickness, which, as a final operation would become clear in any case. The glass used is the commercial commodity, which quite naturally is of graded and standard thicknesses: the flint in all probability is first prepared, or, if adapted at the moment from the base material is prepared by utilizing a hammer; which is the only modern mode accepted.

Then, it would seem in view of what is to follow, that there were two ways of preparation open for discussion. As evidence of another method I quote from Mr. F. W. Godsall, who wrote to me through the kindly reference of Dr. Rowland B. Orr, Director of the Provincial Museum, Toronto. Mr. Godsall had written and made public through the columns of newspapers, such facts as led him honestly to believe that he was the first to give to the civilized world, positive proof as to this second method of flint-workers. Mr. Godsall, after being informed of the writer's communications with Dr. Orr under date of Feb. 10th, 1913, wrote to me from Cowley, Alberta, July 15th, 1914, as follows:

FRANK EAMES, ESQR.,
Gananoque, Ont.

Dear Sir:—Dr. Orr, Director of the Provincial Museum at Toronto, has just written me that he has sent you a copy of a letter of mine published in the *Winnipeg Free Press*, about the making of arrowheads. I rejoice to find that you can confirm my discoveries, as I have had quite a time to convince skeptics, among them the Smithsonian Institute. Enclosed clipping from an English paper shows one step I took to make the thing known, and not lost again. I am only too glad that you had already found it out, and proved it, and that, in my small way, I am now able to back you up, and help to get it known. Any more information you can give will be welcomed. Flint arrowheads are not uncommon on our prairies, but must have been imported by these

Indians, as there is no flint about here, nor can I get any information from the Indians about them. After hearing from you, I propose to send the additional information and proof to the Smithsonian Institute, and other authorities in Canada, and in England.

Yours truly,

F. W. GODSAL.

In reply to my answer to the above letter Mr. Godsal replied as follows:

COWLEY, ALBERTA,

August 12, 1914.

DEAR MR. EAMES:—

I thank you most heartily for your letter and paper on the Fashioning of Flint. It is most interesting, and all that I wanted to establish my contention that Indians used Fire and Water method. I am sending your letter and paper to the Smithsonian Institute at Washington, and I think that they will now be satisfied. I shall then send it to a brother in England to send to Professor Boyd Dawkins, one of the most eminent men interested in these matters. I enclose you the *American Anthropologist* (Vol. 16, No. 1), showing publication of letter from Mr. Ed. Nagle (of whom more later), which I have just received from the Smithsonian. I think Dr. Orr is quite satisfied of the correctness of your ideas. I was away at the Camp of Alpine Club in Canada when your letter arrived.

Yours very truly,

F. W. GODSAL.

Another interesting, though lengthy communication, was sent to England by Mr. Godsal, under the heading, "How Flint Arrow-heads are Made."

I reproduce this letter to render as clear as possible the information secured, how, and from what sources.

Written to Mr. P. T. Godsal from Pacific Grove, California, Jan. 15th, 1914.

This letter I devote entirely to the matter of "How Flint Arrowheads are Made," as I have just received further corroboration of the heat and water method, and I wish to put it on record at once for fear anything might happen to me and it should be lost.

I shall not have spent thirty-two years in Alberta for nothing if I can establish a fact that was not known before to the scientific world. Professor Boyd Dawkins did not know it; it was not known at the Smithsonian Institute at Washington, perhaps one of the greatest authorities on all subjects in the world.

It had always puzzled me how these well shaped, small arrowheads were shaped before metals were used, and one day last year I had a young fellow with me, Archie Gow (brother of George who is helping me at the ranch), who had just spent two years in the extreme north, spending one winter at the mouth of the Mackenzie River. I was showing him my arrowheads, when he told me that he had seen them made, and I of course asked him all about it.

The flint is heated and then cold water dropped on with a bird's feather.

I wrote to Mr. White, Chief Geographer about it, at Ottawa, whom I know, and told what I found out, and asked him to try and find out more on the subject from any scientist, or other authority. He writes me that he had shown my letter to Tyrrell, a Government surveyor, who has travelled much all over Northern Canada, and he replied that "The Indians must have been making fun of my informant." This was not the reply of a man of science, and he failed to tell me how they were made from his own knowledge. But this unsettled me, and made me more determined to prove Gow right or wrong, and to find out how flint arrowheads were made, before the last chance forever passes away, as it is now almost a lost art, and it only happens that some Indians near Great Bear Lake, in the far North, still make a few for the killing of small birds and other animals, and to teach their children. I tried to find out from missionaries and the Indians near me, but they did not know, as there is no flint about us, and arrowheads must have been got from elsewhere, and none have been used in this tribe for many years, although one is constantly picking them up. I wrote to Professor Boyd Dawkins, and the method was quite new to him; but, being a trained man of science, instead of laughing at it he said that he would experiment for himself as soon as he could get a piece of flint, and let me know. Fortunately, when out with the Alpine Club in August, I met Dr. Waisot, of the Smithsonian Institute, and he

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advised me where to write for information, but even there the heat and water method was not known, and I was sent some good drawings of arrowheads, with the "supposition" that they were always shaped by pressing the required piece off with a piece of bone, which method seems quite impossible to me. But they would be glad if I could confirm the information already received. I saw Archie again. I have no manner of doubt that he is absolutely truthful, especially as he referred to other men by name and address in the North to bear him out. I have written to a missionary I have known personally in the North, near Great Slave Lake, and I have also written to one of the Hudson Bay Company's Factories near Great Bear Lake, but those letters are now on their long two thousand-mile journey through the winter gloom of north, and it will be a long time before I get a reply. But while in Edmonton in August, the Government Archivist, named Hughes (now at the office of the Alberta Government in London), told me of a man who had been a trapper and hunter in the far north, and who would likely help me. I found he had left Edmonton, but I pursued him by mail to Pentleton, B.C., and his first reply was disappointing, and I feared that Archie Gow was wrong. But yesterday I heard from him after having written again, and he fully confirmed all that Gow had told me.

After the receipt of my letter he had taken the trouble to send back to Edmonton for his notebook, and I give a copy of his last letter on a separate sheet. Now, is any more evidence wanted to satisfy science? Here are two men, independent of each other and unknown to each other, giving exactly the same evidence. I hope to hear more from the north, but surely we have enough! I shall send the information to the Smithsonian Institute, but I left the name of the particular professor there at the ranch, but I think I can get it again soon. I want you to send this whole letter, mine and Nagle's, just as it is to Professor Boyd Dawkins, and I hope he will let the matter be known through some journal or other recognized paper to publish and establish the fact. It is only by chance I found it out, and it seems to have been nearly lost to the world forever; but I do not know the best way to let those interested know. Professor Boyd Dawkins can do this.

F. W. GODSAL.

Here I submit Mr. Ed. Nagle's letter, as clipped and sent to me by Mr. F. W. Godsall in the form of clipping from an English paper.

PENTLETON, B.C.,
January 5th, 1914.

Mr. F. W. GODSAL,

Dear Sir:—

I am sure you have given up all hope of hearing from me on the flint arrowhead question, but no! I was simply trying to find out for certain how they manufactured those arrowheads from the rough, and here it is. I was wrong. I sent to Edmonton for my notebook used while on a trip to the Great Bear Lake, and here is my note: "Flint is not chipped with stone or with metal, but by aid of water. When an Indian wished to make an arrowhead, he held a piece of flint in the fire until it was very hot, then allowed drops of water to drip from the end of a stick upon the spot to be chipped off. The sudden cooling caused the flint to chip off immediately. Some cunning is of course necessary in the shaping of the arrowhead, but the old Indian method is the best that has been found as yet." When I wrote to you previously I had reference to an arrowhead that had been made from slate stone, which the Esquimaux used in place of flint for boys. [It was this fact that caused Mr. Nagle's confusion regarding the flint ones.]

ED. NAGLE to F. W. GODSAL.

In view of what has been stated herein with regard to forming arrow-head souvenirs of glass in America, and of flint in Ireland, it is needless to try to set aside facts which prove the working of flint by other means than fire and water methods. The writer has experimented with two flakes, suitable by reason of thin edges on each, and he found that by placing one at right angles to the other he could by a dexterous twist with pressure remove flakes so as to produce a fairly uniform outline and shape. By no means, however, has he ever been able to remove a central flake from a rough chip of flint previously broken from the mass by the hammer only, except by heating and dropping water. Has anyone seen a flake, reasonably thin, made thinner? Allowing and accepting the theory

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of the bone punch spoken of by Mr. Willoughby, this tool must work on the edges of artifacts only. Since it is impossible that bone can penetrate or in any way remove particles from central surfaces, then what was the method employed by primitive man in Britain when he chipped a hole completely through the flint hammer-head?

In at least one specimen which has come under the writer's observation such a hole had been made in flint, and chipped, not drilled;—there are no drilled artifacts of flint—did the bone punch pierce that hole? Would a bone punch have the slightest effect? Certainly not. Would a flint chisel stand it, or any other tool of the stone age? Try to realize what it means to attack flint in the solid when one's efforts are confined to the removal of small particles. The chipping in the hole of the hammer mentioned was a clean piece of work, showing no sign of having been bruised or abraded at any of the minute contours.

The hole showed an expansion at both extremities, indicating that a clearance was necessary to proceed, but with what tool?

No tool; since the flaking had been performed without abrasion or without the means of a percussive implement.

In this discussion there are two specific features to be borne in mind, viz.: The removal of edge flakes, and the thinning of the whole surface at the centre of a chosen 'roughed-out' piece of flint. Herein, in my opinion, lies the danger for confusion as to methods. Apart altogether from Mr. Godsal's statements, which appear unquestionable, it seems to me that the gentlemen who have been quoted as having satisfied themselves that flaking was done by means of a bone tool, and my other friend whose statement regarding the making of souvenirs from glass and flint, by means of pried off chips, both refer to edges only. Both have failed to realize that centres as well as edges had in most instances to be worked down.

If the flint worker, by chance, broke from the mass a chip suitably thin for immediate and final formation, that is, having no ugly protrusion on one side or on both, then he may have brought the bone or other serrating tool into use forthwith; but are we to suppose that a piece too thick at the centre for an arrow-point was cast away? I do not believe it! Flint was too scarce at the far distant points of labour in which we find their "shops," and there is ample proof that all the flint borne from its original site was not wholly prepared in the rough at the "quarry."

The writer has in his possession some pieces that are comparatively massive, showing at once that they had been brought from a distance to the working site, where they might be broken up at leisure. These have been found by himself at the actual "finishing department," which is far removed from any deposits furnishing material of a like nature; nor are they typical of the Erican chert, which formation is probably nearest to the spot where they were found, viz.: Granite Island (local name), called Forsyth Island on chart of Thousand Islands, opposite the mouth of Gananoque River.

Although it is now some nineteen years since the writer first experimented with flint chipping—at which time it was thought by him as suggesting merely something new—yet no serious intention of advancing his ideas for the consideration of others seemed probable at that time. How near he came to being correct in his early inferences upon the subject is indicated in the Godsal quotations. The collecting of Canadian stone tools and weapons is a hobby to which he devoted much of his time, but long before he acquired even the nucleus of a collec-

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tion, the germ made known its presence; the viewing of the exhibits in public and private collections while he was still young, was largely responsible for its creation; nor has its presence ever been regretted since so much pleasure has been derived through the close associations and researches with other devotees, who like himself have been tireless in the pursuit of knowledge upon such an interesting subject.

It has to be said that I do not assert that the aboriginal dwellers upon this or any other continent used the fire and water method to the exclusion of any other method in the making of their tools or weapons. Were I to make such a statement, it might be construed into saying that the flaking tool played no part in their operations, but I am convinced that all degrees of finish were not obtained by its use alone upon certain unsuitable forms in the rough.

That an expert craftsman might have accomplished much by patience, without the use of fire—and patience is one outstanding feature of all native peoples—cannot be denied.

Let any one of us undertake to produce an arrow-point with such tools as we have; we could not do it, and yet we are blessed with perfect means of manufacturing far more delicate things than the common arrow-tip; but, it is the very nature of the flint that prevents the use of percussive tools after a certain gauge of thickness has been reached by the hammer. I know, through experiments, that flint can be chipped by water after heating; and I wish to emphasize that the cleverest artisan, even though equipped with the best tool of his choice—which in all probability would be a thoroughly good chisel, cannot remove flint flakes from the solid, smooth-faced material itself, and at the same time leave a smooth contour, free from all trace of incision or abrasion at the point of contact between chisel and flint.

No centre flakes on primitive work show, even in the slightest degree, that they were forced off by being chiselled. Even chisels of the vaunted tempered copper would not do it, since the term "tempered" has more recently been defined as "hammered" copper. I have seen and examined some that were found near Gananoque, none of which (chisels or axes) would for a moment stand up against any such form of application. In my collection are some arrow-tips that will not caliper five thirty-seconds of an inch in thickness which show flaking over the entire surface—how were these flakes removed? Not around the edges but from the centres? Does any tool the savage possessed suggest "striking" them off? I think not; rather, I believe the work on these specimens had been carried too far by the time "the last" flake was removed, to run the risk of a blow; if they were let drop to the floor they would smash like glass. I believe I have established thus far already that percussive methods were out of the question as a medium for thinning flint.

Give an Indian in his heyday of existence the best modern equipment at our disposal with which to perform this particular task. What would he choose or select for it? Nothing suggests itself as possible or probable.

The Indian or other aborigine was a child of nature, and he naturally took to nature's tools; and by their aid, he, with all his patience, could accomplish many particularly difficult tasks.

On one occasion the writer saw some labourers engaged on a difficult piece of road-making; the road was being built down a ravine on the south side of Furnace Mountain in the Township of Duane, Franklin County, New York State. The Adirondack Mountains in that region are of granite formation, and in this

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ravine a huge mass had toppled from the sides until it found its resting place exactly where the road had to go; generally such masses are "sunk" in the earth or in loose rock directly below, a hole being formed and the mass undermined until it can be pried into the hollow formed for its reception. Here it was but a few feet to bed-rock and the mass could not be disposed of in this way. No drills! no explosive! What was to be done? An Indian labourer suggested a method—a very common method, often resorted to by farmers when clearing land in stony localities he said he could dispose of it by the aid of fire and water and took the job for its removal.

First, he set a gang piling spruce tops and brushwood about the obstacle, and then felling trees from the sides of the ravine upon the whole. Another party built a temporary dam, stopping a little mountain brook and holding its flow in reserve till required. Below the dam a crude slide was built of trees, which was faced afterwards with rough boards; this was intended to direct the water upon the rock. Soon a great fire was blazing; and, all being in readiness, the dam was broken, and the flow poured down upon it. "Look out for splinters," cried the Indian. With the water doing its work for a short period, a deep sullen boom came from the overheated mass, which fell apart in three pieces of such size as enabled them to be "sunk."

The contractors for the building of a roadbed at a point in the Yellowstone Park were nonplussed by the nature of the rock found there; drills would not stand in the working, and it was by accident on this occasion that a means was discovered for the advancement of the undertaking. A fire had been built to sit by at dinner-time; after the meal, someone threw a pail of water on the flames. The water in conjunction with the heat caused the "sinter" or amorphous silica deposit to become so fractured as to suggest this action as worthy of further investigation, which finally resulted in the method being adopted for the task in hand.

To quote from Mr. Willoughby's article further, he states that: "Scores of pits are found in Licking and Coshocton Counties, Ohio, sunk into the solid rock, some of which are eighty feet in diameter and twenty feet deep. The actual area excavated cannot be less than sixty acres, and the labour would have required the united efforts of hundreds of men for many years, even if they had possessed steel tools. The best of drills must be repointed in order to penetrate this rock for six inches. Traces of fire are found in these excavations, which suggest the method probably employed in working the quarries. Fires were kindled on the rock, after which water was thrown upon it. This caused the rock to crack. Pieces were broken off with hammer stones found in the vicinity."

Here we have proof that the natives of that day knew of the fire and water process in the working of material required for their needs.

These views are not given with any desire to suggest that the laws of heat and expansion, or cold and contraction, are not fully understood. That would be ridiculous. Nor need we admit that the Indian was possessed of better reasoning power than we. We all know the consequence of pouring hot water in a cold glass; or when cold water falls upon the chimney or lantern globe. We have reversed the circumstances, but the action is the same since we have adhered to the laws of contraction and expansion.

Glass is made from several classes of quartz; pure lime and quartz sand make the glass of commerce. Quartz is an oxide of silicon. The amorphous silicon met with during the Yellowstone operations yielded to fire and water. Flint is

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one of the amorphous or imperfectly crystalline forms of silicon. To the extent of my knowledge, it does not run in strata as do the limestones or sandstones, although it is often found as nodules embedded in the limestone formations as at Silver Creek, near Buffalo; a specimen of which has been experimented with, but not successfully, owing to lack of persistence perhaps on the part of my friend who performed the experiment. Either that, or it compels us to conclude that some so-called flint—we have no true flint in this country or the United States—is more stubborn or unyielding to the finer sense of treatment, but we are sure that in masses heated it will submit to the action of fire and water. All rock will become fractured to such treatment.

While making my own experiments I frequently became much discouraged with the results obtained. Persistence won at last, however, and I succeeded in forming a very fair specimen of arrow-tip by this method alone—heating and dropping water.

Let us for a moment betake ourselves—in imagination—to where a savage is about to prepare the sweat bath; or heat his water for, say, cooking his food.

We will suppose he belongs to that class or race who do not use vessels of pottery, but such as are formed of grass or wicker and rendered impervious to water by a resinous substance:—conditions prohibiting their being placed in immediate contact with fire. He builds his fire, then he heats stones which he contrives to place in the water, thus heating it. Alive to his needs, his inventive faculties are at once aroused as he observes a stone fly into fragments upon being submerged.

This phenomenon of heating and cooling starts him thinking, he conceives likewise the idea of reversing matters; instead of dropping the stone into the water, he drops the water upon the stone! He has discovered that he can bring stone under submission.

If these quotations, proofs and reasonings are considered worthy of notice, this paper will have served its purpose, and what has been, and still is, a pleasure to me, will in all probability furnish some slight pleasure for others; if such should prove to be the case the writer will feel amply rewarded and highly gratified for his endeavours in connection with a matter which has so long been of interest to himself. What I have here presented may, I trust, prove of value to the student when making examination of those examples of native art and ingenuity, which, though often spurned by the clodhopper, are not the less a proof that the savage is entitled to a high consideration from us along the lines of investigation into his modes of life, his activities, and the effect of those influences with which nature surrounded him. The North American pagan presents to the world a most noble specimen, in many respects, of natural man. In contrast with others he is much more elevated in the scale of human greatness.

Facing the multitudinous needs of life, he fought his battles, hunted his food, built his home, clothed himself and his family, built his canoe for his nomadic journeys, largely by the aid of fashioned flint.

