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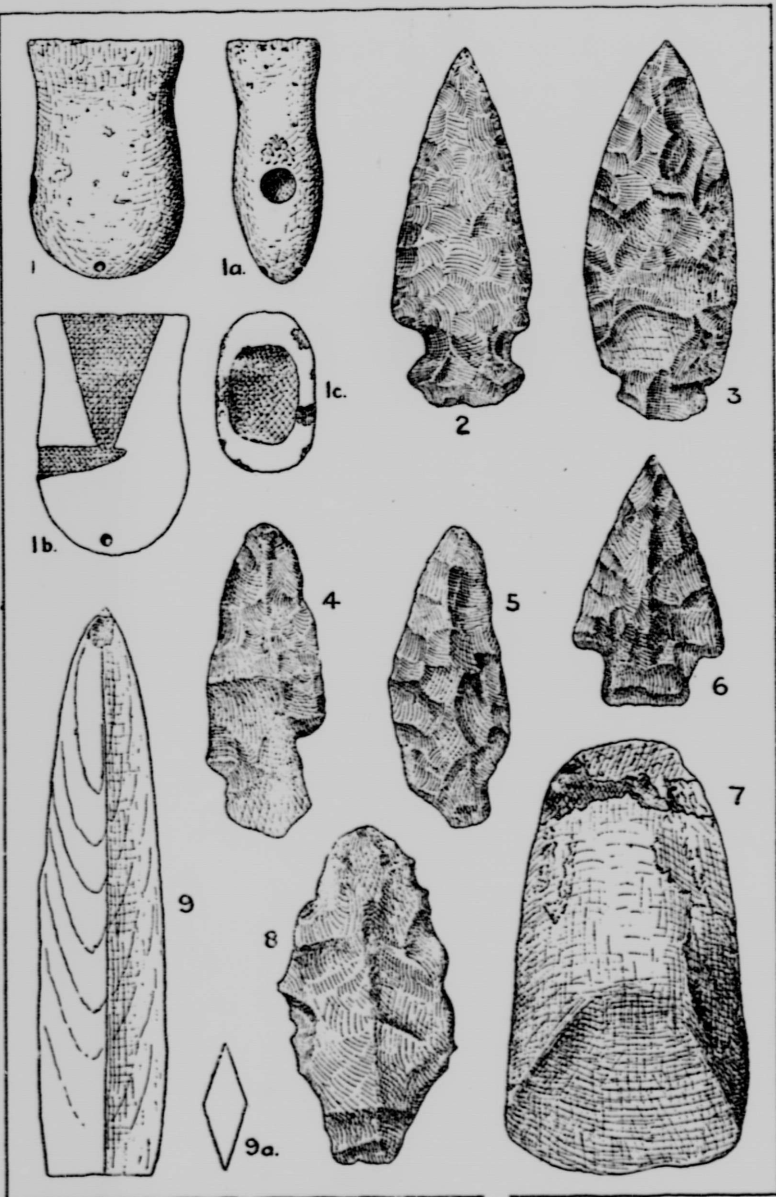

From Prehistoric Camping Grounds.

THE OTTAWA NATURALIST.

VOL. XV. OTTAWA, SEPTEMBER, 1901. No. 6.

FAT IN THE ANIMAL BODY, ITS FUNCTIONS AND ORIGIN.

BY A. T. CHARRON, B. A.

(Read March 12th, 1901.)

This evening I would invite your attention for a few moments to the discussion of a subject that lies on the borderland between chemistry and physiology. We are to consider the nature of fat as revealed by chemistry, its origin and the role that it plays in the animal economy.

What does the word fat convey to your mind? Have you ever thoughtfully asked yourself what fat really is? Ladies handle it every day, men are very often annoyed at the stains it leaves on their clothing as evident proofs of their carelessness, and yet very few enquire into the very nature of that most common substance.

If I were to ask you, what is fat? Some undoubtedly would answer me with Webster that fat is "an oily substance," and if I were to question you further and ask what is an oil, you would again follow Webster and inform me that "an oil is an unctuous substance expressed or drawn from various animal or vegetable substances." Of course, I would have to be satisfied with this definition, which is the only one given in the dictionary.

A true student, anxious to understand the very nature of the substance he has to deal with, is, however, not satisfied with such an ambiguous empty definition. I am positive that the members of this Club who are always so active in scrutinizing nature, are not satisfied with such a hazy knowledge. Let us, therefore, try to elucidate the question of the nature of fat.

To a chemist a fat is a glyceride of a fatty acid. In the formation of a fat two things therefore are necessary, namely, glycerine and a fatty acid. The fatty acids are a series of acids derived from the monatomic alcohols by oxidation. Thus common acetic acid which is derived from ordinary ethyl alcohol by oxidation is a fatty acid.

Every one here present knows what glycerine is. Many times has it been applied to delicate hands and to charming lips to repair injuries caused by cruel cold winds. When applied to the lips that inodorous, colourless, viscid liquid is found to possess somewhat of an agreeable sweet taste. Several no doubt would have hastily thrust it away from them had they known that sweet, inoffensive looking substance to be an alcohol. True, however, it is that it is just as much an alcohol as the accursed beverage which brings unhappiness to so many homes. It is an alcohol, but of somewhat different constitutional composition, for it is what chemists call a triatomic alcohol. Each person carries stored up in his body a rather considerable quantity of that special alcohol. Let our prohibitionists be not alarmed, for this alcohol produces none of the nefarious effects of the so-called fire-water. Its action is only beneficient, for it combines with the fatty acids to form that very necessary substance : fat.

Fat is found widely disseminated in nature. Plants contain a certain amount in the form of oil. It is found in most of the animal tissues. The following table from Gorup-Besanez gives the percentage in the organs and fluids of the body :—

Sweat	0.001	Cartilage	1.3
Vitreous humour	0.002	Bone	1.4
Saliva	0.02	Crystalline lens	2.0
Lymph	0.05	Liver	2.4
Synovia	0.06	Muscles	3.3
Liquor amnii	0.06	Hair	4.2
Chyle	0.2	Brain	8.0
Mucus	0.3	Egg	11.6
Blood	0.4	Nerves	22.1
Bile	1.4	Adipose tissue	82.7
Milk	4.3	Marrow	96.0

Fat being found in the body must necessarily be derived from the food which is absorbed. All foods whether animal or vegetable contain three distinct classes of compounds which deserve special notice, namely : protein, carbohydrates and fats.

Protein is a class of substance characterised by the presence in its composition of nitrogen to the amount of about 16 per cent. Like the carbohydrates and the fats it contains carbon, hydrogen and oxygen, but it stands apart from these two on account of its nitrogen content. Carbohydrates consist of those substances like sugars, starch and fibre, which are composed of carbon, hydrogen and oxygen united in such a way that the relation of the latter to the former is in the ratio of one atom of the latter to two atoms of the former, as in water.

Fat is a substance composed of exactly the same elements as the carbohydrates, but whose atoms are arranged differently in the molecule. The atoms of hydrogen to those of oxygen are not in the same proportion. It contains no nitrogen and is thus quite distinct from protein.

Now do you believe that fat as it is found in the animal body is a simple compound of always exactly the same definite composition? If so, allow me to inform you that you are mistaken. Fat is not a simple compound, but a mixture of three, sometimes more compounds of analogous nature. The three principal compounds are stearin, palmitin and olein. The first two are solid at ordinary temperature and the latter is a liquid. The amount of olein is always more or less in excess of the other two, and it with the help of the heat of the living body keeps them in the liquid form. Olein really acts as a solvent towards stearin and palmitin You must have noticed that in the living body fat exists in the liquid state. As soon as death occurs there is a gradual falling off in the temperature of the body, *rigor mortis* sets in, and the fat becomes solidified. The mixture of those three substances is more or less firm according to the smaller or greater amount of olein it contains.

I told you that fat is one of the component parts of food. You are perhaps anxious to know what part it plays in the nutrition of the body, and what transformations it undergoes previous to becoming an integral part of the same.

Fat is one of the best producers of heat, in fact, it is the most powerful heat producer of all the food stuffs. A glance at its composition will convince you as to the truth of this assertion. The composition of one of the fats (olein) is expressed by the formula C_{57} H_{104} O_6, whilst that of protein is indicated by the formula C_{72} H_{112} N_{18} SO_{22}, and that of carbohydrates by C_6 H_{12} O_6. From a comparison of these formulæ it is evident that in fats the ratio of the carbon and hydrogen (taken together) to the oxygen is greater than in the protein and carbohydrates. Now you are aware that the heat in the body is produced by combustion, and as carbon and hydrogen are the only two combustible substances in these compounds (with the exception of a small amount of sulphur in proteins), that class of compounds in which these two elements (not already combined with oxygen) predominate must necessarily be the greater heat producer. Rubner has very carefully estimated the relative heat value of fat, carbohydrates and protein with the following results :—

100 grammes of fat are equivalent to 211 grammes of protein, to 132 grammes of starch, to 234 grammes of cane sugar and to 256 grammes of grape sugar.

Besides being used as fuel to keep up the body temperature and produce energy, fats are stored up in the body as fat.

Perceiving that fats are absorbed with the food and deposited in the body, physiologists have asked themselves whether there is a direct transposition into the adipose tissue without any previous decomposition. Radziejewsky, Subbotin and others endeavoured to solve the problem.

Radziejewsky fed a dog with erucin, the glyceride of erucic acid, but could find only small quantities of it in the tissues.

Subbotin fed another dog with spermaceti and found none at all in the fat cells, and only traces in the intestinal fats and internal organs. What conclusions could he draw, if not that in the case of carnivora the fat in the food does not pass directly into the cells of the body?

These experiments were repeated by I. Munk, who fed a dog, which had fasted a long time previously, with erucin and he got contrary results finding a considerable amount of the neutral fat. This, however, does not prove that the fat is transferred directly without previous decomposition, for is it not possible that the fat may be saponified and absorbed as a soap, and the neutral fat of the same composition afterwards synthesized in the epithelium cells? In fact the most credited and better experimentally sustained idea is that none of the fats are stored up in the body without previous decomposition. After the fatty material is introduced into the alimentary canal, the first liquid it meets on its way is the acid gastric juice which, as far as we know, has no effect whatever upon it. This juice has the carbohydrates and the proteids to contend with and enough has it to do. The fat, therefore, passes unheeded, but a little further it meets its most bitter enemy, namely, the alkaline pancreatic juice which wrestles with it until its entire decomposition is effected. By its action the fat is resolved into glycerine and a salt of the fatty acids, which salt is known as a soap.

Now as you well know soaps are usually soluble. This one is very similar to that so often called into domestic use and like it is soluble. It dissolves and is readily absorbed by the numerous villi, capillary filaments lining the small intestine, whose functions consist in absorbing the thus dissolved foods. In this way the soap is introduced into the circulating system and carried to the epithelium cells where it in turn suffers decomposition into its organic acid and an alkali. The organic acid again unites with the glycerine which has been absorbed at the same time as the soap and the fat is reformed.

The fact that the fat of an animal fed entirely on a certain kind of fat is not identical in composition with the fat fed, seems to indicate this double decomposition and a certain power of selection on the part of the little villi foraging for their proper food. Undoubtedly if an exclusive diet of a certain fat is given some of the reformed fat will inevitably be of the same composition as the one fed.

The great objection to the absorption of fat in the form of soaps has been that the reaction of the fluid in the small intestine where the absorption takes place is not alkaline but acid, and that a soap cannot persist in the presence of an acid liquid. Carb investigated the reaction of the intestine in three experiments on dogs, and found the intestinal contents to be acid all the way from pylorus to caecum. The indicators used were litmus and phenolphtalein. Moore and Rockwood have recently studied the reaction of the intestine making use, besides the indicators mentioned, of methyl orange, which is not affected by carbonic and weak organic acids. With phenolphtalein the reaction was invariably acid all the way, whilst it was alkaline to methyl orange, thus showing that the acid reaction was due to a very weak organic acid probably to dissolved acids set free from fats. The alkaline reaction indicated by methyl orange can only be due to weak organic acids combined with alkalies *i.e.* in all probability to dissolved soaps. Such a weak acid would not decompose the soap, and so the objection to the theory falls to the ground.

Another objection is that the amount of the alkali required for the saponification wouid simply be enormous. Munk reckons that to so combine with the fatty acids of 200 grammes of fat about 40 grammes of sodium carbonate would be required. Now a dog weighing 25 kilogrammes can easily digest from 200 to 350 grammes of fat in twenty-four hours. Supposing only 200 grammes are digested and that all this is absorbed as soap and glycerine, about 40 grammes of sodium carbonate will be required for the purpose ; now the total blood only contains, in such an animal, alkali equivalent to 6 grammes of $Na_2\ CO_3$. If the other fluids of the body be supposed to contain an amount of alkali equivalent to another 6 grammes, the total alkalinity is equal to 12 grammes of $Na_2\ CO_3$.

In this objection Munk loses sight of the fact that during the process of absorption of fat as soap and glycerine and its subsequent synthesis in the epithelial cells, the alkali combined in the first portions of the soap absorbed is again set free immediately after absorption, and what is to prevent that alkali from being, in some way, in the natural course of circulation, brought back to the intestine there to unite again with some more fatty acid to form soap and thus keep up the continuous action of composition and decomposition !

Whatever may take place the consensus of opinion seems in favour of the theory that fats are absorbed as soaps and glycerine and reformed by synthesis in the epithelial cells and then deposited in the cells of the adipose tissue.

Another problem about fat which has puzzled many a physiologist is its origin. From which class of food compounds is fat derived?

There is no difficulty for anyone in admitting that the fat of the body *may* be derived from the ready formed fat absorbed as food. But is that the only source of fat?

In 1742 Beccaria, in Bologna, advanced the idea that animals take the substances which form their tissues ready made from the vegetable kingdom. This theory was supported by many prominent men, amongst whom may be mentioned Prout, in England, and Dumas, in France. The chief point of the theory was that animal fat is derived from the fat of plants. This appeared so simple and probable, that for a long time nobody questioned its truth. Liebig was the first (in 1848) to dispute this deep seated belief of over one century old. He observed that if by lack of exercise or otherwise, respiration is hindered in Herbivora, fat deposits in greater quantity and thence he argued that as there was no more fat absorbed in the food than previously, that greater deposition must be due to the formation of new fat from the fat free substance of the food. Hindering respiration he thought diminished the combustion of the carbohydrates and the protein, the unburnt carbon was retained in the body and used up in the formation of fat.

As a natural consequence Dumas and Liebig entered into an active controversy, and this set them and their supporters at work experimenting to discover additional proofs to uphold their respective pretentions. Milne Edwards sided with Dumas.

It is not my intention to give you an account of all the experiments undertaken. A few will suffice to make the results and the conclusions drawn therefrom clear to your mind.

Upon instituting experiments it occurred to Voit that fat might possibly be formed from protein. He had noticed that adipocere is often formed from nitrogenous tissue, muscles, etc., when portions of the animal body are kept under water. Wishing to ascertain whether really albumin could be changed into fat, he kept glass tubes, containing pieces of meat, in a water bath at a constant temperature of 40°C. for 3½ months. At the end of this time he found a small increase in the fat content of the substance. The increase was small, but nevertheless the fact was established that fat *could* be formed from protein substances. Further investigations regarding fatty degeneration by Wettick, Forster and others, confirmed Voit's results.

Dumas and Milne Edwards jointly instituted an experiment with bees to find out out whether fat can be produced from fat free substance.

A swarm of bees were fed with honey for 32 days with the following results :—

Amount of wax produced..........	11.515	grammes.
" fat in honey..........	0.667	"
" fat produced from fat free substance	10.848	"

This opened their eyes to the truth of Liebig's statemeut and they acknowledged that fat could be formed from fat free substance. With Voit they supported the view that it was derived from the pre-existing fat and the transformed protein matter.

Other experiments were therefore instituted with the especial object of ascertaining whether or not carbohydrates play a part in the formation of fat.

Berlepsh experimented with bees feeding them on 117 grammes of pollen and honey. The 117 grammes of pollen contained 22 grammes of protein :—

22 grammes protein = at the most........	12	grammes wax.
Amount of wax produced by the bees ...	33	"
" " from other sources........	21	"
Possible amount of wax in bodies of bees.	10	"
Amount of wax necessarily formed from carbohydrates	11	grammes.

E. Erlenmeyer, in 1878, wishing to prove conclusively that the fat could come from carbohydrates alone, fed a swarm of bees solely on rock candy. From each 8 grammes of sugar consumed there was produced 1.589 grammes of wax, which could not have possibly been formed from protein. The nitrogen and fat content of the bees remained unchanged during the experiment.

Henneberg, Kern and Wattenberg experimented with sheep :

A sheep was fed for 70 days with lucerne hay, maize meal and turnips :—

Amount of fat formed	9730	grammes.
Possible amount of fat from fat and protein	6872	"
Fat from carbohydrates	2858	grammes.

The experiment which sets the question at rest, however, is that undertaken by Lawes and Gilbert, at Rothamstead, with pigs. Without giving all the details of the experiment which were scrupulously attended to by these most reliable experimenters, I may only say that they fattened the pigs during 8 to 10 weeks, keeping a record of their composition at the outset and at the finish and of the food consumed, all of which was of accurately known composition. On examining the results obtained they discovered that 29 per cent. of the fat produced must necessarily have had its origin from carbohydrates.

Another experiment, deserving of special notice proving the same fact, has recently been made by Jordan and Jenter, at the New York Agricultural Station.

The experiment was made with a young and vigorous Jersey cow. The cow was fed during 95 days with food from which the fat had been extracted :

Quantity of fat fed during the 95 days	11.6	lbs.
" " not digested	5.9	"
" " digested	5.7	"
Quantity of fat in the milk	62.9	lbs.
" " consumed	5.7	"
	57.2	lbs.

Therefore 57.2 lbs. of fat have to be accounted for otherwise than by the fat contained in the food. Moreover at the end of the experiment the cow weighed 47 lbs. more and was much fatter than at the start.

The increase in flesh could certainly not have been large for during 59 days of this period an accurate record of the nitrogen income and outgo showed that the nitrogen income was represented by 124.3 lbs. of protein and the nitrogen outgo by 125.7 lbs.

During this period (59 days) the amount of protein digested was sufficient to form at the most 17.1 lbs. of fat, and the fat in the food which was assimulated amounted to only 3.3 lbs., so that the total possible amount of fat from protein and ready formed fat was 20.4 lbs. The milk from the cow during that period contained 38.8 lbs. of fat, so that at least 18.4 lbs. of fat must necessarily have been derived from carbohydrates.

Strange it seems, does it not, that I should be proving to you that fat *must* be derived from carbohydrates without having first told you whether it is *possible* for carbohydrates to be transformed into fat.

In this I have followed the emperical method which first establishes a fact and then endeavours to explain it.

The observations of Hanriot and Richet, two French scientists of wide reputation, furnish indirect proofs of the transformation of the carbohydrates into fat. These observers found that with the administration of the carbohydrate food there is a greatly increased output of CO_2 without a corresponding increase of oxygen intake. This fact Hanriot explained by a transformation of carbohydrates into fats in conformity with such an equation as the following:—

$$13\,(C_6\,H_{12}\,O_6) = \underset{\text{(Oleo-stearo-palmitin)}}{C_{55}\,H_{104}\,O_6} + 23\,CO_2 + 26\,H_2\,O.$$

Fat therefore *can* and *is* derived from the three distinct classes of compounds absorbed for the purpose of nourishing the body. We can satisfactorily explain how the fat of the food can be transformed into the fat of the body, but how this formation occurs from protein and carbohydrates is still a problem unsolved. It is one of those secrets which the Creator has not yet revealed to any human being. May we not hope that, as there are at present so many scientific investigations in the field of physiological chemistry in various parts of the civilized world, there may be worked out ere long a satisfactory solution of these complex problems?

PREHISTORIC CAMPING GROUNDS ALONG THE OTTAWA RIVER.

BY T. W. EDWIN SOWTER.

The evidences of Indian occupation that are met with along the Ottawa River, between the City of Hull and Pointe à la Bataille, on Lake Deschênes, consist, for the most part, of the prehistoric camping grounds that occur at frequent intervals along the shores of the lower part of the lake.

Now, just at this point, the "practical man" as Huxley would call him, comes forward with the very pertinent query: "How do you know that these places were Indian camping grounds?

In the first place, it may be said that the grim warriors of our brethren of the Indian race, who repose in their ancient burial places on Lake Deschênes, regard not such poetic license as that which elicited from a Newport skeleton the weird confession of an armored viking; but these lords of the forest have left behind them such traces of their methods of living as cannot fail to be profoundly interesting and widely instructive to those who wish to study the conditions under which a primitive people were slowly struggling, upward and onward, along the highway of civilization.

In a former paper upon the "Archæology of Lake Deschênes," reference was made, among other places, to the traces of Indian occupation that are met with at Raymond's Point, on the Ontario side of the lake opposite Aylmer, Que. Let us take this place as an example, and see if we can prove that it is the site of a prehistoric Indian camping ground.

At this point, following the water-contour of Raymond's Bay, the lake shore consists of a well defined outcrop of Calciferous limestone holding in great abundance the typical gasteropodean fossils of that formation.

Resting on this Calciferous outcrop, we meet with the ubiquitous Laurentian boulder, which the merest tyro in geology would recognize as the legacy of the great glacier which, in its descent from the Laurentian highlands, traversed at this point at least the present course of the Ottawa River.

Where the alluvial soil has been washed away, at high-water mark, the Calciferous rocks are thickly strewn with fragments of black or dark-colored flints, from 2 to 3 inches in diameter down to the finest particles, such as may have been flaked from an arrow-head in the finishing process.

Mingled with these rough fragments are some that bear unmistakable evidence of having been worked, together with roughly as well as finely finished arrow-heads and spear-head shaped knives of the same material. In other words we find these implements, in various stages of completion, along with the raw material from which they were fabricated.

The question which now arises, in regard to the presence of these flints, is somewhat similar to that once propounded by a novice upon seeing some large boulders at Deschênes station: "Have them stones been brought there or have they just growed"?

It is evident that this flint was not "growed" at Raymond's Point as it is not found *in situ* either in the Calciferous outcrop upon which it is strewn or in the contiguous Chazy, so that it must have been brought there, but from whence and by what means are other questions.

It does not appear to have been brought there by glacial action, as it is not found in the glacial drift on the main land or adjacent islands. It is not even found in the dark boulders which line the opposite shore of Chartrand's Island and which, a sapient friend of mine once suggested, may have been pine knots which had been washed ashore and petrified at the time of Noah's flood.

In the Trenton formation in the City of Hull, however, nodules of this flint are found in great abundance, especially along Brigham's Creek, both *in situ* and in detached masses of the same limestone from which latter they may have been removed with but little difficulty. Let some of this flint be broken up and mingled with similar fragments from Raymond's Point and I doubt if the most skilful geologist could distinguish the former from the latter by other evidence than the recency of the fracture.

This, therefore seems to be one of the several obvious reasons for supposing that the flint from both places is identical. That it was picked up or quarried at Hull or Ottawa and carried up the river by Indians who, at Raymond's Point, among places, fashioned it into their arrow-heads and knives. That the aforementioned glacier did not take up the red-man's burden is apparent from the fact that it moved down the river instead of up, so that the flint could not have been carried to Raymond's Point by its agency.

If our practical man wishes us to give proofs of what we know about the direction of the glacial movement, we may show him the grooves below the boat-house on Mr. Watt's farm in the township of Nepean, Ont., and again near the Presbyterian Manse, at Aylmer, Que., where the glacial plough has furrowed up the rocks in its passage down the Ottawa valley. To prove that its passage was down, instead of up the river, a number of places may be shown, notably among which the one on Main street, Aylmer, in front of the Methodist Church. Here, where a section of rock was laid bare by the water-works excavations, it was observed that boulders had been forced under the Chazy strata from tbe westward, leaving large masses of these beds hoisted up and dipping towards the east.

That the flint was not carried by white men is obvious, from the fact that the pale-face, on his arrival in this country, was supplied with his musket and steel knife and the only flints he carried were those for the hammer of his musket or the larger ones for use in the preparation of his fire.

And the palæolithic Indian, it is only reasonable to suppose, went to the nearest and most convenient place to procure such material for the fabrication of his implements, and where it could be obtained in the greatest abundance with the least expenditure of labor, just as his civilized descendant of to-day will do when in search of rim ash or red willow for working into his baskets.

It is also a reasonable supposition, that the palæolithic Indian had acquired such a knowledge of what was good for himself, as to take the precaution of carrying the raw material, for use in his primitive arts, to some such judiciously selected camping ground as Raymond's Point, where, from its strategic and secluded position, he would be the better enabled to stand upon his dignity and defend himself against an enemy, or make himself scarce as prudence or necessity might dictate. An Indian clung to life and wanted his days to be long in the land just the same as a white man, and his natural instincts warned him against sitting down in any exposed position to flake out his flint instruments, where attracted by the noise of his labor, an inquisitive member of some hostile tribe might come and look over his shoulder to see what he was doing and, incidentally, remove some of his hair, together with any tribal prestige he may have acquired as a cunning warrior.

And now for the reasons which point to Raymond's Point as an aboriginal camping ground. We have adduced what seems to be fairly conclusive evidence that the flint was brought there by Indians for purposes of palæolithic manufacture. From the presence of finished and unfinished palæolithic implements in various stages of fabrication, mingled with the debris of the aboriginal workshop, we are convinced by circumstantial evidence, that this primitive industry was carried on upon the spot, just as much so as after an examination of the flat at the mouth of Breckenridge's Creek, higher up the river, we would recognize it as the abandoned site of a modern brick-yard. We also find the worn out and discarded celt, or stone tomahawk, and observe, in its blunted and dilapidated condition, the reasons which led its former owner to cast it aside for a new one.

Following the denundation edges of the alluvial soil, we find fragments of rude pottery made out of a mixture of clay and coarse sand or gravel, which has been imperfectly burnt and bears other evidences of crude fictile workmanship.

If our practical friend is desirous of knowing where the Indian procured the material for the manufacture of this ancient pottery, there is little difficulty in pointing out to him the source from which it was derived.

At Noël's Bay, Coghlan's Creek, Winter Point and several other places in the immediate vicinity, the clay and sand on the lake shore are mixed together in about the same proportion as in the fragments of pottery already alluded to and, as our primitive artificer was the graduate of a rough-and-ready school of art, he made use of this ready-to-hand matrix, instead of going miles out of his way to get better, as the fragments of his work most clearly indicate.

Another important feature of Raymond's Point is the presence of arrow-heads of what we might term foreign manufacture, for although, as a rule, the arrow-tips found at this place are made from the Trenton flint of Hull or Ottawa, we sometimes meet with some that are made from a more compact and lighter coloured flint than that found in the Ottawa district. And one reason why these latter seem to be of foreign rather than of local manufacture is, that we do not find in the debris of the Raymond's Point, or any other Indian workshop on Lake Deschênes, any of the raw material from which they were fabricated.

Within the memory of the generation passing away, this was an ideal spot for the aboriginal hunter. The forest was alive with red deer, the bay teemed with fish and the adjacent creeks were well stocked with beaver, otter, muskrat and other fur-bearing animals. So that this prodigality of nature, in thus supplying the wherewithal to keep the wolf from the wigwam, together with the evidences of Indian occupation already enumerated, seem to be ample proof that the place was an Indian camping ground. And the foreign arrow heads would favor the conclusion that it was also a halting place for roving bands of natives, who made use of the great water highway of the Ottawa River.

Last summer, Harold Nelson, a student in Woodstock College, and a son of Mr. Frank Nelson of the Interior Department, at Ottawa, was good enough to send me some arrow-heads from Paris, Ont. In comparing these with those in my collection, I was surprised to find that some of them were of the same "make" as well as of the same flint, in color and texture, as what I have called the foreign ones, found a few weeks previously, at Raymond's Point.

The presence of flint implements of foreign, as well as of local manufacture on these palæolithic camping grounds of the Ottawa River, seems to present an interesting field of investigation in comparative palæolithology, that might throw some additional light upon the ramifications of intertribal commerce, or the migratory movements of the native races which occupied this country in pre-historic times.

It might be possible after an exhaustive study of the subject, extending over wide areas of occupation, to point with such a degree of accuracy either to the occurrence or to certain peculiarities of material or workmanship of palæolithic implements, as to be able to identify them as the relics of this or that particular tribe that may have been the temporary or more or less permanent occupant of these pre-historic camping grounds.

The palæolithic knife found at Raymond's Point and described in the former paper on the "Archæology of Lake Deschênes," as a "squaw's knife," is without doubt of Indian origin. This implement is also known as a "woman's knife" and is very often mistaken for a spear-head which it very much resembles.

This particular form of knife is not by any means peculiar to this part of the American continent, for it is found on the village sites of western Ontario and even as far south as San Geronimo, in the Isthmus of Tehuantepec, Mexico, according to an article on Aztec relics, by Mrs. Wm. Stuart, in the Ontario Archæological Report of 1899. It is also met with amongst aboriginal tribes in the remotest parts of the world.

Since the spear, as a weapon, is supposed to have been unknown to our Indians, it is just possible that this implement may represent the survival of a knife-form that was, and is to-day, used by primitive peoples to serve the purposes of both knife and spear-head.

As an interesting instance, in this connection, of the same instrument serving different purposes in a rude condition of the arts, H. N. Moseley, Naturalist to the Challenger Expedition, informs us that the obsidian-headed spears of the Admiralty Islanders are used as knives, being cut off just below the ornamental mounting which acts as a handle. Col. A. Lane Fox also observes, in reference to these same implements, that "the shapes of the obsidian spear-heads found, just as they happened to flake off, are interesting as showing the natural origin of such forms and the remark that these spear-heads are used as knives reminds us of like customs in Africa where the Kaffirs, the Watusi described by Grant, the Fans of the Gaboon and others use their iron spear-heads in a similar manner and which accounts for the form of knife and spear-head amongst savages being so commonly the same.

Since the publication of former reports, in the OTTAWA NATURALIST, upon centers of Indian occupation on Lake Deschênes, I have had the good fortune to discover two more ancient camping sites on the Ottawa River, one at Squaw Bay, in Tètreauville, a suburb of the City of Hull, and the other at Powell's Bay, about 10 miles above Aylmer, Que.

I have also been informed by Mr. Gainsford, of March township, that from 1 to 2 miles from the entrance to Raymond's Bay, on one of the creeks that run into it, Indian relics such as stone celts, flint arrow-heads and pottery have been found in great abundance at different times by people living in the vicinity.

As the camping grounds so far examined have, without an exception, been situated on the high water shore line of the river, it would be extremely interesting to verify the existence of an inland village site such as Mr. Gainsford describes; and I feel certain that, as my informant is a thoroughly reliable person, he has indicated a place where we may ultimately unearth a store of important information.

The slate knife, figured in the accompanying plate, was found at this place on the farm of Mr. John Armstrong, and was collected by George Burland of the Ottawa Field-Naturalists Club. Flint arrow-heads were also found in the vicinity by Albert Smith.

Second hand information is all very well in its place if you know the party with whom you are dealing; but, I met a man last summer who has such a loose rein on his imagination that I fear he sometimes allows it to run away with his better judgment. My friend told me that he had found a large stone axe and the head and bust of a squaw carved in stone. When he took me to inspect these Indian relics, I found that the former was a piece of limestone that had a fanciful resemblance to an axe; but, as it weighed about 15 lbs it seemed to me that, if it could be proved that any pre-historic Indian could have wielded such a mighty weapon, it would confirm an opinion that is current among a certain class of our people, that there were giants in those days. The graven image turned out to be a mass of water-worn Calciferous limestone that some wag had embellished with a few artistic touches of red chalk. It occurred to me at the time that, if it were a true likeness, the original might have been worshipped, without any imputation of idolatory, as there could have been nothing like her in the heavens above or in the earth beneath, for she must have been fearfully and wonderfully made. I have merely referred to the above for the purpose of showing how extremely cautious one should be in accepting second-hand information without verification.

The worked flints at Powell's Bay, like those met with at similar places lower down the lake, have been derived from the Trenton formation at the Chaudière. They are strewn along the river side of a long narrow rocky and sandy point that reaches down the river and shelters the mouth of a low marshy creek, which runs into the bay. This point, which is of Laurentian formation, is still a resort for trappers and fishermen.

The north shore of the Ottawa, at the entrance to Squaw Bay, is a bold outcrop of limestone which rises 15 or 20 feet perpendicularly from, and in places overhangs, the swift current of the river, a short distance below the Little Chaudière Rapids. The bay, which forms an indentation in this cliff of about 100 yards in width, extends northward, a distance of 800 feet, to the southern end of Mountain street, or the foot of the declivity which slopes downward from the Hull Electric Railway tracks. The banks of both sides of the bay are bold and rocky, but not so abrupt as the main shore-line of the river. From the upper end of the bay right out to the rocky point which forms its southern extremity, the western shore is strewn more or less, throughout its entire length, with fragments of worked flint, just as we meet with them at similar places on Lake Deschênes higher up the river.

So far, I have only made a casual examination of this camping site, for the purpose of ascertaining its extent and general features, rather than for the discovery of such details as might throw some light upon its origin and subsequent history.

To all appearance, it seems as if this spot had been a landing place at the foot of an old Indian carrying-path, which led up to the head of that break in the canoe route of the Ottawa River caused by theLittle Chaudière Rapids.

There is no doubt that, in pre-historic times, there were periods of tribal inactivity, during which an Indian community may have lived in such peace and comparative security, at Squaw Bay, as to have led even its younger members to indulge in the contemplation of making old bones; but the situation of the dwelling sites of these palæolithic people bear indubitable evidence that no dream of lasting peace ever found them off their guard against possible contingencies, for these makers of flint arrowheads and stone axes were, as the Pathfinder would call it, "judgmatical" in the selection of their camping grounds.

Occupying a strategic position, between the upper and lower portages of the north shore of the Ottawa, this rocky and well wooded inlet possessed exceptional facilities for the formation of an ambuscade, that would not fail to be taken advantage of under the conditions of primitive warfare.

Standing amidst the debris of this pre-historic Indian workshop, one cannot fail to be carried back, in imagination, to a time, when this intricate system of islands and channels, rapids and falls was clothed in the sombre garments of the primæval forest. One pictures to himself the peaceful condition of this northern wilderness ere the once powerful Algonkin-Huron combination, that claimed sovereignty over it, had dwindled into insignificence before the superior military and diplomatic genius of the five confederated nations to the south of the great lakes; ere the Algonkin name, which once carried terror to the council fires of its enemies, had become a term of contempt, through that lack of military organization which led to the downfall and final dispersion of that nation.

One sees a dense cloud of spray hovering over the spot where the downward sweeping waters take their final plunge into the lower river, with a green tree-clad eminence in the background, and is reminded that this place was known to the Mohawks as "Tsitkanajoh," or the "floating kettle; while the Onondagas called it "Katsidagwehniyoh," or the chief "Council Fire."* So that either of these names may have been a shibboleth on the Ottawa during the closing acts in that tragedy of the middle of the 17th century, which resulted in the wiping out of the once dominant Algonkin-Huron confederacy.

But, by the subtle magic of these names, the retrospective scene is changed and the inner circle of the council fire of this ancient camping ground is occupied by the grim war chiefs of the Iroquois. For this wonderful race of sagacious warriors, in conformity with a well planned and far-reaching scheme of conquest, has sent war-parties to secure among other places the passes of the Chaudière and intercept the Huron traffic with the French

*See Ontario Archæological Report of 1898.

settlements on the St. Lawrence, whilst the main force of the confederacy is directed against their tribal strongholds in what is now western Ontario.

In imagination, this romantic and picturesque spot is transformed into a cleverly constructed ambush. Wary sentinels posted at the upper end of the portage pass the word that the enemy is approaching from the upper reaches of the river and is about to run the rapids. The council is broken up, the canoes are manned and with ready musket and uplifted paddle the warriors await the signal of attack. Once within the rift of the Little Chaudière and all retreat, for the luckless Huron or Algonkin is out of the question. Retreat up the river is hopeless, for the foot of the portage is held by the enemy. Escape by the lower portage is equally futile, for the same implacable foe will intercept them before they can reach it, or overtake them before they can pass it. The attack is delivered with the usual results, and the Iroquois return to their concealment laden with the spoils of war, with scalps and prisoners.

Now the manufacturer of yellow literature would like to describe the torture and death of these prisoners at the hands of their captors; but we know that the Iroquois were not always given to vengeance and that they adopted large numbers of Hurons that were thus taken in battle.

Mr. William E. Connelly, in his excellent papers on "The Wyandots," in the Ontario Archæological Report of 1899, in writing of "the oldest branch of the Iroquoian family," informs us that the clan system in the Five nations was the feature of real strength. He goes on to say that: "The clan system was responsible for much of the fierce warfare made by one tribe upon another. It was a religious duty to keep the clan full, *i.e.* every name in the clan list of proper names. No name was allowed in ancient times to become wholly obsolete. The animal from which the clan claimed descent was always angry when these names were not in use, for they were not in his honor. To suffer a clan to become extinct was a reproach to the nation or tribe. It was followed by dire calamity. This both the old Wyandots and Senecas have often told me. War was often undertaken to replenish the depleted ranks of a decaying clan. White men were eagerly adopted and to such an extent had this practice been carried by the Wyandots that after the year 1820 there was not a full blood Wyandot alive. Few women and girls were slain in battle or tortured as prisoners even in ancient times. They were adopted into the different clans of the tribe."

"The Wyandots claim that as late as 1800 at least, the Wyandots and Cherokees made war upon each other for the sole purpose of obtaining women and children for adoption."

PLATE X.

Figure 1—Side view of crystalline limestone pipe, ½ diameter, with perforation at base of bowl, from Pointe à la Bataille, Lake Deschênes, Torbolton township, Ont. Collector, Narcisse Noël, Aylmer, Que.

,, *1a.*—Front view of Fig 1, showing stem-hole and ends of perforation at base of bowl.

,, *1b.*—Section of Fig. 1. Shaded portion shows stem-hole and tobacco cavity.

,, *1c.*—Top view of Fig. 1.

,, 2.—Flint arrow-head, ¾ diameter, from Ottawa River, Bryson, Que. Collector, E. J. Leroy, Bryson, Que.

,, 3.—Flint arrow-head, ¾ diameter, of foreign make, from Raymond's Point, Ont.

,, 4.—Flint arrow-head, natural size, from Paris, Ont. Collector, Harold Nelson, Ottawa.

,, 5.—Flint arrow-head, natural size, from Raymond's Point, Lake Deschênes, Ont. This point and Fig. 4 so closely resemble each other in size, shape and the peculiarly streaked flint from which they are fabricated that it is difficult to distinguish them apart.

,, 6.—Black flint arrow-head, natural size, from Raymond's Point, Lake Deschênes, Ont.

,, 7.—Dark stone celt, ½ diameter, from beach in front of Hotel Victoria, Lake Deschênes, Aylmer, Que.

,, 8.—Buff-coloured flint arrow-head, natural size, from Pointe aux Pins (Queen's Park), Lake Deschênes. A recent fraction at the tip reveals a rind or crust which encloses a lighter-coloured interior.

,, 8—Dark slate knife, ½ diameter, from farm of Mr. John Armstrong, March township, Carleton Co., Ont. Collector, Geo. Burland, Ottawa.

,, 9.—Cross section of Fig. 9.

NOTES ON THE WINTER BIRDS OF THE CARIBOO DISTRICT, B.C.

By ALLAN BROOKS.

I spent the winter of 1900-01 in the western portion of the Cariboo district, and as I was in the field the whole season, I had ample opportunities to note the birds of both the Upper Fraser river valley and the more heavily timbered mountains to the eastward.

The whole district, both in fauna and flora shows a decided infusion of the Hudsonian element, but this is less marked in the case of the winter birds than in the summer residents and the spring and fall migrants, many of which do not occur to the southward, except perhaps as stragglers. Such species as Bartram's Sandpiper, Tennessee, Black poll and Magnolia Warblers, and *Empidonax alnorum* probably migrate east through the Yellowhead pass and down the Mississippi valley.

Many of the mammals found in the district are identical with, or closely allied to those found east of the Rockies, for instance *Arctomys monax* and *Microsorex hoyi*.

The southern range of the Moose in British Columbia will approximately define the limit of the Hudsonian element.

The season was a very poor one for winter birds. Redpolls and Snowflakes, which are very abundant as a rule, were comparatively scarce, and Hawks and Owls were almost entirely absent. The northern portion of Ontario—Algoma district—will approximate very closely to western Cariboo both in climate and physical features.

299. *Dendragapus franklini.* Franklin's Grouse.

Abundant in suitable localities. To the northward it will probably intergrade with the Canada Grouse, as many of the specimens secured showed a decided infusion of *Canadensis* blood, the tail often being narrowly tipped with fulvous or white.

300*b*. *Bonasa umbellus umbelloides.* Gray Ruffed Grouse.

Most of the Ruffed Grouse could be referred to this form, but some specimens were closer to typical *umbellus* or to *togata*.

304. *Lagopus leucurus.* White-tailed Ptarmigan.

Only occurs at high altitudes. The only species of Ptarmigan observed.

308. *Pediœcetes phasianellus.* Sharp-tailed Grouse.

The form occurring at Quesnelle is apparently the typical northern species.

Richardson's Grouse occurs in the district both along the Fraser river and at timber line in the high mountains, but not in the intervening country, and was not observed during the winter.

334. *Accipiter atricapillus.* American Goshawk.

The only hawk observed during the winter months.

352. *Haliaëtus leucocephatus.* Bald Eagle.

349. *Aquila chrysaëtos.* Golden Eagle.

Both eagles occur sparingly.

371. *Nyctale richardsoni.* Richardson's Owl.

372. *Nyctale acadica.* Sawwhet Owl.

366. *Asio wilsonianus.* American Long-eared Owl.

367. *Asio accipitrinus.* Short-eared Owl.

With the probable exception of the last these are resident throughout the winter.

375. *Bubo virgianus.* Great Horned Owl.

375*a*. *Bubo v. subarcticus.* Western Horned Owl.

375*c*. *Bubo v. saturatus.* Dusky Horned Owl.

All three forms occur and intergrade.

376. *Nyctea nyctea.* Snowy Owl.

Several mounted specimens seen. I also heard of the Great Gray Owl being shot near Parkerville.

393*a*. *Dryobates villosus leucomelas.* Northern Hairy Woodpecker.

Tolerably common.

400. *Picoides arcticus.* Arctic three-toed Woodpecker.

Scarce throughout the winter; the greater number seemed to migrate southwards.

This should be the western form lately described by Mr. Bangs, but specimens taken seemed to correspond in measurements with the typical form.

401 *Picoides americanus.* American three-toed Woodpecker.

Much commoner than the last. Both species are among the hardest of birds to collect; they are shy and retiring, especially the last species, and when shot almost invariably remain clinging to the tree by their powerful claws, even if they fall they generally manage to catch on to a small twig or festoon of moss and remain suspended by one or both feet long after death. I shot a male of the Arctic species as it clung to a small stump; though killed quite dead it did not drop. On examination I found the feet were five inches apart and the tail firmly braced. The head and body falling backwards had brought considerable pressure on the tail. It required considerable force to detach the bird.

405. *Hylotomus pileatus.* Pileated Woodpecker.

Scarce. This is probably the northern limit of its range.

475. *Pica hudsonica.* American Magpie.

Tolerably common.

486*a*. *Corvus principalis.* Northern Raven

Common. The first crows were observed early in March.

478. *Cyanocitta stelleri anectens.* Black-headed Jay.

Common.

484*a*. *Perisoreus canadensis capitalis.* Rocky Mountain Jay.

Abundant., All my efforts to find the nest failed From dissection of a number caught in Marten traps I came to the conclusion that not 20 per cent. were breeding birds, and that the eggs were laid about 25th March.

515*b*. *Pinicola enucleator alascensis.* Alaskan Pine Grosbeak.

Common.

521\. *Loxia curvirostra minor.* American Crossbill.

522\. *Loxia leucoptera.* White Winged Crossbill.

The latter the most abundant. Both species seemed to migrate from the district before the close of the winter. Both were common during summer of 1900.

524*a*. *Leucosticte tephrocotis littoralis.* Hepburn's Leucosticte.

Typical examples taken during the winter. The form that breeds in the high mountains near Barkerville is typical *tephrocotis*.

527*a*. *Acanthis exilipes.* Hoary Redpoll.

528\. *Acanthis linaria.* Mealy Redpoll.

I carefully examined all flocks of Redpolls seen and only secured one specimen that showed any approach to *exilipes*. During former winters Mr. Sidney Williams has taken several fairly typical *exilipes* at Quesnelle. I did not observe the Pine Siskin during the winter months.

534\. *Plectrophenax nivalis.* Snowflake.

701\. *Cinclus mexicanus.* American Dipper.

Found in the neighbourhood of open water throughout the winter.

726*b*. *Certhia a. montanus.* Rocky Mountain Creeper.

Tolerably common throughout the winter.

728\. *Sitta canadensis.* Red-breasted Nuthatch.

Less common than the last.

735*a*. *Parus a. septentrionalis.* Long-tailed Chickadee.

Common.

738\. *Parus gambeli.* Mountain Chickadee.

Occasionally observed at Quesnelle.

740*b*. *Parus hudsonius columbianus.* Columbian Chickadee.

Abundant in the heavy spruce timber and on high elevations.

748*a*. *Regulus satrapa olivaceus.* Western Kinglet.

A few of these delicate little birds remained throughout the coldest weather.

The birds enumerated in the foregoing list were all actual winter residents with the possible exception of the Short-eared Owl. Bohemian Waxwings were observed in large flocks during the late fall and again early in March. A single Butcher bird was also noticed in February, probably only accidental, as no others were seen between October and March. Winter Wrens (*pacificus*) remained until the end of October and returned 6th April. The first Robin was seen on the 6th March, but no more were observed for some time, but as I went into the heavily timbered region to the northeast of Quesnelle about that date I had not much chance to observe the migration of the spring birds, which did not begin to show up there till well on in April, the Winter Wren on the 6th being followed by a considerable influx of migratory Goldcrests and Tree Creepers. First Geese (*canadensis*) were seen on 9th April, Snowfinches (*Juncos*) and a Pigmy Owl were seen on the same date, though the latter (the Californian form) might have remained all winter and been overlooked. A considerable number of Robins, Arctic Bluebirds and Red-shafted Flickers were seen on the 12th, and first Varied Thrushes on the 17th. The big rush of spring arrivals came in after the 20th April, when the winter had fairly broken up.

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