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Author(s): B. B. Redding

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HOW OUR ANCESTORS IN THE STONE AGE MADE  
THEIR IMPLEMENTS.

BY B. B. REDDING.

**F**LINT, obsidian, chert and other hard stones having a conchoidal fracture, manufactured into forms to be used as axes, chisels, knives, scrapers, spear and arrowheads, are found in nearly all parts of the world. They are almost the only remains of a race of people who inhabited the earth at a period so remote that they were contemporaneous with the woolly elephant, the cave bear, the Irish elk and other animals now extinct. These implements are often found in connection with the remains of these and other fossil animals. In one instance in Denmark a stone arrowhead was found imbedded in the bone of a deer which has been so long extinct that the species is only now known from its fossil remains. The people who made these stone implements lived in Palestine, ages before Tubal Cain, and in Egypt long before the first Pharaoh; their flint knives, axes and arrowheads have been found in Europe from Greece to Norway, and from France to the steppes of Russia; in Asia from India and the Malay archipelago to Japan and Kamtchatka; in America from Greenland and Alaska south through the United States, the West Indies, the valley of the Amazon and Peru to Terra del Fuego. They seem to prove that man was originally a savage, that he lived by fishing and the chase, and that civilization has been a long, slow and tedious process of evolution.

There is great similarity in these stone weapons and implements wherever found throughout the world. A spearhead or scraper, an arrowhead or celt from England, could not by its shape or peculiarity of manufacture be distinguished from similar

implements found in Denmark, Palestine, Japan or South America. The stones used might differ, but the mode of manufacture and general shape are nearly always the same. How our prehistoric ancestors could have made these stone implements ages before the discovery of the use of bronze or iron, has been the subject of many speculations among archæologists, and many theories have been advanced in support of these speculations. The general conclusion has been that they were chipped into the shapes we find them by blows from small stone hammers. It is, however, proper to state that Mr. John Evans, Sir John Lubbock, Mr. A. Morlot and other writers on prehistoric remains, have suggested that the observations of travelers, as to the modes pursued by savage nations in similar work, might afford a correct solution.

The theory that they were manufactured into the shapes we find them by blows from stone hammers, was generally received until after the publication, in the *Overland Monthly*, of the observations of Mr. E. G. Waite and the late B. P. Avery, and in the Smithsonian reports of a letter of Gen. George Crook, all of whom had had an opportunity to observe Pacific Coast Indians manufacture stone implements and chip them into perfect shapes without the aid of stone hammers. As, however, these Indians used iron or steel in their work, obtained from white men, it was thought they might have changed the processes pursued by their ancestors. From a late newspaper paragraph I see that Mr. F. H. Cushing, who is connected with the Smithsonian Institution, by independent observation has arrived at the conclusion that the stone implements were not chipped into shapes by blows, but that the small flakes were broken out by pressure, and that to prove his theory he made a flint chisel, chipping it into shape by pressure with the aid only of a piece of hard wood.

Having had an opportunity to see a stone arrowhead made by a man, practically still living in the stone age, without the aid of any implement other than those found in a state of nature about him, and taking notes at the time of each act of manipulation and every process, I have thought that a record of what I saw, added to those made by other observers, might have some value in determining the processes used in similar work by our remote savage ancestors.

Prior to the close of the Modoc war, the Wintoons or Cloud

River Indians were without firearms. Up to that time the few settlers who reside about the base of Mount Shasta made it a rule to permit no Wintoon to carry a gun. As there are no agricultural lands and no mines on the Cloud river, the Wintoons were left in almost undisputed possession of their prolific hunting grounds and to the inexhaustible supplies of salmon and trout with which that river abounds. The Wintoons had but little contact with Americans until after Mr. Livingston Stone established a station on the river for the taking of salmon eggs for distribution by the U. S. Government. Very few of these Indians as yet have guns, their principal reliance in the chase being upon their primitive but powerful bow and arrows. The arrow maker is still a man of great importance in the tribe.

While visiting the United States Fishery a few days since I expressed a wish to Deputy U. S. Fish Commissioner Livingston Stone, who has acquired a knowledge of the Wintoon language, that one of the best arrowhead makers of the tribe should make, in my presence, a stone arrowhead, using only such tools and implements for the purpose as were in use by the Indians before their contact with white men. These people are only now emerging from the stone age, and a record of their manufacture of stone implements may give an illustration of the methods pursued by our ancestors in the palæolithic age, ten or twelve or more thousand of years ago, when they lived upon the products of the chase of the fossil deer, the aurochs and the cave bear.

Promptly at 3 o'clock came Consolulu, an old man between sixty-eight and seventy-two years of age, gray haired but erect and vigorous. He had been for many years chief of the tribe, and was elected chief when a young man, because alone and unaided he had killed a grizzly bear with his bow. He brought, tied up in a deer skin, a piece of obsidian weighing about a pound, a fragment of a deer horn split from a prong lengthwise, about four inches in length and half an inch in diameter, and ground off squarely at the ends—this left each end a semicircle, besides two deer prongs (*Cariacus columbianus*) with the points ground down into the shape of a square sharp-pointed file, one of these being much smaller than the other. He had also some pieces of iron wire tied to wooden handles and ground into the same shapes. These, he explained, he used in preference to the deer prongs, since white men came to the country, because they were

harder and did not require sharpening so frequently. When asked where he obtained the obsidian, he answered from a place on the north side of Mount Shasta, about sixty miles distant; that in former days the land where it is found was claimed by the Yreka Indians, and as this stone was wanted by the Trinity Indians, the Yrekas and the Modocs, as well as the Wintoons, it was rarely obtained without a battle. The piece he had was a light-blue in color, and he valued it at twenty dollars; he stated that if it were white it would be worth forty or fifty dollars. I could not learn that white obsidian is harder or is worked with greater ease; its increased value is probably based on its greater rarity. After stating that in battle he had been twice wounded with arrows, once in the shoulder and once through the calf of the right leg, and showing the scars above the ankle where the arrow had passed through, missing the bone, and been drawn out at the other side, and further stating, with evident gratification at the recollection, that while the arrow was still in his leg he sent one of his own into the throat of his opponent, from the wound of which he had bled to death in a few minutes, he commenced the operation of making a stone arrowhead. Holding the piece of obsidian in the hollow of the left hand, he placed between the first and second fingers of the same hand the split piece of deer horn first described, the straight edge of the split deer horn resting against about one-fourth of an inch of the edge of the obsidian—this being about the thickness of the flake he desired to split off; then with a small round water-worn stone which he had selected, weighing perhaps a pound, he with his right hand struck the other end of the split deer horn a sharp blow. The first attempt resulted in failure. A flake was split off but the blow also shattered the flake at the same time into small fragments. He then repeated the operation, apparently holding the split deer horn more carefully and firmly against the edge of the large piece of obsidian. The next blow was successful. A perfect flake was obtained showing the conchoidal fracture peculiar to obsidian. This I purchased, and instructed him to split off another from which to make the arrowhead. He repeated the operation and was again successful, and I have no doubt he could, with only an occasional failure, have split up the whole piece in a few minutes into shapes for spearheads, knives and scrapers. The shape naturally taken by the obsidian when split off in this manner is that

of a spearhead, and it could be put to use, for this purpose, with but slight alteration. The thickness of the flake to be split off depends upon the nearness or distance from the edge of the obsidian on which the straight edge of the split deer horn is held at the time the blow is struck.

The flake having been obtained, I watched with much interest and attention the process of working it into an arrowhead.

He now squatted on the ground, sitting on his left foot, his right leg extended in a position often assumed by tailors at work. He then placed in the palm of his left hand a piece of thick well-tanned buckskin, evidently made from the skin of the neck of a



FIG. 1.—Obsidian Flake.

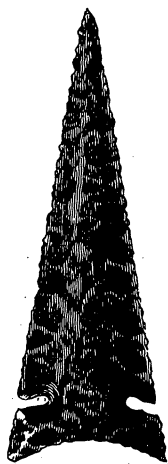


FIG. 2.—Arrowhead of Obsidian.

deer. It was thick but soft and pliable. On this he laid the flake of obsidian, which he held firmly in its place by the first three fingers of the same hand. He then rested the elbow on the left knee, which gave the left arm and hand holding the flake, firm and steady support. He then took in his right hand the larger of the two deer prongs, which, as has been stated, had its point sharpened in the form of a square file, and holding it as an engraver of wood holds his cutting instrument, he commenced reducing one edge of the circular form of the flake to a straight line. With the thumb of the right hand resting on the edge of the left palm as a fulcrum, the point of the deer prong would be made to rest on about an eighth of an inch or less of the edge of

the flake, then with a firm downward pressure of the point, a conchoidal fragment would be broken out almost always of the size desired. The point of the deer prong would then be advanced a short distance and the same operation repeated, until in a few minutes the flake was reduced to a straight line on one edge. As this operation broke all the chips from the under side of the flake, if left in this condition the arrowhead would be unequally proportioned, that is, the two cutting edges would not be in the center. He therefore with the side of the deer horn firmly rubbed back and forth the straight edge he had made on the flake until the sharp edge had been broken and worn down. The flake was now turned end for end in the palm of his hand and the chipping renewed. When completed an equal amount was taken from each side of the edge of the flake and the cutting edge was left in the center. It was now plain that the straight edge thus made was to be one side of the long isosceles triangle, the form of the arrowheads which is used by his tribe.

With the flake of obsidian firmly held in the cushion of the left palm and the point of deer horn strongly pressed on the edge of the flake, the effect was the same as the blow which split the flake from the larger piece. While, however, he was not always sure of the effect of the blow in splitting off the large flakes out of which to make the arrowheads, he in no instance appeared to fail in breaking out with the point of deer-prong the exact piece desired. The soft thick pliable piece of tanned deer skin on which the flake in his left palm was held, may have added to the cushion, but seemed to serve no other purpose than to save his hand from being cut by the countless sharp chips as they were broken off. One of the long sides of the arrowhead having been thus formed, the flake was turned over and the other side formed in the same manner. As, however, very much more of the obsidian had to be chipped away, he brought more pressure upon the point and broke out larger chips until the flake began to assume the shape desired, when the same care was exercised as when the first straight edge was made. In breaking out large or small chips the process was always the same. The pressure of the point of deer horn on the upper edge of the flake never appeared to break out a piece, which, on the upper side, reached beyond where the point rested, while on the under side the chip broken out might leave a space of twice the distance. Invariably when a line of

these chips had been broken out the sharp edge was rubbed down, the flake turned end for end and the chipping renewed on the other side. By this process the cutting edges of the arrowhead were kept in the same line. The base was formed in the same manner. No lines were drawn but he would occasionally look at his work as it progressed and chip on one side or the other to keep their proportions equal. The base of the arrowhead—opposite the point—when finished, is inserted in a slot made in the end of the wooden shaft, and is firmly tied to it by the tendons of a deer. To hold the arrowhead firmly to the shaft and to prevent the thread of deer tendon from interfering with the penetrating power of the arrow, a slot about one-fourth of an inch deep is chipped into both cutting edges of the arrowhead about one-fourth of an inch above the base. This causes the arrowhead to look as if it were barbed, but the object seems only to be to provide means by which the arrowhead may be firmly fastened to the shaft, at the same time avoiding the making of any obstruction to the penetrating or cutting power of the arrowhead. The chipping out of these slots was the last operation to be performed. It seemed to me more difficult than any other part of the work, and I thought that in this would be the danger of the loss of all the patient labor that had been expended. In practical operation it was the simplest, safest and most rapid of all his work. He now held the point of the well-shaped arrowhead between the thumb and first finger of his left hand with the edge of the arrowhead upwards, the base resting edgewise on the deer-skin cushion in the palm. He then used the smaller deer prong, which had been sharpened in the same form as the larger one, but all its proportions, in every respect, were very much smaller; its point could not have been larger than one-sixteenth of an inch square. He rested this point on the edge of the arrowhead where he desired to make the slot, and commenced sawing back and forth with a rocking motion, the fine chips flew from each side, the point of the deer horn descended, and in less than a minute the slot was cut. The arrowhead was turned over and the same operation repeated on the other edge. It seemed that by this process, if he desired, the arrowhead could have been cut in two in a very few minutes. He now examined his work in the strong sunlight and, being satisfied, handed me the completed arrowhead. It had taken him forty minutes to split the two



flakes from the large piece of obsidian and chip one of them into the arrowhead. A younger man, equally expert, would probably have done the work in half an hour. When I came to the purchase of the arrowhead and flake, I found they would cost seventy-five cents, payable in shells, *Dentalium entalis*, which he esteemed more highly than their value in money. The worth of the flake and arrowhead was not based upon the time or labor employed, but upon the value of the obsidian, as he offered for a dollar's worth of shells to give me ten arrowheads of the same shape and size made from the bottoms of glass ale bottles.

The celts, knives, chisels and scrapers of the stone age are all much simpler and more easy of manufacture than these semi-barbed arrowheads.

I doubt if stone hammers were used in their manufacture other than to split off the flakes from a large piece of flint or obsidian, and when thus used the blow was communicated through the split deer horn or a piece of hard wood in the manner I have described. The blow from a stone hammer direct on the flint or obsidian would be very uncertain in its results even in the most skillful and practiced hands. With the split deer horn the thickness of the flake and probable length could be determined with tolerable accuracy. Probably large chips could be broken from the edge of a flake by a slot in the end of a deer horn as is now practiced by the natives of Alaska with a walrus tusk, used as I have seen window glass broken with a key, but an arrowhead is too small and delicate for either operation.

I cannot but believe that our prehistoric ancestors in the stone age used the same processes as were followed by Consolulu, and that in describing what he did I have told how the remote ancestor of

“The ancient arrow maker  
Made his arrowheads of sandstone  
Arrowheads of chalcedony  
Arrowheads of flint and jasper  
Smooth and sharpened at the edges  
Hard and polished keen and costly.”