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PROCEEDINGS

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PROCEEDINGS
OF
THE CANADIAN INSTITUTE,
SESSION 1888-89.

SPECIAL MEETING.

A Special meeting was held on 22nd September, 1888, at which Mr. George H. Dunham, of New York, exhibited Edison's latest improved Phonograph, explained its construction, and gave practical illustrations of its working.

FIRST MEETING.

The First Regular Meeting, 3rd November, 1888, the President in the chair.

Messrs. H. S. Howland, Jr., and Arthur Cox, were named as representatives of the Institute on the Board of Directors of the Toronto Art School.

Letters were read from Prof. Bryce, of Winnipeg, respecting the preservation of Old Fort Garry, and from "La Société de Géographie," of Paris, respecting an International Geographical Congress at Paris in 1889.

Donations since the Annual Meeting 51, including 17 volumes and pamphlets from Mr. Henry Rowsell and a col-

lection of copper ores from Mr. Robert R. Hedley, of Sudbury, for which thanks were voted.

Exchanges since the Annual Meeting 1177, including 30 new exchanges.

The Council reported the election as Associates of Messrs. Murray A. White, Albert Grupe, G. F. W. Price, J. A. Varley, Wm. Metcalf, James Marston, John Maughan, and James H. Fleming.

M. Montague Chamberlain and A. B. Eadie, M.D., were elected Members.

Mr. A. F. Chamberlain, B.A., read a paper on "The Mississaguas of Scugog." He detailed a visit he had made to the Indian settlement on Scugog Island in the month of August last.

The name Mississagua, which probably means 'many mouths of Rivers,' takes us back to the Indians who in 1670, dwelt upon the River Mississagua, in north-western Ontario, as we learn from the Jesuit Relations for that year. The Mississaguas who have retained that name are perhaps to be regarded as the oldest Ojibway immigrants from the old Mississagua region into Ontario. Mrs. Bohn, an intelligent old Indian lady, regarded her people as the descendants of the Odishkwagami, a tribe who some 150 or more years ago dwelt on the northern shores of Lake Superior. The Mississaguas of Scugog retain some memory of the strife between their ancestors and their hereditary enemies, the Natowé or Iroquois. Most of the legendary lore and song has been forgotten by the Indians, but there are a few members of the band who retain something of the unwritten literature of their people. While at Scugog he was able to obtain the Indian text of a number of myths, stories, and songs, besides a considerable amount of general information. He also obtained a number of archæological specimens, which will be dealt with on a

future occasion. The paper dealt chiefly with the general historical and sociological condition, past and present, of the Scugog Indians.

In answer to a question of Mr. Browning's, Mr. Chamberlain gave the following statistics of the Mississaguas from Government returns :

Year.	At Scugog,	Rice Lake,	Alnwick,	Mud Lake,	New Credit.
1880	41	111	210	152	220
1881	42	111	214	154	208
1882	45	104	211	154	214
1883	41	94	216	157	217
1884	41	93	217	157	215
1885	43	93	231	157	218
1886	44	92	232	158	226
1887	44	90	229	154	239

This table shows an *apparent increase*, for the figures of eight years, of 22. But, as seen from the returns for the settlement of the New Credit, where the apparent increase is the largest, the death-rate exceeds the birth-rate, and the seeming growth is to be accounted for by adoption and admission by marriage.

	1881	1882	1883	1884	1885	1886
Births.....	3	7	7	9	7	7
Deaths	15	6	6	11	11	3
Excess of Births ..	—	1	1	—	—	4
“ Deaths..	12	—	—	2	4	—

Natural decrease in 6 years—12.

SECOND MEETING.

Second Meeting, 18th November, 1888, the President in the chair.

Donations and exchanges since last meeting, 58.

Prof. Ashley was elected a Member.

Rev. S. H. Kellog, D.D., read a paper on "Modern Hindi as related to the ancient Sanskrit and Prâkrit."

In answer to a question from Rev. Prof. McCurdy, as to the amount of Hindi literature in existence, Dr. Kellogg said, the amount of Hindi literature in existence is very great. At a meeting of the International Congress of Orientalists held in Vienna, September, 1886, Mr. George Grierson, B.C.S., presented a list of over 900 Hindi authors and their works, which filled more than 2000 MS. pages.

A large part of this literature is, however, of little intrinsic value, being occupied with mythological poetry in praise of this or that imaginary deity. There is, however, some epic poetry, of which the best known work is the "Ramayan of Tulsi Das," written in the 17th century; a work, which though not a translation, is based upon the "Ramayan of Valniki." This work is not without literary merit, is very popular, and has the excellence not always found in Hindi mythological literature, of being perfectly clean. A considerable number of works exist which embody protests against the superstitions and errors of Puranic Hindooism, and are of a strictly ethical and religious character.

The best example is to be found, probably in the writings of Kabir Das, 15th Century, the founder of one of the numerous sects which flourish in North India. These contain much that is most excellent, and are marked by no small degree of moral earnestness. Their popularity is great, not only among his own professed disciples, but among Hindoos of all classes through the Doab.

Historical and scientific literature is almost exclusively modern, and has been called forth by the combined influence of Christian Missions and the educational work of the British Government in India. It may be added, that with the exception of the last named class of modern works, the largest part of Hindi literature of every kind is written in verse.

THIRD MEETING.

Third Meeting, 17th November, 1888, the President in the chair.

A communication was read from the Governor-General's Secretary forwarding a despatch from the Colonial Secretary, enclosing the reply of the President of the Orange Free State to the proposal for the adoption of a Universal System of Time Notation.

Donations and exchanges since last meeting, 35, including an autograph letter by W. L. Mackenzie to Horace Greeley, dated 21st December, 1849, presented by Mr. George E. Sears, for which thanks were voted.

The following were elected Members :—Ojjiatekha (J. Sero), Arch. H. Young, B.A., and L. B. Stewart.

Mr. W. Houston, M.A., read a paper on "The Science of English."

He began by defining the sense in which he used the term "English." In his opinion, the very essence of science was the investigation of a subject matter; and the science of English was the investigation of the way in which we expressed our thoughts in the English language. The science of English was treated as having four aspects, as follows—(1) The nature of the sentence, as making a statement, which gives us the science of grammar; (2) the nature of words as having meaning and form, which gives the science of philology; (3) the nature of prose-structure, which gives rhetoric; and (4) the nature of verse-structure, which gives prosody. Various lines of investigation under each head were briefly indicated.

Mr. VanderSmisen referred to the imperfect way in which grammar was taught. The teaching was too mechanical. What is most neglected is the relation of words to one another in a sentence. The knowledge of the forms of the words was not sufficient. It was surprising, for instance, how

many persons did not know the difference between *praised* and *have praised*. They do not seem to understand the relation between *have* and *praised*, and do not consider that the word *have* does not always express the same relation.

Mr. Marling wished to know whether those scholars who had the advantage of a good drilling in Latin were not better acquainted with the English language.

Mr. Houston said that it would take a much longer time to make them good English scholars through Latin than through English itself.

Mr. Dale, in proof of the importance of the study of the classical languages to a thorough knowledge of English, shewed that the study of the science of language must necessarily come after the perfecting of the language. We must have the perfect forms of the words as the basis of a scientific study of the language. This perfection of form was intimately connected with that completeness of expression exhibited in the addresses to public audiences.

Mr. Spence remarked that the knowledge of another tongue was not necessary to the formation of a perfect language. The Greeks formed a perfect language without the knowledge of any other language than their own.

Mr. Keys, in referring to the classification of the science of English, which Mr. Houston had used in his four divisions of *Grammar, Philology, Rhetoric* and *Prosody*, thought that it was unfortunate that he had used the term "Philology" for his second division, as it was in a sense quite different from that in which it was generally used. It was difficult to find a word to express the idea for which Mr. Houston had used the term "Philology." He thought, however, that the expression "Word-Lore," would convey the idea exactly.

FOURTH MEETING.

Fourth meeting, 24th November, 1888, the President in the chair.

Donations and Exchanges since last meeting, 111.

Mr. Charles Levey read a paper on "Heat and Heating Buildings," which was devoted to the theory and practice relating to the construction of heaters for heating buildings by hot water, also to the philosophy of the art as demonstrated by a large number of experiments conducted on a commercial scale by the writer, and to the noting of all incidents of interest and value growing out of the experiments, together with quotations and illustrations from eminent authors supporting the conclusions drawn from the experiments referred to. Mr. Levey also gave his own illustrations of leading features and a concise summary of the root principles involved.

 FIFTH MEETING.

Fifth Meeting, 1st December, 1888, Dr. Kennedy in the chair.

Donations and Exchanges since last meeting, 43.

Mr. W. A. Sherwood was elected a Member.

Mr. W. A. Douglass, B.A., read a paper on "Wealth and Its Measurement," and illustrated the subject by diagrams. He said:—

We are so much accustomed to speak of a man's wealth in terms of value, that it is commonly accepted that an increase of value is coincident with an increase of wealth. But since value may arise in two ways—1st, by labour producing commodities; 2nd, by some commodity becoming scarce—a statement of value unless accompanied with a statement of the quantity of commodity can give us no idea

whether there has been an increase or diminution of wealth. Value, therefore, alone cannot be taken as a measurement of wealth.

Some time ago rabbits were introduced into Australia, and at first when they were comparatively rare they were regarded as a useful addition to the wealth of that country, and for a while the increase of their number was regarded as an increase of wealth; but their number has now become destructive to crops, and the settlers are pestered by them. An increase of quantity therefore by itself is not necessarily an increase of wealth.

To show the relation of quantity and value to wealth a diagram was formed tracing a variable quantity of water, commencing from absolute drought to the point of satiety, thence to the point of excess, and ending with a deluge.

At the point of satiety there is no value, as water can be had without toil; as it grows scarce value appears; the wealth in water diminishes till when the zero point is reached the wealth has disappeared and value is infinite. Let the quantity increase from the point of satiety till we arrive at the point of excess. There is no value, as no toil is needed to obtain a supply, but we still have wealth in water. Let us pass the point where excess begins and water is now superabundant, we must toil, not to get it, but to get rid of it; here, again, value appears, but directly opposite to the kind of value first mentioned, and which, therefore, we may call negative value. As the quantity now further increases water as wealth diminishes, till at the point of deluge this wealth disappears and negative value becomes infinite.

SIXTH MEETING.

Sixth Meeting, 8th December, 1888, the President in the chair.

A communication was read from the Colonial Secretary conveying a request from the Governor of Hong Kong to forward for the use of the Educational Department of that colony, 25 copies of the Treatise on Time and its Notation.

Messrs. J. S. Monahan and Andrew F. Hunter were elected Members.

Donations and exchanges since last meeting, 25, including a Hand Grenade and Coal Torpedo made in Toronto by Southern Refugees during the late Civil War, presented by Mr. Daniel Lamb, on whose behalf a paper on the subject was read by the Secretary.

Mr. J. A. Livingston read a paper on "The Purposes of Comets."

He exhibited a globular body about six inches in diameter, composed of quartz which he asserted was a meteorite. It was split in two, was hollow and had quartz crystals like a geode.

Mr. Chamberlain enquired whether there was any evidence for meteorites composed of quartz.

Mr. Armstrong stated that in a conversation which he had with Mr. Proctor, the latter had said, that, so far, nothing had been found in meteorites but metals or the oxides of metals. This alleged meteorite looked as if it had been formed by the action of water.

Mr. Elvins said that in catalogues of meteorites, they were divided into two classes, metallic and non-metallic. All that he had seen were metallic. He would like to ask whether such stones, as that Mr. Livingston had exhibited, do not exist scattered among rocks.

Mr. Macdougall said that the matter had not come under his notice, so that he could not answer the question very well. He had never met with anything similar to that exhibited that could be said to be of meteoric origin.

Mr. Harvey referred to the passage in the Roman historian (Livy) that in a certain year it rained stones. From this and other accounts it would appear that such falls of meteorites were more common in ancient times than at present.

The President said that in some cases the specimens found were of volcanic origin. He had submitted several to experts who said that there was nothing meteoric about them. He did not think that the specimen exhibited was of meteoric origin. He felt sure that many were spurious.

Mr. Carpmael then gave an account of a magnificent meteor that he had seen about 8 o'clock p.m., in the early part of July 1884. He judged that it would be 100 yards in diameter, and was about 30 miles from the surface of the earth. It passed at the rate of about 1000 miles a minute. It was seen by others, whose observations agreed with his own calculations. It had remained quite visible for several minutes.

SEVENTH MEETING.

Seventh Meeting 15th December, 1888, the President in the chair.

Donations and Exchanges since last meeting, 39.

Mr. Edgar Lowell Proctor was elected a Member.

Mr. J. Castell Hopkins read a paper on "The Progress of Canada."

EIGHTH MEETING.

Eighth Meeting 22nd December, 1888, the President in the chair.

Exchanges since last meeting, 38.

Letters were read from Hon. E. Dewdney and Mr. Sandford Fleming, respecting copies of Indian Treaties, Deeds of Surrender, etc., asked for by the Chairman of the Sociological Committee.

The Council reported the election of J. Ramsey and George Atkinson as Associates.

Messrs. B. E. Walker, and R. W. Smith were elected Members.

Mr. A. F. Chamberlain, B.A., read a paper on "Deluge Myths of the Canadian Indians."

The writer compared the myths of several tribes of Canadian Indians as recorded by various authors, and as heard by him from the Mississaguas of Scugog. With some of the tribes the Deluge is localized, with others it seems to have a more general character, and with some, no doubt, is completely mythical. The Eskimo myth, as recorded by Petitot, is very simple; no cause is assigned for the great flood, which covered the summits of the Rocky mountains. Some Eskimo tied their boats together so as to make a large raft, on which they floated safely over the huge waves. The flood was calmed by a juggler or magician throwing first his bow and then his earrings into the water.

Quite different to this short account are the legends of the Déné-dindjié. In the Loucheux version the Deluge is caused by Etroetchokren (the Navigator) rocking his canoe upon the waters of the river. He saved himself by crawling into a huge hollow stalk of grass, encased in which he safely rode out the flood, which in subsiding stranded his ark of safety on a high mountain. With the aid of the crow, whom he first killed and then resuscitated, the "Navigator" repopled the earth. He pierced the side of the pike, from which issued forth men, the crow pierced the side of the loach, from which came women, and the earth was replenished. The Dog-rib tradition is somewhat different. Tchapeioi (the Old One) is the Noah of this tribe. When the flood occurred he built a raft, on which he placed two of each species of animals. When all the land had completely disappeared he sent down the beaver and other amphibious animals to dive for earth. The muskrat only succeeded. He came to the top floating on his back, with a little clay in one of his paws. This bit of earth Tchapeioi threw into the water and continued to blow upon it until it assumed the proportions of the earth of former days. In a version of a neighbouring tribe the cause of the flood is this: A young man called to a whale to swallow him, which the fish did, but

the youth found his stomach an uncomfortable residence, and hearing his sister lamenting on the shore he called to her and told her to take off her shoe, and throw it into the whale's mouth, but to keep hold of the string. This the girl did, and the whale soon had to disgorge the young man, who was landed safe and sound on the shore. But the angry whale lashed the sea so vigorously with his tail that the waves mountain-high overwhelmed the earth. Of all the inhabitants the young man and his sister alone escaped. The Hareskin legend, of which Kunyan is the hero, resembles the Dog-rib story, except that the beaver is the successful diver.

The Ojebways of Lake Superior and Lake Huron relate the myth in a similar way to the Hareskins and Dog-ribs, but the hero of it is the demi-god Nanabojou or Nanabush, who saves himself by climbing to the top of the tallest pine on the tallest mountain in the world. The work of restoration is similar to that of the Noahs of the Hareskins and Dog-ribs. With the Ojebways of Lake Huron, the cause of the Deluge is that Nanabojou killed the white lion who dwelt beneath an enchanted lake, whose water in anger after his death overwhelmed the whole earth. Nanabojou's refuge was a tall pine, which in response to his entreaties grew taller and taller as the flood rose higher. The Mississagua story is very similar to this; with both, the muskrat is the successful diver.

Mr. Charles Armstrong gave a statement of a remarkable experience of the influence of mesmerism attending the recent amputation of one of his fingers. The statement was as follows:—

It became necessary a short time since for me to have a finger amputated, so I applied to Dr. Emery to do it for me. In reply to a question, I told him that I objected to chloroform, and would not take it. We then made an appointment for next day, Friday, December 14th, at his office, and, on arriving, I was introduced to Prof. Seymour by the doctor, who asked me if I would object to the professor making an experiment to control the nerves so as to prevent pain. I consented, but did not think he would succeed. Everything being ready, the professor took my arm and passed his hand along it for the first time, and then said he was ready. I saw the doctor take up the knife, and, leaning my head back, looked up, determined to show no

sign of pain if I could help it. I felt the knife touch and press into the flesh, but strange to say not the slightest pain. I looked at my hand, saw it red, and till the end of the operation saw everything, the incisions, the scissors clipping the tendons ; I also distinctly felt the resistance, but no pain even when the stitches were put in. The last stitch on the back of the hand having been put in, Prof. Seymour let go my arm, which he had held all this time, and my hand was turned over. It was then decided to put one more stitch in the palm, and that one I felt in all its intensity. While Prof. Seymour laid his hand on my arm I felt not the slightest pain, but as soon as he took his hand off the next stitch gave me acute pain.

NINTH MEETING.

Ninth Meeting, 12th January, 1889, the President in the chair.

Exchanges since last meeting, 108.

Mr. A. F. Chamberlain, B.A., read a "First Contribution to the Bibliography of the Archæology of Canada and Newfoundland."

In general archæology the name of Sir Daniel Wilson stands foremost, and the number of papers written by him at various times is very large. For our own Province of Canada, the most exhaustive work on the subject is the report of Mr. David Boyle, the curator of the museum of the Canadian Institute for the year 1887. Other writers upon the archæology of Ontario are Prof. H. Croft, Rev. C. Dade, Paul Kane, R. W. McLachlan, E. Van Cortlandt, T. C. Wallbridge, and Sir Daniel Wilson. The papers of these writers describe local archæology and are to be found in the Canadian Journal and the Proceedings of the Canadian Institute. To various reports of the Smithsonian Institution, Messrs. E. W. Guest and others have contributed papers relating to the archæology of Ontario. In the journal of the Anthropological Institute are to be found

papers by Sir Daniel Wilson, Sir Duncan Gibb, Dr. Fairbanks, and others. The archæology of the Province of Quebec has been but little considered. Numerous notices are to be found in Sir Wm. Dawson's "Fossil Man," Mr. A. Sandham's "Ville Marie," and the pages of "Le Naturaliste Canadien" (by the Abbé Hevart and others). The best view of the state of our archæological knowledge of New Brunswick is in the sketch by Mr. L. W. Bailey, in the bulletins of the Natural History Society of New Brunswick for 1887. Other writers on New Brunswick archæology are Prof. S. Baird, who has written on its shell-mounds, Rev. Jas. Fowler, A. C. Smith, and G. F. Mayhew. Rev. G. Patterson has, in the Smithsonian report for 1881, given a summary of Nova Scotian archæology. In Manitoba, Rev. Prof. Bryce and Mr. Chas. N. Bell have dealt with archæology, chiefly treating of the mounds. Other writers on the archæology of the North-Western portion of Canada (and they are but few) are Donald Gunn, Jean L'Heureux, Rev. John McLean, J. G. Swan, and Sir Daniel Wilson. The advantages of a complete bibliography of the archæology of Canada are very great, and it is to be hoped that it will soon be completed. The best idea of the archæology of Newfoundland and Labrador is to be gained from the articles on this subject by Mr. F. G. B. Lloyd, in the Journal of the Anthropological Institute for 1875.

Mr. Chamberlain also read a paper on "The Archæology of Scugog Island."

He described the situation and contents of a number of graves on Noncon Island, a portion of Scugog Island. Some 15 graves had from time to time been found there, all containing skeletons, but only three containing relics. In one grave were found a hard stone chisel, some perfect and imperfect shuttle-stones, several fragments of deer's horn, some half-dozen flint arrow heads, a portion of a bear's jaw, a piece of plumbago, a bone spear point, a bone harpoon, a bone awl, and some other articles. Ploughed up in the field at various times were found heavy stone chisels, whetstones, shuttlestones, etc. A number of pieces of pottery were also found. Noncon Island appears to have been the site of a pottery factory; it is probable also that flint arrow heads were made there. The graves were situated some distance north of where the pottery was found.

No traces of connection with European civilization were found in any of the graves. The interments are probably to be referred to the ancestors of the Mississaguas or Ojibways, and date back a considerable period, as these Indians have been acquainted with the island for over a century. The Indians now at Scugog cannot account for the presence of the remains, and have had nothing to do with them. Mr. Chamberlain presented the collection to the museum of the institute. The collection consisted of four large chisels or hoes, one long and one round whetstone, some half-dozen so-called shuttle stones, seven arrow heads, a bone spear head, a bone awl, a bone harpoon point, several unfinished stone implements. Besides these there were several pieces of deer horns, a portion of bear's jaw, and other articles interred with the skeletons.

TENTH MEETING.

Tenth Meeting, 19th January, 1889, the President in the chair.

Exchanges since last meeting, 41.

Messrs. Adam Morrison, William James Nelson, and A. A. Dewdney were elected members.

Mr. J. M. Clark, M.A., read a paper on "The Luminiferous Ether."

He set forth the reasons which induce men of science to believe in the existence of the ether. He demonstrated not only that the ether exists but also that it pervades all interstellar, intermolecular, and interatomic space. The varied and important functions performed by the ether were described and its properties discussed. The ether was shown to be a form of matter—to be a highly-attenuated substance of enormous elasticity. The particles were shown to be exceedingly minute, but the velocities of the particles correspondingly great. A calculation of the density of the ether was also given, and the mass of the ether in the solar system approximately estimated. The paper also contained a criticism of the un-

dulatory theory of light, and pointed out the difficulties in the way of its final acceptance.

In answer to a remark from Mr. Richardson, Mr. Clark said, the ether being a cause sufficient to explain all the phenomena, and, there being no known facts inconsistent with it, there was therefore sufficient proof of its existence.

The President, in answer to a question respecting the impenetrability of atoms, said, he did not know of any proof that they were impenetrable. It had often occurred to him that the different chemical forms of the same substance may be combinations of the same element with ether.

In reference to the opinion that the mass of the ether moved, he supposed that it was not improbable that the ether permeated the masses of bodies.

ELEVENTH MEETING.

Eleventh Meeting, 26th January, 1889, the President in the chair.

Donations and exchanges since last meeting, 42.

Dr. Otto Hahn and Dr. Hugo Töppchen were elected members.

A letter was read from the Secretary of the Philological Section announcing the resignation of Dr. McCurdy and the election in his stead of D. R. Keys, B.A., as Chairman of that Section.

A communication was read from the Royal Academy of Sciences of Turin offering a prize to the scientific author or inventor, whatever be his nationality, who before the end of December, 1890, shall, according to the judgment of that academy, have made the most important and useful discovery, or published the most valuable work in physical and experi-

mental science, natural history, mathematics, chemistry, physiology, and pathology, as well as geology, history, geography, and statistics. The value of the prize amounts to 12,000 Italian lire, or about \$2,400. The prize will in no case be given to any of the national members of the Academy of Turin, resident or non-resident.

A letter was read from Mr. J. Hickson, general manager of the Grand Trunk Railway, in reference to the adoption of the 24-hour system. Mr. Hickson stated that he would rather not attempt to introduce the proposed system on the Grand Trunk Railway until the public have become more familiar with it.

Mr. David Boyle, Ph.B., curator of the museum, presented his report for the past year, enumerating a very valuable collection of archæological specimens recently added to the museum.

Rev. John McLean, M.A., Ph.D, read a paper on "The Blackfoot Confederacy."

He dealt with the history of the Confederacy, the contemporaneous Indian tribes, the mode of hunting the buffalo, and the extinction of the vast herds of buffalo that formerly roamed over the illimitable prairies of the Far West. A disquisition was given on the mythology and traditions of these people. Wonderful was their native religious system, with its elaborate ceremonial, prayers, sacrifices, and animistic beliefs. The physical characteristics of the tribes present in general a people of greater stature than the Wood Crees and Assiniboines, with arms and legs not fully developed. They have marriage customs similar to the Algonkin family, and engage in many kinds of amusements, nearly all of which are used for gambling purposes. The tribal laws are still in existence. They have also a political organization, with secret societies, and a system of telegraphy. There is a medical priesthood with initiation ceremonies, and some of the medicine men are proficient in surgery, besides having a good knowledge of herbs. The language is Algonkin but has an admixture of words from some other Indian language. A

valuable collection of articles in use among the Indians by which the paper was illustrated was presented to the museum of the Institute.

Mr. Arthur Harvey had lived among the Indians many years, and had found them honest, truthful people. Many of his happiest hours had been spent with them. A great difference existed between the Whites and Indians now, but if we went back to Homeric times we should find customs similar to those of the Indians of the present day. We would find the same intense religious feelings. Among the Indians we have the neolithic people. It seemed to be a necessity that the old civilization must pass away before the new. Now the Indians have become degraded, but they have become degraded by contact with the whites. We have only the residuum. All the best men have gone, and we have been the means of destroying them. He had listened to Mr. McLean with the deepest interest. He was glad to see that he had risen above all minor prejudices and recognized the common brotherhood of man.

Mr. Boyle enquired whether Mr. McLean had been keeping records of the myths found among these people, the relics of which exist in great number.

Mr. McLean had jotted them all down as he went through the camps.

Mr. Boyle was glad to learn that Mr. McLean had distinguished between myths that were pure, and those that had been impregnated with European ideas.

In answer to a question from Mr. Browning in regard to the mode of tracing relationships, Mr. McLean said there was a considerable mixture of customs in these matters. In the election of a chief no attention was paid to it.

TWELFTH MEETING.

Twelfth Meeting, 2nd February, 1889, the President in the chair.

Exchanges since last meeting, 46.

A communication was read from the Audubon Monument Committee, requesting the co-operation of the Institute in obtaining funds for the erection of a monument to John James Audubon.

Mr. W. A. Sherwood read a paper on "Colour in Nature."

He based his principles on the Newtonian theory, accepting red, yellow, and blue as the primary colours in preference to the theories of Helmholtz and Maxwell. Having treated of the influence of the primaries, secondaries, and tertiaries on each other through the prism and in nature, Mr. Sherwood discussed the cause of colour-blindness. This he ascribed to the constant use of black and white. The costumes of society are principally black and white, so is the bulk of our writing and nearly the whole of our reading. Mr. Sherwood asked, "Are we in these things acting in accordance with the design of nature?" He thought we were not, for in neglecting colour we were going in direct opposition to the lesson of the book of nature. As to the prevalence of colour-blindness, he cited the published results of the examinations of locomotive engineers, where men fully qualified in every other respect fail to secure the coveted posts owing to being unable to distinguish the coloured signals. Another illustration was derived from Philadelphia, that city of education and refinement, where one out of every five of the children was found to be colour-blind or compelled to wear glasses. The greatest painters the world has produced flourished in lands where colour is seen on every side. From these resources of nature the artists drew their inspiration, and not from shops of fashion. Colour-blindness is almost unknown in many countries, Japan, Spain, and Italy for example. Here we have unfortunately the reverse of this. Mr. Sherwood believed this accounted for the preference many persons

have for steel engravings and prints to paintings. This is false to the principles and teachings of nature. Those who favour engravings do so honestly because of their training in black and white, to which from childhood they have become accustomed. The children of the Quaker City had seen the sombre attire of their parents and even worn the same themselves, their city surroundings show the white marble residences and the black roadway, their books and writing are all black and white. Nature punishes all infringements of her laws; in this, as in other cases, the old truth holds good, "Be sure your sin will find you out." Mr. Sherwood concluded his paper, which was amply illustrated with diagrams, by a glowing description of an August sunset. "The day," said he, "is rich in colour, and after night spreads her mantle o'er the scene other worlds take up the colour which for the time we have lost. What is more glorious than colour? It is God's handiwork, and, like himself, is perfect. The representations of heaven are full of colour, and with more of colour in our daily surroundings life would be more cheerful."

THIRTEENTH MEETING.

Thirteenth Meeting, 9th February, 1889, the President in the chair.

Donations and Exchanges since last meeting, 69.

Mr. Daniel Lamb was elected a member.

Dr. G. Sterling Ryerson, read a paper on "Colour-Blindness in its Relation to Railway Employés and the Public."

Dr. Ryerson said that students of colour-blindness adopted the Young-Helmholz theory of colour as the simplest to work with, though much light had been thrown upon the subject by Sebruck and Stilling, of Germany, Prof. Wilson, of Edinburgh, and others. The theory of Helmholtz was that there were three optic nerves or fibres, one for red, one for green, and a third for violet. Colour-

blindness arose from the complete or partial paralysis of one of the three. It was met with as total and partial inability to distinguish colours, the causes being congenital and hereditary defect; severe illness or injury, particularly to the spine or head; and excessive smoking and drinking. The action of light, in the normal individual, on the three nerves is to produce the sensation of white light, under which the various colours had their proper effect on the organs of perception, but a colour-blind person saw greens and reds as greys. All nations exhibited a certain percentage of colour-blindness even the Indians, among whom some researches on this subject had recently been made. From 2 to 13 per cent. was the usual proportion. Colour-blindness generally existed side by side with a great keenness of perception as to light and shade, so that some engravers had been actually more capable owing to these personal conditions. As a rule colour-blind people were unconscious of their defective vision in this particular. Describing the tests for colour-blindness, Dr. Ryerson said that Dr. Stilling invented a method of working letters in worsted of various colours on a velvet ground. The simplest and best test was, perhaps, that of Dr. Thompson, of Philadelphia, which consisted of a row of different coloured skeins of worsted hanging from a rod, skeins of different colours being placed in the hands of the person suspected of colour-blindness, with the request to match them with those on the stick. It was most important that railway employes should be periodically and strictly examined with reference to this inability to see colour. They were frequently only able to judge of colour by intensity of light, and when this ability was interfered with by fog or steam the effects might be most disastrous. He thought reform was needed in the arrangements of the railway companies in this respect. A verdict of manslaughter should be returned against railway companies in case of accident through neglect in ascertaining whether their men could or could not judge of a danger signal; and he thought the Department of Railways and Canals ought to take the matter up. A proper system of examination for colour-blindness might be satisfactorily conducted by divisional superintendents. He was not seeking to put the companies in the hands of an army of doctors.

Discussion ensued, in the course of which the fact was brought out that researches in colour-blindness began about 100 years ago, the

first explorer in the field being Dr. Dalton, who was himself colour-blind, and who was once the amusing victim of his disability. As a Quaker, he was of course anxious to maintain a discreet soberness of tint in his attire; but after the degree of doctor was conferred upon him at Oxford, he walked about the streets of that ancient city and of London attired in his scarlet gown, under the impression that it was a neat grey. Persons in dry goods stores who were colour-blind generally distinguished the colours by their perception of light and shade, and by making a judicious and helpful arrangement of their stock. It was also suggested that some of the mysteries of colour exhibited by certain artists, as pictures, arose from partial colour-blindness, which deprived them of the power of seeing their productions as others saw them. Colour-blindness was a considerable disadvantage to a medical man, particularly in the case of disorders which exhibited their effects upon the skin, in determining the line of demarcation in gangrene, etc.

FOURTEENTH MEETING.

Fourteenth Meeting, 16th February, 1889, Vice-President T. B. Browning, M.A., in the chair.

Donations and Exchanges since last meeting, 55.

The Council reported the Election as Associates of C. R. Dent, C. H. Harvey, and Wm. Blackburn.

Mr. Kivas Tully, C.E., was elected an Honorary Member.

Messrs. John Notman, and James Bain Jr., were elected Representatives of the Institute on the Industrial Exhibition Committee.

Dr. A. M. Rosebrugh, read a paper on "Prison Reform."

It was moved by Dr. Meredith, seconded by Dr. Cassidy, and carried,

That the Institute concurs in the recommendation of the Prisoners' Aid Society, and deems it advisable that the Government appoint a commission to visit prisons and collect information for the guidance of the Government on the question of Prison Reform, and that the secretary send a copy of this resolution to the Government.

Dr. Meredith referred to the cheering fact that so many men of cultivated minds were devoting attention to the subject of Prison Reform. He thought that the consensus of opinion was with the conclusions at which Dr. Rosebrugh had arrived. He considered it as cruelty of the worst character to send young boys and girls to the County jails, where they would associate with the most hardened criminals. It was in truth sending them the high road to the gallows. He was of opinion that boys and girls under fourteen years of age should in no case be sent to the County jails. He thought that they should receive some corporal punishment before a special Magistrate and be dismissed.

Mr. Massie, Warden of the Central Prison, Toronto, said he fully agreed with Dr. Rosebrugh, in all his remarks. After eight years experience he was convinced that reform must commence with the County jails. It would take a long time to eradicate their evil influence. Some of the measures advocated by Dr. Rosebrugh may be considered as too radical, but he was convinced that they were in the right direction. He was glad to notice that crime had not increased in Canada. He referred to the too great severity of punishments at an earlier period, and mentioned his recollection of a circumstance that had occurred at the coronation of Queen Victoria, when a man who under circumstances of great want had stolen a sheet, was sent for ten years to Botany Bay. A very respectable woman who had reared a family of nine, had written to him about a boy of hers. He found the boy, who was very reluctant to see his mother. She had lost seven children, but she felt more trouble on account of the boy than for the loss of all the others. He enjoyed very much the reading of the

paper and hoped that it would be published in the public journals.

Dr. Cassidy was much impressed with the statements he had heard. He had learned much from Dr. Rosebrugh's paper. Not having devoted much time and independent thought to the consideration of the subject, he would not venture any criticisms on it. He was strongly opposed however to the enforced idleness of prisoners, and considered it of importance that they should be kept usefully employed. Some better employment should be found for them than trundling around filled wheel-barrows. In the case of a drunkard who was sent to prison, the man's labour should go to the support of his wife and children.

Mr. Elvins coincided with the views of Dr. Cassidy in regard to making the labour of the imprisoned husband help to support his wife and children who were the greatest sufferers.

Mr. Browning considered it hard that the labour of the prisoner should come into competition with that of the free labourer. He thought that it would be well if the police officers were not so anxious to make arrests.

Mr. Armstrong said that one object of Prison Reform should be to bring a number of young offenders to the cultivation of the land. This would relieve the artisan from the competition of prison labour.

Dr. Meredith said that the great object of the Industrial School at Mimico, was to instruct the boys in farming. He decidedly objected to penal labour. The great object of Prison Reform was to render them honest. They should be taught to regard labour as a privilege and a boon.

Warden Massie thought that a man who committed a theft should be imprisoned until he earned a sum sufficient to refund what he had stolen. The average expenses of the prisoner amounted to forty-seven cents per day. What he earned above the amount required for his maintenance, should be passed over to his family.

FIFTEENTH MEETING.

Fifteenth Meeting, 23rd February, 1889, the President in the chair.

Donations and exchanges since last meeting, 29.

Prof. Ellis read a paper on "Milk Analysis and Milk Standards," in the course of which he said that in the year 1874, Wanklyn published "A Practical Treatise on Milk Analysis."

In this little work he described the method which he used for the analysis of milk, and published a number of analyses made by himself of milk supplied to the London workhouses, and ten analyses of milk known to be genuine; and he there asserted that cow's milk never contains less than 11.5 per cent. of solids, and seldom so little as 12 per cent. Of these solids, the fat was the most variable. The solids not fat were very constant, and never fell below 9.2 per cent. In the same year the Society of Public Analysts was organized, and adopted the following "limits" for milk:—"Milk shall not contain less than 9.0 per cent. of solids and fats, and not less than 2.5 per cent. of butter fat. The method of Wanklyn came into general use in England, but was not adopted by the Somerset House authorities, nor did they commit themselves to the Society's limits. In course of time improved methods of extracting the fat were introduced, and it became evident that Wanklyn's method failed to get out all the fat. The last method of fat extraction is Mr. Adam's paper method, which has been adopted by the Society of Public Analysts and by the Chemists of the United States Agricultural Department at Washington. In this method the milk is sucked up by blotting paper, dried and extracted by ether in a special apparatus contrived for the purpose by Saxblet. The use of asbestos instead of paper has been recommended by Mr. Macfarlane, the chief analyst at Ottawa, and has been adopted as an alternative method by the Washington authorities. The more complete extraction of fat by these methods lowers the percentage of solids not fat, and the Society of Public Analysts has now fixed their limit at 8.5 per cent. of solids, not fat. From the results of a number of analyses of the milk of herds of cows in Canada, undertaken by authority of the Government in the

summer of 1887, by the public analysts, of which those from the Toronto district were made in duplicate by the chief analyst and myself with closely concurrent results, he using the asbestos and I the paper method, I am convinced that even this standard of 8.5 per cent. is too high. The average results for the whole Dominion were:—Solids, 12.48 per cent.; fat, 3.86 per cent.; solids not fat, 8.62 per cent. This average leaves but little margin for variation, and as a matter of fact, in many of the samples, the solids not fat fell below 8.5 per cent.

Dr. Cassidy asked what was considered a good percentage of fat.

Dr. Ellis answered 3.5 per cent. of fat. The minimum, he considered, to be about 1.5 per cent.; 2.5 per cent. is not uncommon. From a herd of cows the butter-fat may fall as low as 2.5 without there being any adulteration. He thought that a limit should be fixed by law at which milk should be sold. He had recommended in his report that if the milkman protested against the analysis, the analysis should be made from the milk of the cow. The cow that gave the best milk belonged to a man who took a pride in grooming his cows, keeping everything very clean and giving them good fodder.

The President remarked on the importance of milk analysis. In his own family he found sickness was caused by the use of the milk. The cows had fed on the banks of the Don, and typhoid fever had resulted.

A paper was also read on the "Detection of Methyl Alcohol in Commercial Spirits," prepared by Drs. Ellis and Babington. The authors show that the admixture of methyl alcohol with ethyl alcohol may be readily ascertained by Victor Meyers' vapour density apparatus, and propose this method as test for the purity of commercial spirits.

SIXTEENTH MEETING.

Sixteenth Meeting, 2nd March, 1889, Vice-President Browning in the chair.

Exchanges since last meeting: 38.

Mr. E. G. Hanning, C.E., P.L.S., was elected a member.

The following resolution reported from the Geological and Mining Section, was adopted and a copy was ordered to be forwarded to the Ontario Government :

In view of the great variety and undoubted value of the mineral resources of Ontario, and the necessity to the capitalist, scientist and prospector of having a typical collection of minerals to refer to in the capital of this province, it is highly desirable that the Government of Ontario make arrangements as soon as possible for a mineral museum at the new Parliament Buildings, or elsewhere, in Toronto, and in the meantime that temporary arrangements be made for a mineral museum at some suitable place in the city.

The following resolution was also passed :

That the members of the Canadian Institute desire to record their sense of the loss they have sustained in the death of George Paxton Young, M.A., LL.D., Professor of Metaphysics and Ethics in University College, Toronto, one of the most distinguished life-members of the Institute, whose high character as a man, attainments as a scholar, and success as an educationalist, will cause his name to be long held in grateful remembrance by all who had the pleasure of his acquaintance. His numerous papers in Mathematics and Philosophy, read before the Institute, are among the most valuable contributions to its "Proceedings;" and we hereby desire to tender our respectful sympathy to his relatives and friends in their great affliction.

That a copy of the above resolution be sent to the nearest relative of Professor Young.

Mr. Alexander D. Black read a paper on "The Genesis of the Heaven and the Earth."

SEVENTEENTH MEETING.

Seventeenth Meeting, 9th March, 1889, the President in the chair.

Exchanges since last meeting, 39.

Mr. C. W. Nash was elected a member.

Mr. A. F. Chamberlain read a paper by Mr. William Kennedy, on the "Formation of Valleys," which chiefly related to "The central basin of Tennessee, a study of erosion."

In the structure and formation of valleys, it was contended, there were laws as fixed as those to be found in any other division of geology, and as clear and readily understood when rightly interpreted. Valleys had been formed, and were now in course of construction, in various ways. They could be classified into four different kinds. A very insignificant agency might be the cause of the formation of an immense gorge, with its narrow channel, precipitous sides, and its rushing turbulent torrent as the beginning of a broad fertile valley, extending over many miles. Thus were formed the Grand Cañon and other similar gorges found in Colorado. They were not due to any great convulsions of the earth, such as earthquakes or volcanic eruptions, but were solely the effects of quiet, persistent, never-ceasing erosion. The paper then gave a very elaborate description of the great central basin of Tennessee, its geological structure and geological history. Then followed an account of the Appalachian coal field. The paper concluded with a description of the process of erosion and the agents by which it was effected.

Mr. Harvey thought that so far as the geology of the Middle States of the American Union was concerned, the paper just read was highly valuable, and it would be desirable to have it printed in the Proceedings. Passing over the geology of the Tennessee Basin, he wished to make some remarks on the erosion of valleys, especially on the erosion of

the valley of the Don. He referred particularly to a creek he passed almost every day, called 2nd or 3rd creek or Cemetery Creek. Of this creek he proceeded to show the process of erosion. From Bloor Street all the drainage runs north, the creek was on an average, 50 feet below the level of Bloor Street. It was about $2\frac{1}{2}$ miles long, and 300 feet wide. He had taken out one-eighth of an inch of sediment when dried from a gallon of water. During fifteen days, this creek flows down at the rate of four miles an hour, and every gallon of water carries down $\frac{1}{8}$ of a solid inch of sediment. Calculating from these elements, it would take 70,000 years to carry down the contents of the valley. This would be the age of the valley of the Don. He had observed several of these Don creeks and concluded that the average erosion of the valley was about the same as it is now. He thought there was no difference in the erosion of a creek where there were trees and of one where there were no trees. All things considered he thought the erosion was the same now as when there was a primeval forest.

The President thought that on some days there might be fifty times the volume of water carried down that Mr. Harvey had mentioned. It would then remove a considerable portion of the bank. This would shorten the time considerably. He had known at one flood, in the course of a few days eight inches of sand deposited over several acres of the Don Valley.

Mr. Elvins said: Of course all these valleys were cut through the drift. The Don itself was cut through the drift. In undisturbed portions of the drift, but by no means at the bottom of it were found portions of trees of the same species, as those now existing. These fossil remains being the same as the present trees, it seemed to him impossible that time required for the erosion of the Don could have been so long as that given by Mr. Harvey. It was not likely that it exceeded 6,000 or 7,000 years.

Mr. Harvey thought that some valuable results may be arrived at, and, recommended the appointment of a committee to investigate the subject.

EIGHTEENTH MEETING.

Eighteenth Meeting, 16th March, 1889, the President in the chair.

Exchanges since last meeting, 66.

Messrs. Arthur Harvey and D. B. Dick were appointed Auditors for the current year.

A communication was read from "La Societa Siciliana per la Storia Patria," Palermo, announcing the death of its distinguished President, S. E. Vincenzo Fardella, Marchese di Torrearsa, Cavaliere dell Ordine Supremo della SS Annunziata, ex-President of the Chamber of Deputies of Sicily, Senator of the Kingdom, and late President of the Senate of Italy. A resolution of condolence was adopted by the meeting, and ordered to be sent to the above mentioned society.

Dr. Otto Hahn read a paper on his trip through Canada in 1878, and the discovery of organisms in meteorities, with demonstrations by the microscope.

NINETEENTH MEETING.

Nineteenth Meeting, 23rd March, 1889, the Vice-President in the chair.

Donations and Exchanges since last meeting, 33.

Communications were Read from the Royal Society of Canada, respecting the Seventh Annual Meeting, and from

“La Societa Toscana di Scienze Naturali in Pisa” announcing the death of its President.

Mr. W. H. VanderSmisen, M.A., read a paper, prepared by Rev. Neil MacNish, LL.D., of Cornwall, on the authenticity of the “Sean Dana.”

The paper contained a defence of the literary honesty of the Rev. Dr. John Smith, of Kilbrandon and Campbelltown, Argyleshire, against the strictures of Mr. J. F. Campbell, compiler of “Leabhar na Feinne.” Dr. Smith published in 1780, twenty years after the appearance of Macpherson’s Ossian, a work called “Gaelic Antiquities,” containing “a collection of ancient poems translated from the Gaelic of Ossian,” etc., and in 1787 his “Sean Dana,” or ancient lays or poems, the original Gaelic of those translated in the first collection. Mr. Campbell casts doubt on the genuineness of these poems, and charges Dr. Smith with having given his own compositions to the world as those of Ossian. Against this charge Dr. MacNish’s paper defends the author, on the ground partly of the high character he bore, as evidenced by the testimony of the Highland Society’s report on the Ossian poems, but chiefly on the internal evidence of the poems themselves.

Mr. David Spence said that it was almost unnecessary to discuss the question. In his opinion the authenticity of the poem of the Sean Dana had been fully established. With regard to the authenticity of the poems of Ossian, Hector McLean one of the best Gaelic scholars, had come to the conclusion that the English poems which McPherson had collected were composed by McPherson himself. This did not agree with the opinion of certain German writers, but he (Mr. S.) had looked into the matter pretty closely and believed that McLean’s theory was true. The Gaelic poems were genuine. He had read over the different arguments and had no doubt of their genuineness. He came to the conclusion that McPherson had found those poems in the Highlands. The manuscripts from which the poems were taken were found in McPherson’s possession. Dr. MacNish considered that a great change had come over the Highlands since McPherson’s time. It

should be noticed that the clergy had set their minds against the people learning those tales. This had prevented many people who had learned them from repeating them. He had met with an old man who recited at great length many of those tales.

Mr. VanderSmussen asked whether the poems of Ossian were in accordance with the folk-lore and traditions of the people.

Mr. Spence said they contained many fragments that were so, though no doubt much amplified.

Mr. T. R. Rosebrugh, B. A., exhibited and explained a "New Trigonometrical Scale."

The principle of the new method of solving triangles depends upon the facts (1) that the difference of the logarithms of a side and of the sine of its opposite angle is a constant quantity for every triangle. (2) That when the indexes of a "chord operator" and scale have assumed a relative displacement corresponding to this value, the graduation marks of the three pairs of opposite sides and angles are found respectively at three pairs of coincident points. (3) To secure this the observer need only see that the condition that the three angles of a triangle are together equal to two right angles is satisfied by the scale indications. The "three point problem" may be solved by the scale with great facility without using equations; the operation being one of simple inspection to determine the point at which a certain condition is satisfied. In the case of right-angled triangles, the solution may be combined in one operation with that of changing the denomination in which the sides are measured.

TWENTIETH MEETING.

Twentieth Meeting, 30th March, 1889, the President in the chair.

Donations and exchanges since last meeting, 39.

Mr. Frank L. Blake was elected a member.

A communication was read from the President of the Committee of Organization of the International Congress of Maritime Affairs, to be held in Paris in the month of October; also from the Geological and Mining Section requesting the Institute to appoint a committee to wait on the Government with reference to the establishment of a Mineral Museum; also from the Antiquarian and Numismatic Society of Montreal enclosing a petition to the Hon. Minister of Finance for the Dominion of Canada, praying that the present duty of 15 per cent. *ad valorem* on printed books be changed to a specific duty of six cents per pound weight avoirdupois. It was resolved that the petition be signed and transmitted to the Government.

Mr. T. B. Browning, M.A., read a paper on the "French Shore Question."

He began by saying that he adopted the above title not because it described the subject matter he was to speak of accurately, but because the name was well known to the public, and brought the chief portion of the international complication into clear relief. He would himself prefer the heading The French North American Fisheries. From 1629 to 1886 no less than 20 treaty conventions or declarations had been made regarding them; many of the older arrangements had been superseded, and certain of the later had never been ratified. Three ideas seemed to run through them all, to be granted on both sides and to form, as it were, the underlying basis of negotiations: (1) That the fisheries are one and not several; (2) that they are the national property of Britain: and (3) consist only of the codfish and such minor species as are used for bait. The latest treaty is that of November 20, 1815, which confirmed the settlement of the previous year, 30th May, 1814, Article XIII. of which specified the places where the French exercise the rights granted them by previous agreements. These places are:

(1) The gulf of St. Lawrence, at a distance of three leagues from the coast of continent and islands, 15 leagues from Cape Breton, and 30 from Nova Scotia.

(2) The banks of Newfoundland, including the Great Bank in the North Atlantic.

(3) The islands of St. Pierre, Miquelon, and Langley.

(4) The western shore of the main island from Cape Ray northwards to Cape Bauld, thence south-eastwardly to Cape John, a distance or coast line (not including indents) of 398 miles, commonly called the French shore.

Mr. Browning gave a description of these several fisheries, their extent, mode of pursuit, the bounties paid, and the value of the fisheries, which he estimated at \$5,000,000 yearly. The ordinances of the French and English Governments were brought under review in their chief points, the former dating from Louis XIV., the latter from an order of the Star Chamber in the reign of Charles I., confirmed and amplified by statute 10 and 11, William III., c. 15. The result of both is to introduce and perpetuate a practical communism as regards land-holding, to prohibit settlement, the growth of private rights, and make this side of the Atlantic subservient to the interests of the other. Notwithstanding the stringent regulations imposed, a resident population and independent industries have sprung up, and now flourish both in Newfoundland and St. Peters. In regard to the French shore, Mr. Browning contended that the claim of France to exclusive right there received no countenance in the treaty of 1783, its declaration, in the statute passed in pursuance of it in 1788, the proclamation issued under that Act; nor from the prior treaties of 1763, 1713; and traced its growth to the French ordinances or regulations governing their own subjects. Under these the French shore is divided into "places" of the 1st, 2nd, and 3rd class, to correspond with the bounties given to vessels under the French laws. Within each class lots are cast as to which "place" any ship may have. This it holds with its fishing grounds or stages for five years, when another casting of lots is had, the practical outcome of which is an exclusive allotment for a term to individuals, and, as regards the nation, an exclusive use or enjoyment of the whole shore. The system is one of usurpation, amounts to national ownership, while the treaties affirm that at no time shall his most Christian Majesty or any of his subjects make any claim of right to Newfoundland, or any portion of it, and assert the sole ownership of Britain.

Mr. Browning enumerated particulars wherein the French had exceeded their treaty privileges, *e. g.*, (1) in parcelling out the shore, (2) exercising jurisdiction over British subjects, (3) prohibiting British sea fishing and prescribing conditions for it, (4) preventing the British from the river fishery and lobster fishery along shore. No magistrates were appointed in this district till 1878: no grants of lands or licenses for search for mines, till 1881; nor can the mines chiefly coal and copper, be worked, because the French forbid the use of the sea-board for shipping and other purposes.

Two conventions have been lately drawn to set at rest the questions raised—one in 1857, and the other in 1886, both of which were rejected by Newfoundland, the last on these among other grounds:— (1) The portions set aside for the exclusive use of France as “places,” are the best harbours or fishing grounds. (2) The ignoring of Newfoundland magistrates and the appointment of a naval board of two commanders in the English or French navy for the decision of disputes either of whom could act in the absence of the other. Newfoundland has no confidence in the French navy or its commanders. (3) Chiefly because it guaranteed to the French the right to take and purchase bait within English bounds. That nation has lately raised its bounties on the exportation of fish so as to equal the value of the article, and is by this means, underselling Newfoundland in the neutral markets of Spain and Italy. The convention rejected, the Island Legislature passed a bait law by which she seeks to counteract the force of the French bounties and preserve the bait fishes for her own use. According to the latest accounts, the law is working well, is enforced by a special cruiser, and is receiving the active support of the Home Government. Mr. Browning looks for the settlement of these difficulties, not to any change in the attitude of Newfoundland but in that of France. Her object in bountying these fisheries, the development or providing of material for a navy, is not attained; the experience of two centuries and the advice of her naval commanders are against it, while the perpetuation of the fishery regulations is detrimental to the best interests of all parties, English and French, and is against the trend of civilization on both sides of the Atlantic.

TWENTY-FIRST MEETING.

Twenty-first Meeting, 6th April, 1889, the President in the chair.

Exchanges since last meeting, 37.

Mr. O. J. Klotz was elected a member.

The President nominated the following Committee in pursuance of the Resolution passed at last meeting :—The Council of the Institute and Messrs. T. R. Clougher, John Notman, R. W. Phipps, A. Harvey, A. Rankin, Andrew Elvins, A. F. Chamberlain, and Dr. P. H. Bryce.

Dr. W. Canniff read a paper on "The Value of Sanitation."

Mr. Levi J. Clark read a paper on "The Sewage Problem in Toronto."

There are three plans at present before the citizens for the disposal of the city sewage. I shall describe them as : 1st, Messrs. McAlpin and Tully's ; 2nd, Mr. Sproatt's ; and 3rd, Messrs. Hering and Gray's. They all recommend two intercepting sewers, a high level one along the line of Gerrard street, and a low-level one along Front street, having a fall in each case from west to east, and extending from about Garrison Creek sewer to near the Don. Then Messrs. McAlpin and Tully recommend a connecting sewer joining Gerrard and Front at their eastern extremities, and continuing out into the lake to a distance of 4,100 feet, at a point east of the Eastern gap, to deep water, the discharge pipe to be a seven-foot steel pipe. The other two schemes recommend a continuation of the Gerrard street sewer across the Don and eastward to near Victoria park, where the sewage would be carried out into the lake through a six-foot pipe, by the second scheme 3,500 feet long, and by the third 2,000 feet long. In the second scheme the Don was to be crossed by a bridge 40 feet high, in the third the river was to be siphoned under. Both the latter schemes require the pumping up of the sewage from the lower level sewer into the high-level one. The first scheme requires no pumping, being a purely gravity scheme.

I have a strong objection to all these schemes with regard to the outlet pipes, being of the opinion that they would not operate satisfactorily, and also in case of the second and third schemes, with regard to pumping, which is nothing more nor less than a worthless, expensive nuisance. The outlet pipes lie under water, so that they flow always at the full, and knowing their size and the amount of sewage discharged through them, it can easily be told to the thousandth part of an inch what the velocity would be. I would call your attention to the following table, and challenge anybody to refute its accuracy. First through a seven-foot pipe:—

<i>Gallons.</i>	<i>Feet per Sec.</i>	<i>Miles per Hour.</i>
12,000,000	.577	.394
9,000,000	.433	.295
6,000,000	.288	.197
12,000,000 6 ft. pp.	.785	.534
8,000,000	.523	.356
4,000,000	.262	.178

We know that 12,000,000 gallons is the average amount of water that is pumped into the city per day, and allowing that it is all returned to the sewers, by reference to the above table it would only have a velocity of .577 ft. per second, less than seven inches, and in the six-foot pipe of about 9½ inches. But we know that much of the water pumped into the city never reaches the sewers: for instance, that which is used for watering lawns, sprinkling streets, building purposes, steam engines, etc., so that a safer calculation would be to take two-thirds or three-quarters of that amount. By reference to the table you will see that 9,000,000 gallons will only have a velocity of 5 1-5 inches per second, or less than 3-10 miles per hour.

Mr. Baldwin Latham, one of the most eminent English engineers, says in regard to self-cleansing sewers that, "In no case should the velocity be less than two feet per second, but in the generality of cases it should be much greater." Mr. N. Beardmore gives two and a-half as the least, Mr. Phillips gives the same rate, while Mr. John Neville says three feet per second is required. Now compare these rates with the actual facts as set forth by the table—velocity required two to three feet per second, actual velocity five to seven inches. We are told in the reports of these experts that the velocity in some parts of the system would be as high as five miles per hour, equal to 7½

feet per second, for instance on Gerrard street. Now what will be the inevitable result? The sediment and solids that are held in suspension while being rapidly whirled along Gerrard street at the rate of seven feet per second will immediately begin to subside when they reach the outlet pipe, and the velocity is reduced to five inches. The pipe will be choked and perfectly useless. What is needed is some means of keeping this outlet free and clear. I will explain my method for accomplishing this end, adopting the first scheme, namely: A high-level and a low-level sewer, and a connecting line down say Parliament street. I would have it, after passing Front street, turn to the east, pass under the bed of the Don (new mouth) to the angle formed by its bottom with the eastern bank, then follow this angle down as far as the river needs, dredging thence easterly and continue out to deep water. The object of this diversion is to interpose the waters of the Don between the discharge of sewage and the intake of water. This would give perfect security from contamination of the water supply. Along the line of the connecting sewer, somewhat to the south of King street, I would have a flushing tank situated, capable of holding say 400,000 gallons of sewage, arranged to discharge itself automatically wherever the sewage rose to a certain height. Now, estimating that one-half, 6,000,000 gallons, is collected in the high-level intercepting sewer, and passes out through the flushing tank, it would fill and discharge fifteen times in the twenty-four hours with a velocity of from 5 to 8 miles per hour, sufficient to sweep along whole bricks, stones, or cannon balls, and deliver them safely into deep water. Now considering that the entire system, as herein briefly described, can be constructed for about three-fourths of a million dollars, why should the people of Toronto throw away one and a half millions on a worthless scheme when they can get an efficient one for half the sum?

Mr. Kivas Tully thought that the Canadian Institute and the citizens of Toronto were much indebted to Mr. Clark for the clear way in which he had placed the subject before them. As to the difficulty in Tully and McAlpine's plan that Mr. Clark had referred to, he would see that it had been obviated. Mr. Tully showed how the difficulty was removed by an hydraulic slope. Any obstructions would be swept away into

deep water. He highly approved of Mr. Clark's plan of an Automatic Flushing Tank. This would secure a regular periodical flushing, the outlet pipe could be cleaned by natural means, as by showers. Mr. Clark's plan secured the cleansing of it by artificial means. Mr. Tully then referred to Mr. Miller's method of deodorizing the sewers. From what he had seen of it he thought that it was very practicable. The substances required could be procured in Devonshire, England.

Dr. Canniff referred to the saying that Doctors always differ, but the differences among Engineers surpass any thing among doctors. He asked whether there was not great danger of the contamination of the water from the Sewage as it passes along.

Mr. Tully thought that on the whole the proposal before the people was the correct one, and hoped that the By-law would pass.

Mr. Macdougall gave an explanation of the system in use in England.

Mr. Harvey asked whether the separate system with steel pipes in use in Europe could not be introduced here.

Mr. Macdougall said the difficulty would be in the great cost of it.

TWENTY-SECOND MEETING.

Twenty-second Meeting, 13th April, 1889, the President in the chair.

Donations and Exchanges since last meeting, 58; including 3 pamphlets and a copper axe and spear found on the north bank of the Kaministiquia River, by Capt. Smith, of Fort William, for which thanks were voted.

On motion of Mr. Williams seconded by Mr. Macdougall, Messrs. J. H. Pearce, W. E. Middleton, W. Brodie, W. H. Merritt, A. Harvey, J. B. Williams, A. Macdougall and Prof. R. Ramsay Wright were appointed a committee to see the Government in regard to the Algonquin National Park for the preservation of wild animals and natural forests.

Mr. L. J. Clark was elected a member.

Mr. Arthur Harvey read a paper on "Outlines of the Geology of the North-west of Lake Superior with special reference to the Silver District of Thunder Bay."

Mr. A. F. Chamberlain, B.A., read "A Second Contribution to the Bibliography of the Archæology of Canada."

The second "contribution" consists of about one hundred titles of papers, articles, and passages in works of various travellers and scientists referring to the archæology of the Dominion of Canada and Newfoundland, the first contribution containing about seventy such items. To the citations of titles are added brief notes of the contents and importance of the articles, etc. In the list of names figure very prominently Sir Daniel Wilson and Sir J. William Dawson; of the latter some eight and of the former some twenty articles are chronicled, besides their works "Fossil Men" and "Pre-historic Man," respectively.

The works of travellers afford many passages relating to archæology, etc., and when all have been examined the Bibliography will be approaching completeness. For the Eskimo we have the works of Ross, Parry, Richardson, Franklin, Hall, Schwatka, and many more, besides the recent investigators, Kumlein, Rink, Rae, Turner, Boas, etc. In Labrador we have the works of the Moravian missionaries, and Kohlmeister, Cartwright, Chappell, Dobbs, etc., besides the more recent explorers, Hind, Packard, Gordon and others. In Nova Scotia the labours of Rev. Geo. Patterson, whose collection of specimens is now in the museum of Dalhousie College, are especially valuable. In Montreal the results of the energy of Sir William Dawson are seen in the museum of McGill College. For Ontario,

Mr. D. Boyle's report just issued is of highest importance, besides which the (as yet unpublished, but most valuable) material of Mr. A. F. Hunter and Dr. Tachè is to be mentioned. The Manitoban region has received attention at the hands of Rev. Prof. Bryce, Mr. Chas. N. Bell, and Lieut.-Gov. Schultz. Dr. Geo. M. Dawson's valuable contributions relating to the Indians of Queen Charlotte's Islands, his papers on Jade in the North-West of British North America are the most important of the articles dealing with the archaeology of the British Columbian region; besides these we find much in the works of Grant, Mayne, Scouler, Wilson, Bogge, Sproat, etc., and the recent investigations of Krause, Deans, Boas, and others. The compiler of the bibliography will be especially grateful for references to the archaeological articles in local papers.

Mr. H. R. Wood, B.A., presented a paper on "The Silver Belt of The Kaministiquia."

TWENTY-THIRD MEETING.

Twenty-third Meeting, 28th April, 1889, the President in the chair.

Exchanges since last meeting, 48.

Mr. D. B. Dick having declined to act as auditor, Mr. J. B. Williams was appointed in his place.

Mr. J. C. Hamilton, M.A., LL.B., read a paper on "The Mound Builders of America."

He first described a site of a mound builders' old city, now a beautiful park, in Richfield township, Ohio, visited by him. Having fortunately remained in the possession of owners of means and taste many of the old landmarks yet remain. He then discussed the subject at length, taking first the remains found in Ohio, which was the central home of the race and had not less than 10,000 places where these people left traces of their former occupancy, of which

1,500 are enclosed earthworks. In New York state there are 250 enclosures. In an area of 50 miles on the borders of Iowa and Illinois there are 2,500 mounds, besides earthen enclosures. He quoted from various authorities as to the extension of the remains of these people even into Manitoba, and by the Saskatchewan and other water courses to British Columbia. He described the great works at Fort Hill, Fort Ancient, Newark, Cahokia, and elsewhere. He dwelt on the happy results that have followed at Marietta, Ohio, and some few other places where the remains have been preserved as far as possible intact. He showed diagrams of several mound works in Ohio and Indiana which added to the interest. He discussed the state of civilization and customs of these predecessors of the Indians, and analysed the various theories propounded by Count de Nadaillac, Sir J. Lubbock, Col. Charles Whittlesey, Sir Daniel Wilson, and other writers. He spoke of their inner life, their government, religion, dress, ornaments, etc. He found no traces of Georgite theories among them, considered that the government was patriarchal and tribal. The religion was like that of the Aztecs, with sacrificial rites and sun worship. As to their origin, he considered them not by any means the first race of men on this continent, but that they were akin to the Toltecs and Aztecs of America, and to the present Japanese, and so of a clearly Asiatic type. Referring to Nadaillac, Sir Chas. Lyell, and other authorities, he considered these people as a great and widespread nation, which occupied this continent for perhaps 2,000 years, but that some 1,000 years ago their distinct nationality was lost in contests with the Indian races, chiefly Shawnees and Cherokees, in the Ohio regions, which then overran the continent, amalgamated to some extent with them, but that the greater part of the Mound Builder race was driven to the South and became lost in the great Nahua nations, of whom the Aztecs were one. He drew a picture of the life of the people, and referred to the art of the archæologist, which respects not the tombs of the Pharaohs nor the graves of the proud old Peruvians and Mexicans, but has gathered as mummies and skeletons many such remains to be stared at by the curious in museums from Bulak to Central Park. He lastly depicted what may be found as to Canadian civilization after another score of centuries have passed, when some pundit from the then "Dominion of United Africa" or the "Japanese Republic"

shall drop down from his electric flying machine and inspect the remains of civilization of the Canadian Caucasian race.

A paper was then read by Ojijatekha on "Pagan Belief in Religion."

TWENTY-FOURTH MEETING.

Twenty-fourth meeting, 27th April, 1889, the President in the chair.

Exchanges since last meeting, 38.

The Council reported the election as Associates of H. C. Champ, Herbert C. Eddis, and Edmund Staunton.

W. H. Child and T. A. Staunton were elected members.

Capt. Stupart, R.N., read a paper on "The Flying Proas of the Ladrone Islands, and the Navigation of the natives of the Western Pacific."

FORTIETH ANNUAL MEETING.

Fortieth annual meeting, 4th May, 1889, the President in the chair.

Donations and exchanges since last meeting, 47.

George E. Lumsden was elected a member. Dr. Joseph Workman was elected an honorary member.

Sir Daniel Wilson announced that Mr. Sandford Fleming had authorized him to state that he had in 1853 insured his life for £1000 currency in favor of the Institute, and that he was making arrangements with the Insurance Company to have the amount paid over to the Institute at once. The cor-

dial thanks of the Institute were tendered to Mr. Fleming and a Committee appointed to prepare an appropriate resolution, which Committee subsequently reported the following —

The Canadian Institute recognizes in the gift now offered to it by Mr. Sandford Fleming a fresh and unexpected evidence of his kindly and generous heart, and of the deep interest he has always taken in the welfare of the Institute. A mere expression of thanks conveys but feebly the gratitude with which the Institute acknowledges its indebtedness to Mr. Fleming whose numerous contributions to its Proceedings have been crowned by the movement initiated by him before the Institute now leading to the adoption of a uniform system of time-reckoning over the whole world.

The Fortieth Annual Report was read and adopted, as follows :

The Council of the Canadian Institute has the honor to lay before its members its Fortieth Annual Report.

The Council has much pleasure and gratification in recording an increased interest in the work, and an extension in the influence and prestige of the Institute.

The movement for a universal system of time-reckoning, initiated by Mr. Sandford Fleming has spread far and wide. A deputation waited on His Excellency Lord Lansdowne in May of last year with regard to this subject, who was kind enough to bring the pamphlet on "Time-Reckoning" before the notice of the Secretary of State, through whom it was sent to all the colonial and foreign governments.

Cosmic or twenty-four hour time is being largely adopted on this continent ; inquiries have lately been received from the government of Hong Kong on this subject. The very enterprising kingdom of Japan has adopted the system as the basis of its time reckoning.

A clock marking cosmic time, the present of an American firm, has been in the reading room of the Institute for over twelve months.

The government of our Province paid the institute the compliment of placing one of its members, Mr. W. Hamilton Merritt, on the Royal Commission to enquire into the Mineral and Mining Resources of the Province. The report is of great value and will largely extend the development of our mineral resources.

The interest in the work of the Institute has not flagged during the past year, there have been 24 ordinary meetings at which 31 papers were read, and 36 meetings of sections at which 39 papers were read, or a total of 69 papers for the session.

The range and character of these communications have been fully equal to the standard of former years, they have been well and fully discussed. The average attendance at the meetings is in advance of last year. The attendance of members in the reading room has also increased.

The Council desires to record its high appreciation of the generosity of the Government in again placing the sum of \$1,000 at the disposal of the Institute, for the extension of archaeological research. Through the indefatigable exertions of the curator many valuable additions have been made to the museum from the Province and from the United States. The admirable arrangement of the specimens in the various cases, has greatly assisted the study of this important branch of our national history. It is gratifying to report that the museum has been visited by a large number of ladies and gentlemen, from many of whom valuable donations have been received.

The appointment of Mr. David Boyle, as representative of the Provincial Government at the Cincinnati Exhibition last year has been productive of much good to the interests he represented there, and has been the means of many valuable gifts being presented to our museum. The archaeological report for 1888 has already appeared as an appendix to the report of the Minister of Education for last year.

The thanks of the Institute are due to Mr. Sandford Fleming for his exertions in procuring an interesting and valuable present from the Grand Trunk Railway Company of a portion of the first sod of the Northern Railway, cut on the 15th October, 1851, by Her Excellency the Countess of Elgin and Kincardine, and the bottle used on 14th January, 1853, to christen Collingwood harbor, and an extract from the *Globe* of the 26th January, 1863, giving an account of these relics and other interesting matters.

The members of the Photographic Section, desiring to extend their work in a more practical manner, resolved to form a Photographic Society having wider scope than they believed would be offered by

union with the Institute; they have in consequence withdrawn from the Institute. The Council regret this action.

The Biological and Natural History Section continues to make its influence felt, and deserves the thanks not only of the Institute but of the citizens at large for its recent successful remonstrances against the destruction of the purely natural beauties of High Park.

The list of donations and exchanges has increased; the library has received many valuable additions. This department is carefully attended to by our energetic librarian; over 300 volumes were bound this year; extra accommodation in the library is an urgent necessity.

The treasurer's statement shows a satisfactory balance at the credit of the Institute, and the increased interest taken in the Institute by the comparatively small number of members in arrears.

The membership has been increased by 22 elections during the past session. The Council after much careful thought determined to make a thorough examination of the list of members and enforce the rules against members in arrears who refused to make any settlement. *The list now submitted is more complete than any hitherto presented to the Institute, and represents truly the actual membership: the Council would urge on the Institute the importance of adhering to the step now taken, and enforcing the rules against members in arrears, as it is only by this means that membership in the Institute will become of value.*

The Council endorses the remarks of the auditors that a proper valuation of the assets of the Institute should be made.

During the past year the Institute has lost by death two distinguished life members, the Rev. Walter Stennett, of Cobourg, and Prof. G. Paxton Young. *Apart from his special attainments in the department of Mental and Moral Philosophy, Prof. Young was a mathematician of very high order; some of his later papers read before and published in the Proceedings of the Institute, placed him in the foremost ranks of mathematicians.*

In recognition of his valuable services at the inception and in the early days of the Institute, as well as his honourable professional career, Mr. Kivas Tully, C.E., (who was our first Secretary) has been elected an honorary member.

Your Council is much gratified to announce that the invitation of the Institute to the American Association for the Advancement of Science to hold its next meeting in this city has been accepted, and there are bright prospects of a very successful meeting.

Following up the memorial of January 1888, meetings have been held with the Honourable Commissioner of Crown Lands with reference to setting aside a tract of land for the preservation of the forests and wild animals in this Province. At his suggestion a memorial with a sketch map showing an area which could be made available for such purposes is being prepared.

The reports of the various Sections are appended. They all report satisfactory progress in their several branches.

All of which is respectfully submitted.

CHARLES CARPMAEL,
President.

APPENDIX II.

MEMBERSHIP.

Number of Members at 1st April, 1888,—309.		
Honorary Members	7	
Life Members	10	
	17	
Ordinary Members :		
1. Who have paid their subscriptions to 31st December, 1889, including new members	141	
2. Who have paid their subscriptions to 31st December, 1888..	65	
3. " " 31st December, 1887..	14	
4. Who are two years and more in arrears	3	
	223	
	240	
5. Losses through death and withdrawals.....	36	
6. Names struck off the roll for non-payment of arrears	23	
7. Names placed on suspense list for no. payment of arrears ..	10	
	69	
	309	

Associates		32
8. Members elected during the present session who have paid their annual subscription	15	
9. Members elected during the present session who have not yet paid.....	7	
		<u>22</u>

APPENDIX II.

TREASURER IN ACCOUNT WITH THE CANADIAN INSTITUTE FOR THE YEAR
ENDING MARCH 31st, 1889.

To Summary:—

“ Amount received from building fund	\$ 110 11
“ “ “ in Imperial Bank	163 56
“ Cash on hand	9 20
“ Annual subscriptions.....	809 75
“ Rents	233 50
“ Government Grant.....	1,000 00
“ Journals sold	15 65
“ Periodicals sold	9 49
“ Biological Section	50 00
“ Woodcuts	4 75
“ For Conversazione of 1886	2 00
“ Interest	60
	<u>\$2,408 61</u>

By Summary:—

“ Salaries.....	\$ 370 50
“ Printing Journal.....	688 67
“ “ Miscellaneous	39 25
“ Stationery	45 53
“ Postage.....	129 26
“ Freight and express charges....	23 27
“ Repairs.....	56 96
“ Gas	32 88
“ Water	24 00
“ Periodicals	123 21
“ Furniture	6 00
“ House cleaning	99 30
“ Fuel.....	78 25
“ Taxes	9 36
“ Phonographic Exhibition	15 00
“ Architect	50 00

APPENDIX.

49

Customs charges and brokerage	3 00
" Advertising	7 75
" Sundries	19 35
" Interest	212 00
" Promissory note.....	200 00
" Balance in Imperial Bank.....	137 00
" Cash in hand	38 07
	<u>\$2,408 61</u>

Examined and found correct.

(Signed) ARTHUR HARVEY, } Auditors.
 J. B. WILLIAMS, }

JAMES BAIN, JR., IN ACCOUNT WITH ARCHEOLOGICAL GRANT.

To Government Grant for 1888-89.....	\$1,000 00
" Balance forward.....	35 45
	<u>\$1,035 45</u>
By Purchase of specimens	\$ 550 00
" " cases	91 65
" Engraving and printing of specimens for Report.....	102 50
" Travelling expenses and remuneration of Curator	255 67
" Bank charges	38
" Balance on hand.....	5 25
	<u>\$1,035 45</u>

Examined and found correct.

(Signed) ARTHUR HARVEY, } Auditors.
 J. B. WILLIAMS }

ASSETS AND LIABILITIES.

ASSETS.

Building.....	\$11,500 00
Warehouse	720 00
Ground	3,000 00
Library	5,000 00
Specimens	2,000 00
Personal Property	1,000 00
	<u>\$23,220 00</u>

LIABILITIES.

Mortgage No. 1, due 1892.....	\$ 3,000 00
“ “ 2, “	1,000 00
Balance in favor of the Institute.....	19,220 00
	\$23,220 00

The Auditors having carefully gone over the accounts and vouchers beg to report :

That the cash accounts kept by Mr. Young are in perfect order.

That the distribution into the various heads of income and expenditure, made by Mr. Bain, the treasurer, corresponds therewith.

Your Auditors think it would be wise to have a proper valuation made of the various assets of the Institute—Library, museum, and building, and to procure by this means a reliable statement of its Assets and Liabilities—and recommend the subject to the consideration of the Council.

(Signed)

ARTHUR HARVEY, }
J. B. WILLIAMS, } *Auditors.*

Canadian Institute, Toronto,
April 25, 1889.

Classification of papers read, by subjects:—Anthropology, 1; Archaeology, 3; Astronomy, 2; Chemistry, 2; Economics, 1; Geology, 3; History, 2; Mathematics, 1; Miscellaneous, 3; Philology, 3; Political Science, 1; Physics, 3; Physiology, 1; Sanitary Science, 2; Social Science, 1; Sociology, 2; total, 31 papers read at 24 meetings.

Read at the meetings of the Biological Section, 22 papers; Architectural Section, 3; Geological and Mining Section, 5; Philologica^l Section, 9 papers; total, 39. Making in all 70 papers.

LIBRARIAN'S REPORT.

To the Council of the Canadian Institute :—

The statement for the Library for the year 1888-89 is as follows :

I. Donations to the Library \$5

II. Exchanges :

1. Canada	138
2. Great Britain and Ireland	451
3. United States	569
4. Mexico and South America	43
5. Austro-Hungary ..	150
6. Belgium	54
7. Denmark	4
8. France and Algeria.....	396
9. Germany	106
10. Italy	146
11. Netherlands	25
12. Norway	30
13. Portugal.....	7
14. Russia	37
15. Spain	18
16. Sweden	18
17. Australia	31
18. British India and China.....	34
19. Japan and Java	20.

Total 2,307

III. New exchanges 39

IV. Total number of exchanges..... 435

V. Periodicals subscribed for, same as last year with the exception of *Hardwicke's "Science Gossip,"* which has been discontinued 31

Total amount of these 769

VI. Number of volumes bound during the year..... 306

VII. Number of publications taken from Reading Room and Library during the year..... 1,900

All of which is respectfully submitted.

GEO. E. SHAW,
Librarian.

REPORT OF THE BIOLOGICAL SECTION.

The Section has to report a year of progress and prosperity.

The regular fortnightly meetings have been held throughout the year, and the attendance has been satisfactory.

A schedule is attached shewing the papers read—22 in all.

As this section is to a large extent educational in its objects it is not required that the papers read should be the result of original research, and we would welcome the assistance of some of the many members of the Institute who are well qualified to give us much information that would both interest and instruct.

The microscope which our last report mentioned as having been purchased but not then arrived has been received and by its means many points in the papers read before the section are illustrated and the enthusiasm of those members engaged in the study of minute forms of life has been quickened. The microscopical curator will always be ready to attend meetings of the Institute, or other sections, when the use of the instrument is desired. A small collection of slides has already been secured for the Section's cabinet, and more are expected.

Two years ago when the Institute contemplated the completion of the museum upstairs this Section became responsible for two years for the interest on the mortgage of \$1,000 which was given to raise the necessary funds, and we are glad to say that this has been paid, and the Section is now free from debt or liability.

Not much progress has been made in our department of the museum. We merely desire to draw attention to the fact that biological specimens cannot be mounted without money and that our Section has absolutely no source of income except grants from the Council of the Institute.

W. E. MIDDLETON,
Secretary of Biological Section.

The officers for next year are: James H. Pearce, President; W. E. Middleton, Secretary.

SCHEDULE OF PAPERS.

1	E. E. Thomson	<i>Canadian Birds.</i>
2	Rev. K. F. Junor	<i>Echini.</i>
3	J. H. Pearce	<i>Inaugural Address.</i>
4	M. Chamberlain	<i>Canadian Birds.</i>
5	J. Noble	<i>Mosses (First Paper).</i>
6	"	" (Second Paper).
7	Wm. Brodie	<i>Parasites of Potato Beetle.</i>
8	Wm. Brodie	<i>Leptothrips Gramineæ.</i>
9	J. H. Pearce	<i>Flowers (First Paper).</i>
10	"	" (Second Paper).
11	W. E. Middleton	<i>Fresh Water Sponges.</i>
12	J. B. Williams	<i>Birds Observed in 1888.</i>
13	Wm. Brodie	<i>Snakes.</i>
14	W. E. Middleton	<i>Structure and Fructification of Ferns.</i>
15	C. Armstrong	<i>Canadian Ferns.</i>
16	Wm. Brodie	<i>Relation to Environment.</i>
17	E. E. Thomson	<i>Winter Birds of Toronto District.</i>
18	J. H. Pearce	<i>Moulds and Kindred Fungi.</i>
19	W. E. Middleton	<i>Microscopic Mounting.</i>
20	James Noble	<i>Plant Evolution.</i>
21	James Noble	<i>Plant Development.</i>
22	A. Elvins	<i>Volvox Globator.</i>

REPORT OF THE PHILOLOGICAL SECTION OF THE
CANADIAN INSTITUTE, APRIL 6, 1889.

Gentlemen,—I have the honor to present for your consideration the Third Annual Report of the Philological Section, for the year ending March 31, 1889. During the session the Section has met regularly on the second and fourth Tuesdays of each month.

Following is a list of papers read at the various meetings :

- (1) April 10, 1888—"A Chart of Elocutionary Drill." By T. B. Brown, M.A.
- (2) April 24, 1888—"Volapük, the new World-Language." By D. R. Keys, B.A.
- (3) April 24, 1888—"On some words of Indian origin in the French Canadian Dialect and Literature." By A. F. Chamberlain, B.A.
- (4) November 13, 1888—"The language of the Mississaguas of Scugog, with special reference to Sematology." By A. F. Chamberlain, B.A.

- (5) November 27, 1888 — "The Semitic Vowels." By Rev. Pro McCurdy, Ph.D.
- (6) January 8, 1889—"The Origin and Development of Grammatical Gender." By A. F. Chamberlain, B.A.
- (7) January 22, 1889—"Language Learning and Language Teaching." By William Houston, M.A.
- (8) February 12, 1889—"The Gaelic Vowel System." By David Spence, Esq.
- (9) " 26, 1889—"The Gaelic Consonants." " " "

During the month of March the section continued the investigation of the Gaelic Language introduced by the papers of Mr. Spence, of whose valuable assistance it was enabled to avail itself. On the 8th January, 1889, the Rev. J. F. McCurdy, Ph.D., resigned the office of Chairman of the Section, to which position Mr. D. R. Keys, B.A., was duly elected.

The officers for the ensuing year are :—Chairman, D. R. Keys, B.A. ; Vice-Chairman, Jno. Squair, B.A. ; Secretary, A. F. Chamberlain, B.A.

(Signed) A. F. CHAMBERLAIN,
Secretary Philo. Section, C. I.

The Council of the Canadian
Institute, Toronto.

REPORT OF THE GEOLOGICAL AND MINING SECTION OF THE CANADIAN INSTITUTE FOR 1888-9.

To the President and Council of the Canadian Institute :

GENTLEMEN,—Very much interest continues to be manifested by the members of this section in the study and discussion of those subjects which form the specialty of our organization.

At the various meetings which have been held during the year the attendance has been good.

At the first meeting of the sessional year communications were read from the Department of the Interior referring to measures taken by that Department for collecting and publishing statistics and other information on the mining and metallurgical interests of the Dominion, and enclosing a copy of an Order-in-Council on the same subject, ap-

proved by the Governor-General in Council; also referring to an interview had by the Chairman and Secretary of this Section with the Deputy Minister of the Interior on the subjects of (1) Prompt publication of the Survey's reports on mining affairs; (2) Coöperation of the Dominion and Provincial Governments in the collection of such information, and (3) Legislation making the furnishing of information compulsory.

In thus directing the attention of the authorities to an important subject, the section has been able to do good work, and recent publications of reports justify the action taken by this section.

A number of interesting papers have been read during the year, and the discussions arising therefrom have aided materially in familiarizing many with facts relative to the minerals and mineral resources of our Province.

The Section has also taken much interest in the project of establishing in this city a Provincial Mineralogical Museum, and trusts that its efforts in this direction may yet be crowned with success.

Officers have been elected as follows for the current year :

Chairman—W. Hamilton Merritt.

Vice-Chairman—Arthur Harvey.

Secretary and Curator—David Boyle.

Managing Committee—R. W. Phipps, A. F. Chamberlain, A. Elvins, John Notman, P. H. Bryce, M.D.

The present year is confidently regarded by the section as likely to prove more than usually profitable to the section in all that relates to the investigation and study of geology and mining in Ontario.

W HAMILTON MERRITT,

Chairman.

ARTHUR HARVEY,

Vice-President.

DAVID BOYLE,

Secretary.

PAPERS READ DURING THE SESSION.

Mr. Harvey—"On Certain Lacustrine Deposits;" "On the Synclinal Trough of Lake Superior."

Mr. Merritt—"The Iron Ranges of Northern Michigan and Minnesota;" "Laurentian Formation of New Jersey, with Relation to the Iron Mines therein."

Mr. Mills, of St. Ignace, Michigan—"Iron Smelting Furnaces."

REPORT OF THE ARCHITECTURAL SECTION FOR
SESSION OF 1888-89.

GENTLEMEN:—The members of the Section have met fortnightly during the Session, the meetings being chiefly occupied by instructive and interesting discourses, theoretic and practical, delivered by some of the prominent Architects and Master Mechanics of this city, who commended and encouraged the objects and motives of the Section, promising and offering us their entire sympathy and support.

The following were among the papers read and debated upon, being subsequently published in the *Canadian Architect*:

"The responsibilities of Students to their Profession," by R. Gambier Bousfield, A.R.I.B.A.; "Subsoil Irrigation," by E. Burke, Architect; "A Discourse on Carpentry," by R. Wilson.

Besides the papers and addresses, competitions were engaged in in designing Bay windows, Oriel windows, Entrances, etc.

At the close of the Session the following officers were elected: Robert Dawson, Chairman; Chas. D. Lennox, Treasurer; J. Fras. Brown, Secretary.

Yours verily,

J. FRAS. BROWN, *Secretary*.

REPORT OF THE SOCIOLOGICAL COMMITTEE.

The Committee on Sociology begs leave to present its report for the year 1888-9.

1. Your Committee was constituted at the first meeting of Council this year and at once procured a circular, which appears in the last *Fasciculus* under the heading "Sociological Circular," to be drawn up, printed and distributed chiefly to the following classes of persons :

(1) Indian agents, farm instructors, inspectors, teachers in Indian school in Ontario, Quebec, New Brunswick, Nova Scotia, Prince Edward's Island, Manitoba, the North-West Territories and British Columbia.

(2) Magistrates, inspectors of North-West Mounted Police, registrars, clerks of the peace. members of Council in North-West.

(3) Missionaries of the leading churches : Church of England, Roman Catholic, Presbyterian, Wesleyan.

More than a thousand copies have been distributed, so that your Committee is of opinion that the circular has found its way to most persons in the Dominion who are interested in Indian questions.

2. Your Committee has received material assistance from the Hon. Edgar Dewdney, Superintendent-General of Indian Affairs for the Dominion, the Hon. A. S. Hardy and the Hon. G. W. Ross, Ministers respectively of Crown Lands and Education in Ontario ; is deeply indebted to the newspapers, educational, religious and legal press of Canada for bringing the subject to the attention of the public, and for extended and favorable notices of the Committee's work ; also to the following periodicals : Magazine of Western History, Popular Science Monthly, Journal of Anthropology of the United States, Historical Review and Law Quarterly of England.

3. At the request of your Committee the Canadian Pacific Railway has kindly consented to carry archæological, geological and natural history specimens free of charge for the Institute.

4. The publication of the Indian Treaties of Canada and the Provinces has engaged the attention of your Committee. The Council and Institute will, no doubt, be pleased to learn, from the accompanying

letter of Mr. Van Koughnet, that this important work is under way and will shortly be completed. The correspondence on the subject is herewith submitted. Copies of the Dominion Reports on Indian Affairs from 1875 up to and inclusive of 1888 have been received for the use of the Institute, for which your Committee has duly returned its thanks to the Superintendent-General.

5. In reply to the circular a number of letters and abstracts have been received, among them

(1) A short abstract from the Rev. T. S. Cole, B.A.

(2) An interesting letter from Inspector A. Bowden Perry of Prince Albert, North-West Territories, which your Committee begs to submit to the Editorial Committee for publication, together with a detailed paper on

(3) "The Western Déné," by the Rev. A. G. Morrice, O.M.

A number of other papers are promised, principally by reverend gentlemen whose duties bring them into direct contact with the Indian population of Manitoba and the North-West.

6. Your Committee begs leave to reserve such remarks of a sociological nature as it may desire to make for the separate papers as they appear, suggests that the circular be re-issued with such alterations and additions as may seem proper, and entertains the hope that the success which has accompanied its efforts this year will be redoubled in the year to come to the common benefit of the Institute, its members and the country.

All which is respectfully submitted on behalf of the Committee.

T. B. BROWNING,

Toronto, May 3, 1889.

Chairman.

The election of Officers for the ensuing year resulted as follows:

President--Charles Carpmael, M.A.

Vice-President--T. B. Browning, M.A.

Treasurer--James Bain, Jr.

Editor—George Kennedy, M.A., LL.D.

Curator—David Boyle, Ph.B.

Secretary—Alan Macdougall, M. Inst. C.E.

Librarian—A. F. Chamberlain, B.A.

Members of Council—W. H. Ellis, M.A., M.B., Alex. Marling, LL.B., G. E. Shaw, B.A.

The following papers were presented and taken as read :

“The Western Dénés,” by Rev. A. G. Morrice, O.M.

“The Indians of Canada,” an introduction to the work of the Sociological Committee, by T. B. Browning, M.A.

It was resolved that the thanks of the Institute are due to the newspapers of the city of Toronto, especially to the *Mail* and *Empire* for the space which they have so freely given to its proceedings, and for the extended notices of the meetings which have so regularly appeared in their columns.

SOCIOLOGICAL CIRCULAR.

PART I.—SOCIOLOGY.

SIR,—The Canadian Institute is desirous of collecting and incorporating in its PROCEEDINGS reliable data respecting the political and social institutions, the customs, ceremonies, beliefs, pursuits, modes of living, habit, exchange, the devolution of property and office which obtain among the Indian peoples of the Dominion, and of enlisting your voluntary coöperation in the work. It feels that this department of research has not been so fully cultivated in Canada as its importance demands, fears that the opportunity of gathering and carefully testing the necessary facts may with the advancing tide of European civilization soon pass away, and is of opinion that much light may be cast upon the genesis and growth of government as well as upon legal, sociological and economic thought by an accurate study of our Indian tribes in their existing conditions and organizations.

The Institute, without desiring to contract the field of observation, begs leave to direct your attention to the following matters:—

(1.) The basis of family or tribal organization, *e.g.*, whether it be purely personal, or partake to any extent of territorial attributes; the received mode of ranking and tracing relationships, paternal, maternal, or both; with a table of degrees, if possible, of agnates and cognates.

(2.) Adoption, its kinds, ceremonies and formulæ, the extent of its use, and the particulars in which it modifies the family, gens, tribe, etc.

(3.) The rules and practice which govern the contracting, maintaining and dissolving of marriage; the degrees of prohibition; exogamy and endogamy; the effect of marriage on the status of woman, her position upon divorce, etc.

(4.) Grades of persons of both sexes apart from office, free and slave; to what extent mature children of either sex are the subjects of rights; the age of enfranchisement, if any.

(5.) The character of parental power, paternal and maternal; its extent over persons and property in matters civil and criminal; exceptions to it.

(6.) Offices, their kinds, the powers annexed to them, the terms for which and on which they are held; the mode of succession, *e.g.*, general election, election by a few, election within a group, inheritance, etc.

(7.) Assemblies or councils and the questions treated at them; how and by whom they are summoned; in whom resides the right of debate and franchise in the several assemblies of the family, gens, band, tribe, or nation.

(8.) Property, its admitted classes inside the family and tribe; joint proprietorship how acquired, held, managed, aliened; whether common ownership is acknowledged, and in what respects it is distinguished from joint ownership; whether private property is allowed; if so, how acquired, enjoyed, transferred, or lost; whether succession to it is permitted; if so, within what degrees; if not, how it is disposed of, *e.g.*, buried with body on death of owner, burnt, or otherwise destroyed.

(9.) Division of labor and duty, civil and military, and how apportioned, *e.g.*, to chiefs, sub-chiefs, ordinary male members, ordinary female members, immature children; methods and extent of production, modes and measures of distribution, the means of support of family or tribe, the interior economy of family and gens or band; the modes of bargain and sale in use; by whom conducted; the use of gifts.

(10.) The settlement of disputes or conflicting claims as between (*a*) members of same sub-family, (*b*) family, (*c*) different families or sub-families, (*d*) bands, groups or gentes, (*e*) tribes, (*f*) nations; in whom resides the civil and in whom the criminal power, by tradition or custom; how and by whom dooms are pronounced and inflicted; whether punishments as between the tribes are corporate or individual; the compounding of crimes and offences, *e.g.*, murder, theft; to what extent the bond of blood-feud binds; ostracism, surrender of offender, death penalty; in what cases practised; the effect of vows upon the performance of contract.

(11.) The making of inter-family and inter-tribal arrangements, *e.g.*, treaties as to boundaries, peace and war, sale and purchase; the solemnities observed among larger and smaller groups.

(12.) The cultus and sacrifices which obtain in sub-families, families, totem, etc.; moral or religious code which accompanies them; the form and purpose of the different tribal or inter-tribal ceremonies in use, *e.g.*, dog-, sun-, thirst-dance, etc.

(13.) Death and birth rates; effects of miscegenation.

(14.) Practice in cases of burial, its rites.

(15.) Border civilization, its effect upon the beliefs and moral conduct of Indian peoples.

(16.) The influence of territorial reserves, outside jurisdiction, education and support upon the Canadian Indians.

PART II.—PHILOLOGY.

LEXICAL.

(*a.*) Vowel and consonant sounds, their classification, the predominance of vowels over consonants, or consonants over vowels; the variation of vowels or the gliding of one into another, *e.g.*, O into A, A into E; the transmutation of consonants *e.g.*, L into N or R, T into D,

D into TH, P into B, B into F or V, G into K, K into Z, or, inversely, aspirate into medial, medial into thin; at different periods or in cognate words of different dialects of the same language.

(b.) Are roots monosyllabic or polysyllabic; what part particles play in the formation of words and whether and to what extent reduplication is used as a means of compounding?

(c.) Whether the language is agglutinative or inflexive; if inflexive, how? Examples of formations.

GRAMMATICAL.

(d.) The parts of speech which admit of gender, number, case; their formation, kinds, (*e.g.* animate or inanimate) with examples or paradigms. Do non-verbal adjectives obtain; if so, do they admit of inflexions? The classes of pronouns in use. Are personal pronouns distinct from, infixed in, prefixed or suffixed to the verb?

(e.) Conjugations, forms (negative and affirmative) voices, moods, tenses, numbers, persons of the verb; the position which its radical, personal and modal elements take; the extent and purpose to and for which participles are used; adverbial forms how derived; whether the reduplicative, initiative and final elements of the verb are infixed in, prefixed or suffixed to it, separated from it or altogether absent.

SYNTACTIC AND GENERAL.

(f.) What regular place (if any) each word or part of speech occupies in a sentence?

(g.) Is the verb the predominant element in the language? Do nouns and verbs expressive of collectivity or abstract qualities obtain? Examples.

(h.) Do fine distinctions abound in the language or are they wanting? A list of idiomatic peculiarities.

(i.) A list of simple numerals, names of days, moons, feasts, common plants and vegetables, animals, articles in general use, the more evident planets, for comparative purposes in tracing the relationship of languages and migrations of peoples.

(k.) Contributions to the folk- or myth-lore of the Indian tribes.

(l.) Sign language and mode of telegraphing.

The Institute will be happy to receive and give its best attention to papers upon any and all the above, or such other subjects allied to them as may seem to you important.

It would appear from reports published in the newspapers that in the Province of Ontario, in the other Provinces and the Territories of the Dominion, a considerable quantity of valuable information concerning our Indian people is reduced to writing, but is not given to the world because no proper channel has been established for its dissemination. This Institute desires to draw these scattered rays to a focus for the benefit of students at home and abroad; and believes that investigators will find in its PROCEEDINGS (now circulating among members in Canada, 300, foreign societies and institutes, 400,) that avenue of communication of which they have been so long in need. Proprietary rights in the papers may be reserved.

For some years the Institute has given special attention to collecting and classifying specimens of natural history, geology, and Indian archaeology which, according to the custom of the Institute, are duly inscribed with the names of the donors. Its museum includes many very rare and valuable specimens which are open for inspection and study every lawful day from 1 p.m. to 6 p.m. It is the desire of the Institute to increase its collection in all departments, enhance its public usefulness and render it worthy of the Dominion as a national institution. Through the liberality of the Canadian Pacific Railway Company, the Institute is enabled to make announcement to donors and intending donors that specimens for the museum will be carried over the Company's line free of charge in packages suitably packed for freight.

It is particularly requested that packages of specimens for transmission by rail, papers, abstracts, communications in or pertaining to the matters of this circular be directed to

The Chairman of

THE SOCIOLOGICAL COMMITTEE

Canadian Institute,

58 Richmond Street East,

Toronto, Ont.

On behalf of the Committee,

T. B. BROWNING M.A.

Chairman.

Toronto, August, 1889.

THE CENTRAL BASIN OF TENNESSEE.

A STUDY OF EROSION BY WILLIAM KENNEDY.

VALLEYS AND THEIR FORMATION.

How are valleys formed? Have they no rules guiding their structure? or are their architecture, their form, their outlines and position or even their existence merely matters of chance and governed by no fixed laws?

In their structure and formation there are laws as fixed as those to be found in any other division of geology and as clear and readily understood when they are rightly interpreted.

Valleys are depressions in the surface of the plane of the globe in much the same manner as mountains are prominences or elevations upon the same plane. Valley and mountain are complementary of each other, so to speak of the one implies the presence of the other. Only, that in some cases the mountain part of the two is of a particularly flat broad type; the flat top extending over a great many miles in every direction and in fact completely enclosing the valley. Then, however, the enclosed depression is called a Basin and the rules governing its construction are sometimes a little different from those affecting the formation of a valley.

Valleys have been formed and are now in course of construction in various ways. To enumerate all the modes in which old valleys have received their present forms and recent ones have started out to form themselves would probably be to enumerate nearly every known valley in the world. They may, however, be classified into various divisions according to the primary causes of their formation. For the purposes of such classification all valleys may be divided into four different kinds, each being due to the peculiar manner of the inception of the valley. This is obviously the proper manner in which such classification should be made as no valley exists, or at least none is known to exist, in which a great part of the size and form of such a valley cannot be traced to erosion or denudation. The effects of erosion are recognizable in numerous cases long after the traces of the original cause of the valley have ceased to exist.

Valleys may be due to the flexing of beds or to the breaking of them, the flexing producing one kind of valley and the breaking another. Although so much, with regard to the extent and form of all valleys, is due to erosion, yet it is doubtful whether this cause ever originated a valley.

"The examination of the geological structure of valleys plainly testifies that almost every great hydrographical basin has derived its form originally from some other agency although its outline may have been subsequently altered by the continued action of currents within it."—(*Chambers' Encycl. Vol. IV, Art. Erosion*).

Valleys may be divided into the following :

1. *Synclinal Valleys*.—These are due to the folding of the earth's crust and always run parallel to the folds, or mountains, upon either side of the valley. As a general rule the dips of the two opposing sides are toward the centre of the valley. While this may be a general rule regarding the dip of the sides of a synclinal valley it is by no means invariably the case. There are valleys which properly belong to this class in which the dips are parallel to each other. Among the folds of the Appalachians many of them were so folded back upon each other as to give under the action of denudation valleys which although true synclinal valleys have the dip of the strata on both sides parallel. Synclinal valleys never cross the ridges or folds among which they lie.

2. *Monoclinical Valleys*.—Valleys of this description always face an escarpment, and have for the other side an indefinitely long dip or slope. Such valleys may be due to the slipping of the upper beds upon the lower ; or to the unequal erosion of beds lying upon the same side of a fault with the same exposure, or they may be formed along a fault by the difference between the uplift on the one side and the down throw upon the other.

3. *Valleys of Elevation*.—Paradoxical although it may seem, we have a class of valleys which are higher than the hills. These run along the summit of anticlinals and are due to the fracturing of the beds at the point of flexure and the admission of water. The water erodes the under-lying beds to such an extent that in a short time, geologically speaking, a valley often of a considerable size is formed. There are several valleys of this description within the territory con-

rected with the Central Basin of Tennessee. The Sequachee Valley in Eastern Tennessee belongs to this class. The Sequachee Valley is a long narrow valley pursuing a straight southwesterly course for about seventy miles, with an average width of about four miles, and enclosed between two escarpments of from 800 to 1000 feet in height. The head of the valley lies within the Cumberland Tableland, in fact Sequachee Valley breaks the Cumberland Tableland into two divisions; and the mouth may be said to debouch into the Valley of the Tennessee River, near where the boundary lines of Georgia and Alabama meet the Tennessee line. In going eastward from the margin of the Central Basin, the Sequachee fold is the first great fold met with. It forms the Crab Orchard Mountain at its north-eastern end, and by a continuation southwesterly it is exhibited in the Sequachee Valley which is simply the fold with the upper portion of the plications worn off owing to fracture, admission of water, and consequent erosion.

In the same line of folding there is a small basin "Grassy Cove" formed in a similar manner, but Grassy Cove is completely surrounded by hills.

Another good instance of a valley of elevation is to be found in the Jones and Roup's Valley in Alabama, and lying between the Coal Basin of Warrior on the west, and that of the Cahaba on the east. Dr. Smith (Geological Survey of Alabama, 1876, p. 14) says: "The rugged barren hills of the coal fields contrast strikingly with the rolling fertile lands of the valley, and we have presented here, as has been remarked by Professor Safford, the curious case of a valley which is higher than the mountain. The geological structure of the region is in general as follows: In the middle of the valley the strata belong to that sub-division of the Lower Silurian which I have called Quebec or Knox Dolomite; these rocks are found dipping generally towards the south-east, though in many places they dip both north-west and south-east. Crossing from the centre of the valley south-east towards the Cahaba coal fields, we go over the rocks of the Chazy and Trenton, the Niagara, the Black Shale, the Sub-carboniferous, the Millstone Grit and the shales and sandstones of the coal measures all lying conformably and dipping south-east. Going north-westward we find the same succession of strata up to the coal measures of the Warrior fields, the dip being sometimes north-west, though often

south-east. Such in simplest terms is the geological structure, and there is no doubt but that the coal basins of the Warrior and Cahaba were once continuous; that at the time of the disturbances along the Appalachians, they together with the underlying formations down at least to the Quebec or Knox Dolomite were uplifted into a long anticlinal fold; that this fold was fractured along its axis or summit, thus affording a channel for denuding waters, and finally that the great mass of sandstones, coal beds, shales, and limestones, which constituted the fold has been broken down and removed by the action of running waters till nothing is left of it now except the low rim on each side adjacent to the coal measures." This valley is from six to eight miles from coal field to coal field.

These two valleys exhibit in many ways peculiarities similar to what are found in the district in Central Tennessee and Southern Kentucky and, as we shall see further on, may be looked upon as the resultants of similar causes.

In some cases valleys of elevation have been denominated as anticlinal valleys owing to the peculiarity of their formations. It might be better to give them that name as their existence is due to the presence of the anticlinal, while the valley has nothing to do with the elevation of the ridge.

4. *Valleys of Erosion or Denudation.*—A valley of erosion is one due to the eroding and denuding effect of water in some of its many forms, or to atmospheric or some other sub-aerial causes. It is asserted that erosion never was the primary cause of the production of a valley, but rather that denudation is only a secondary cause operating from some pre-existing condition of things, and thereby forming a valley of denudation.

A very insignificant agency may be the cause of the formation of an immense gorge, with its narrow channel, precipitous inaccessible sides, and with its rushing turbulent torrent, or the beginning of a broad fertile valley, whose smiling fields, watered by a slowly flowing and meandering stream, extend over an area of many miles, to be surrounded on its margin by rounded hills gradually rising to the level out of which the valley had been formed.

The land emerging from the sea may have risen furrowed with ripple markings, small and scarcely perceptible, such as we often see

upon the present shores. Or the newly made land may have been covered with gravel or shells. Any of these agencies would have been sufficient. In the case of the ripple-markings, these slight furrows may have been uneven; a larger one than its neighbours attracting the drops of water falling upon the surface of the rock, either in the shape of rain or as spray from the ocean, or it may be the receding tidal waters of the sea: A little channel is formed, this draws other little rills to it, and in this way it goes along growing in size as it increases in length. This operation can be seen any and every day upon the sea shore wherever there may be a deposit of sand or clay. Every stage of the work passes before the observer's eye during the few hours the tide is absent—the wave-furrows, the trickling of the water along the furrow, its gathering in size and finally its miniature gorge where it passes through the bank of mud into the ocean. The land rises a little and fresh beds are laid bare. The streamlet becomes longer and deeper; its branches increase in size and number and its drainage area grows greater. So the work goes on, the land rising, the stream becoming greater and stronger as its course lengthens until by successive elevations the land has become a continent in extent, and the stream a river hundreds of miles in length, gigantic in depth and width, and the small channels which joined it away back in the past ages are now mighty lateral gorges, or it may be that the whole system has broadened out into extensive valley plains, the site of cosy farm-houses or occupied by a populous city, while the tiny wave marking has become a great commercial highway for the nations of the world.

It was in some such simple manner as this that the Grand Cañon and other similar gorges found in Colorado, in what is known as the Grand Cañon District, described by Dutton, were formed. They are not due to any great convulsion of the earth, such as earthquakes or volcanic eruption, but are solely the effects of quiet persistent never ceasing erosion. The rivers running through these Cañons were formed when the Tertiary rocks first rose above the sea level. Some irregularity of the surface then determined their course and ever since that time they have kept persistently in that course until now the Grand River has cut a gorge 5,000 feet deep, straight down into the carboniferous formations. The rocks rose up in front of the river and were cut through.

It is clear that the structural deformations of the surface, the uplifts and the downthrows, had nothing to do with determining the present distribution of the plateau (Grand Cañon District) drainage. The rivers are where they are in spite of them. As irregularities rose up, the streams turned neither to the right nor to the left but cut their way through in the same old places. What then did determine the situations of the present drainage channels? The answer is that they were determined by the configuration of the surface existing at or very soon after the epoch of emergence. Soon afterwards that surface began to be deformed by unequal displacement but the rivers had fastened themselves to their places and have ever since refused to be diverted. (Dutton, Second Annual Report, U.S. Geol. Survey p. 62.)

The river having made a break in the surface there is room for denudation to go on laterally as well as vertically and by what Powell terms the "Recession of Cliffs" the narrow stream bed of the river is slowly but gradually widened into a great valley or basin, bounded on either side by a wall of the receding cliffs, with its head lying away up at the source of the stream and its entrance at the place where the river enters the sea or joins some other and greater stream having a valley of its own.

There comes a time in the history of all streams in which their corradng power reaches a minimum—that is presuming there are no upheavals or no gradual elevation of the land within the course of the stream. This period of minimum corrasion is when what is termed the base level of erosion has been reached. The base level of erosion is reached when the channels have reached an altitude in which their declivities are so small, the velocity of the water so feeble, and their transporting power so much reduced that they can do no more than urge along the detritus brought into their troughs from high lands along their margins. Their transporting power is just equal to the load they have to carry, and there is no surplus left to wear away their bottoms. Under these conditions the slopes of their ravines are less rapid; their narrow bottoms widen and flatten until they grade into smooth bottomed meadows stretching from base to base of steeper ascents on either side. The widening of the bottoms is due to the low gradient which has been reached in the progress of excavations of the valleys. The running waters now cut but slightly on their bottoms because with the low slope at which they have arrived they are

unable promptly to remove from their beds all the material which the steeper valleys at the head and the slopes on either side throw into them in times of freshets and heavy rains. In their struggles with this material they wander to and fro and widen their valleys more than they deepen them.

Surface valleys are valleys of erosion but cut out of surface accumulations, such as drift or lake beds which have not yet become solid rock. They are, in consequence, relatively wide and shallow. This class would be any where of more recent origin than the other classes. In drift regions many of these surface valleys are due to the uneven formation of the drift. The retreating ice sheet by its change of front, by its alternately advancing and retiring, and the streams which issued from underneath the ice caused an accumulation of debris at various places along its margin. This debris forming barriers between higher lands, enclosed basins which for want of an outlet became lakes which ultimately drying up either by evaporation or the erosion of a channel through the morainic barrier left broad valleys comparatively shallow when their wide extent is considered.

Another form of valley of erosion is that due to glacial action. These are known by their being differently shaped than those due altogether to the action of running water. Water cut valleys have mostly a sharp bottom with sloping **V** shaped sides with often a winding course, but valleys due to ice action of the glacier type have a rounded bottom and more perpendicular sides, giving such gorges a **U** shape. They also end in a glacial amphitheatre which is usually wanting in water cut channels. The original form is always more or less modified by other causes.

In the districts overlaid by the subcarboniferous *Protean beds* of Kentucky, Tennessee and Northern Alabama, there are numerous small basins or cavities known as sink holes. Some of them are dry, but others form small pools or lakes and afford water in otherwise dry districts. These sinkholes exhibit in a striking manner the eroding effect of rains and frosts. Some of the sinks are from forty to one hundred and ninety feet deep and cover an area of from five acres to two thousand acres. The rim of sandstone surrounding these depressions is generally nearly level, the out cropping rocks

within, are also nearly horizontal. Near the centre there is an opening of from three to fifteen feet in diameter. Into this opening the water which has fallen within the margin of the basin has been drained since the day when the rocks exposed within were raised above the drainage of the country, and thus by the slow process of washing and weathering, the rocks which once filled these cavities have been worn and carried down into the subterranean drainage of the country. All this has evidently come to pass in the most quiet and regular manner. The size of the central opening is too small to admit extraordinary floods, nor is it possible with the level margin around to suppose that these cavities were worn by eddies in a current that swept the whole cavernous member of the subcarboniferous limestone of Western Kentucky, but the opinion is probable that the upheaving force which raised these beds to their present level, at the same time ruptured and cracked the beds in certain lines; that afterwards the rains were swallowed into openings on these fractures producing by denudation the basins of the sink-hole country and further enlarging the original fractures by flowing through them and thus forming a vast system of caverns which surround the western coalfield.—*Owen, Geol. Survey of Kentucky, Vol. IV, p. 511. 1861.*

This class of basins is not confined to the district included in Kentucky and Tennessee. Similar sink-hole basins were noticed by Dutton, in the Grand Cañon District, and which he says imply a system of subterranean rivulets, but it is not more wonderful than the endless caverns in Kentucky and Indiana, and it is probably not upon so large a scale nor so greatly ramified.

The great central Basin of Tennessee is a valley of erosion, due according to all existing evidences to simple aerial causes. This valley is of a somewhat irregularly formed oval shape having a broken into and fringed margin. Its long axis extending in a northeastern and southwestern direction is about one hundred and twenty miles in length—that is excluding the narrow gorge traversed by the Cumberland River at the northern end, and the Elk river valley at the southern extremity. The shorter axis or width of the basin measured in a northwesterly and southeasterly direction is from fifty to fifty-five miles, measured in the latitude of Nashville it is sixty miles in width. The area of this great basin has been computed at six thou-

sand one hundred and ninety square miles. It is surrounded upon all sides by a high, almost precipitous, wall or escarpment surrounded by a broad flat top. The top, or broad plateau forming it, extends from the base of the Cumberland Mountains, or rather Cumberland Table land, on the east, to the shore of the old paleozoic Sea a few miles beyond the Tennessee River on the west, and from the State of Alabama in the south, it extends across Tennessee and covers the greater part of the southern and central portions of Kentucky. The area of this extensive plateau within the State of Tennessee and immediately surrounding the basin is computed by the State Commissioner of Agriculture, in his Report for 1887 (p. 156), to be eight thousand two hundred square miles. This wall and top with its broad extent has been called by Professor Safford the "Highland Rim," and the whole Basin and Highland Rim has been compared by him to a great broad rimmed flat bottomed dish slightly tilted to the northwest. This tilting to the northwest is due to a general dipping of the whole country in that direction and is altogether independent of any of the numerous directions of dip found locally.

From this it will be seen that the Central Basin is simply an erosion through the Highland Rim into the underlying formations.

This Highland Rim is almost continuous in its circumscribing the Basin. It is only broken by four narrow rocky gorges through which the Cumberland, Elk and Duck Rivers pass. At the northeastern corner the Cumberland enters the basin through a long narrow pass, and on the northwest again the same river passes out of the basin by a gateway somewhat similar to the one by which it enters. Upon the south, the Elk River leaves the basin by a narrow rugged channel, and upon the west another outlet of the same kind affords a passage for the waters of the Duck River. Of these outlets only those connected with the Cumberland River are navigable. The others are too narrow, rocky and shallow to be of any practical use.

Although these gorges are the only ones piercing the plateau of the Highland Rim, and finding an outlet through it, the margin of the Rim is broken into by numerous streams which have their sources somewhere upon its broad flat top. These streams have cut for themselves long narrow channels running back, sometimes several

miles, into the plateau and finishing with a waterfall. In some of the channels, lateral ones, due to smaller streams flowing over the face to join the main stream, are cut into the hill for a considerable depth. These gorges, or channels, give the high wall surrounding the basin a serrated, or fringed appearance. This, however, is a peculiarity not confined to the margin of the Highland Rim but is also characteristic of the various formations occupying the lower levels within the centre of the basin.

On the eastern side the Caney Fork has cut into the Rim a very extensive valley running in a southeasterly direction about eighteen miles, with a width of between four and five miles. This is the most extensive gap along the eastern escarpment. The Duck River has also cut a gorge, and in the southeastern corner the Elk River is forming a pretty extensive valley.

The western escarpment is much more broken than the eastern. The Harpeth River has formed a channel of considerable width and length, while the Duck River before entering the gorge through which it escapes to join the Tennessee has formed a broad deep valley with several lateral gorges opening into it both from the north and the south.

Along the southern end of the basin there is a very much broken ridge of land having the same elevation as the Rim. This ridge, which is known as the Elk Ridge, passes through the counties of Moore, Marshall, Giles, and Lewis, and forms a division between the basin of the Elk River and the body of the main basin itself. It is, however, broken through in two places—the valley in Moore county in which Lynchburg is situated and the valley utilized by the Louisville and Nashville Railroad running south from Columbia.

Throughout the basin at several points the summit reaches the same elevation as that of the rim, and the structure of the exposed rock formations is the same. In addition to the Elk Ridge, the most noteworthy place in which these summits are found is a tract running along the eastern boundary through the Counties of DeKalb, Wilson, and Rutherford, where these hills form a line running nearly parallel to the axis of the valley for sixteen miles when the line turns, and for about twelve miles runs in a north-westerly and south-easterly direction.

The average elevation of the Highland Rim taken from the mean levels for Railroad purposes gives on the

	feet.	R. R. Survey.
Eastern and south-eastern sides . . .	1019	Mean of 13 Stations.
Northern side	816	" " 3 "
Western and South-western sides . .	951	" " 6 "

or an average elevation of 942 for the whole Rim. The mean average elevation of the floor of the Basin above the same point and from the same authorities taken from twenty-nine stations is 567 feet. These measurements are above the level of mean tide in Mobile Bay. It will thus be seen that the average amount of erosion necessary to form this Basin would be a thickness of 375 feet extending over an area of 6190 square miles, and this after the surface of the country had reached the level of the summit of the escarpment. Nor was this the whole of the erosion that has evidently taken place in this region of the world as there are many circumstances pointing to the belief that denudation has removed an extent of sub-carboniferous and carboniferous rocks if not greater, at least as extensive as the whole of the Tennessee Coal field as at present existing.

The abruptness with which the escarpment rises from the level of the bottom of the Basin will be seen from the following figures taken from the alignments of the various Railroads crossing it.

LOCALITY.	FOOT OF RIDGE.	T.O.P OF RIDGE.	DIFFERENCE.	DIST'NCE	AUTHORITY.
	Feet.	Feet.	Feet.	Miles.	Survey.
Near Edgefield Junction.	563	895	332	1.5	L. N. R. R.
" Gallatin	694	951	257	1.	"
" Tullahoma	814	1079	265	5.	"
On Tennessee and Alabama Railroad	702	1019	317	6.	R. R. Survey.
Near Pulaski	630	924	294	3.	C. S. R. R.
Nashville, Chattanooga and St. Louis R. R.	524	841	317	4.	R. R. Survey.

In addition to the serrated or rather fringed like appearance of the margin of the rim, or the escarpment, there is yet another peculiarity connected with it—that is, the absence of any terracing upon this escarpment. It has been assumed that the basin was at some former time the bed of a lake. In no place has it any terrace markings indicating that the basin was at any time the seat of an ancient lake. The northern and western divisions of the margin show appearances somewhat terrace-like, but these divisions are, as we shall afterwards see, due to the constitution of the rock formations and their unequal weathering qualities and not to any other cause. The long narrow neck of land extending between the Cumberland and the Harpeth Rivers in the southern part of Davidson County, does not show anything which might be attributed to the action of water in such a body as to terrace the sides of the hills forming the shores. The fringed appearance of the escarpment appears to indicate a slower and steadier but at the same time a no less equally powerful eroding agent as any power that waves might bring to bear upon it.

If by any means the Central Basin of Tennessee were formed into a lake it would occupy a space 110 square miles less than Lake Ontario, but would be about 40 feet deeper.

GEOLOGICAL STRUCTURE OF THE HIGHLAND RIM.

The geological structure of the Highland Rim presents us with an evidence that the position now occupied by the basin was at the close of the Lower Silurian Age, or during the period between the deposition of the last of the Nashville beds and the beginning of the Niagara, or the deposition of the Medina or lowest member of the Niagara group, elevated to a considerable height above the waters of the surrounding sea. The sections shown by the different sides of the basin enables us to trace with considerable accuracy the extent of territory laid dry about this time. A general section of the escarpment upon the eastern side shows the total absence of the beds of the Upper Silurian and Lower Devonian formations and the Black Shale of the Upper Devonian lying in contact with the beds of the Hudson River formation, or Nashville rocks. On the northwest, west, southwest and part of the south sides the Niagara including the Clinton and

Medina formations are to be found in position, but not in any thickness, and the Clinton and Medina represented generally by Professor Safford's beds of transition. They appear to be chiefly the thin feather edges or beveled wedge shaped ends and abut against the underlying Nashville series of rocks. That this is the case is seen by the fact that these beds increase in thickness as they go westwards, until they reach their heaviest development in the valley of the Tennessee River. The Lower Helderberg formation is also well developed in the Tennessee River valley, but thins out before it reaches the side of the basin, as none, or at least very doubtful, traces of it have been found in the western escarpment.

A general section of the eastern escarpment or margin of the basin from the gorge of the Cumberland on the north east to the valley of the Elk River in the south, and extending along the whole eastern side gives in descending order.

LOWER CARBONIFEROUS.

Siliceous, of which cherty limestones calcareo-siliceous rocks and heavy layers of solid chert are quite characteristic.

The Siliceous group includes two divisions—

- b. The Lithostrotion or Coral bed consisting of cherty limestone fossiliferous, often crinoidal, sometimes siliceous and argillaceous, and everywhere characterised by the Coral Lithostrotion Canadense. This bed is equivalent to the St. Louis limestone.
- d. The lower or Protean bed, a series of strata, silico-calcareous in the main often limestone, often sky-blue silico-calcareous and sometimes argillaceous rock weathering into shale; the series containing as a characteristic feature heavy layers of chert ranging in thickness from one inch to two feet, alternating with the other rocks of the member. It often holds layer and locally heavy beds of crinoidal Limestones. The estimated thickness of the Siliceous group in Tennessee is from 30 to 500 feet.

With the exception of a small patch in Short Mountains in Cannon County the Lithostrotion beds do not appear in the escarpment upon any of the sides of the basin.

DEVONIAN.

Black Shale.—This shale which lies immediately under the lower division of the siliceous corresponds to the Genesee slates, or Hamilton group of the New York section and the Hamilton formation of western Canada. The characteristic mass of this formation is a nearly black bituminous, rather tough slate or shale. It contains very generally grains and nodules of Pyrite scattered through its mass. West of the Cumberland Table Land the Black Shale has at its top a thin layer of argillaceous very fetid concretionary bodies of round oval, kidney shaped and usually more or less flattened. They vary in size from that of a peachstone to masses two feet across, and occur packed with bluish shale in a layer from two to twelve inches thick. Below the shale there is generally a dark gray bituminous fetid sandstone which sometimes replaces the shale.

Estimated thickness in Middle Tennessee from 50 to 70 feet.

Nashville Group—(Hudson River Group).—The Nashville formation consists of bluish siliceous calcareous shales with beds of dark blue, highly fossiliferous, roughly bedded, impure limestones. The *Orthis* or lowest member of the group consists of blue siliceous and sandy limestones weathering into fine, thin earthy yellowish sandstones and shales. The upper beds weather into thin flaggy beds, the surfaces of which are often crowded with fossils.

Estimated thickness in Middle Tennessee about 500 feet.

Trenton.—The Trenton formation in Middle Tennessee is intimately connected with the Nashville series of the Basin and consists mostly of limestones of a light blue or dove colour, sometimes grey, arranged in groups of alternately thick and thin bedding—the thick bedding mostly cherty; the lower or “Central Limestone” being much more so than the upper beds.

Estimated thickness in Middle Tennessee about 500 feet.

The Trenton formation reaches the bottom of the Basin—the Central Limestone being the lowest bed exposed anywhere throughout the Basin.

These beds from the Siliceous to the Trenton are continuous across the ends of the Basin, and are also found in place upon its western side. The Trenton is continuous across the Basin and with the Nashville rocks forms its bottom.

If we now turn to the sections as exposed upon the north, west and southwest sides of the Basin we will find that while all the formations as exposed upon the east are to be found represented in these sections, with an equal regularity we have another set of beds to deal with which are not to be found anywhere along the eastern side of the Basin, and which owing to their interposition lie unconformably to those underneath. These are the Niagara, including the Clinton and Medina. They are interposed in their proper position in the geological scale between the Nashville or Hudson River formation and the Black Shale.

It is chiefly the uppermost part of the Niagara formation that is found in Middle Tennessee. The Meniscus limestone of Dr. Safford's Report consists of thick-bedded crystalline and fine-grained limestone more or less argillaceous and often weathering into shale. Most of the limestones are sparry and crinoidal; many contain green points. The series is divided into an upper or sponge-bearing bed and a lower or variegated bed, and each about 100 feet in thickness. This lower bed is an alternation of grey, red and mottled layers, and much tends to crumble into shales. The limestones of the upper bed are light grey and light bluish grey, and much of the bed weathers into shaly matter.

Where this formation is first met with in the slope of the western side of the Basin it is not in very great force, but generally only in the shape of a feather edge, or running out, but increasing in thickness in a westerly direction, or towards the valley of the Tennessee River. This feather-edged Meniscus bed is first found in the northern side of the Basin in the western part of Macon County and upon the southern side of the Basin it first appears in Lincoln. From Lincoln it passes through the south-west part of Bedford County and through the Counties of Lawrence, Lewis, Maury, Williamson, Davidson and Sumner in a sort of semi-circular course until it reaches the place of its first northern appearance in Macon County.

From this line westward until the old shore line west of the Tennessee River is reached the Niagara formation is represented in the geological scale of the State of Tennessee.

It has already been noticed that nowhere along the escarpment or slope of the eastern side of the Basin is an outcrop of the Niagara to be found. Even the deep gorge made by the Caney Fork on the east does not show it, and it is not to be found in the valley of the Elk River in the southeast. Beds of the Niagara age, however, are found in East Tennessee, and these extend as far west as the Sequachee Valley on the Alabama State line and run in a northeasterly direction to the Kentucky boundary at the Cumberland Gap.

These lines of Niagara outcrops pass clear across the State into Alabama on the south and Kentucky upon the north. The nearest outcrop of Niagara beds in Kentucky is at Liberty, Casey County. —(*Proctor, Geological Map, 1887*). As they do not appear in the gorge of the Cumberland as far north as Port Burnside, we may safely suppose that the two lines of exposure in Tennessee unite somewhere in the district between Port Burnside and Liberty. The southern junction of the two takes place in the State of Alabama within a short distance south of the line between the two States.

With these two boundary lines it will be an easy matter to trace the extent of territory raised above water, or at least elevated sufficiently high to prevent the formation of rocks of the Niagara group, by the general disturbance following upon the close of the lower Silurian. It will be seen also that the greater part of the area now occupied by the Central Basin, being devoid of the Niagara formations, must have been above water at the time these rocks were being laid down.

Passing west toward the Tennessee River Valley another member of the Upper Silurian makes its appearance. It is doubtful whether the Lower Helderberg is to be found anywhere around the escarpment margin of the Basin. It is, however, found occupying a narrow strip of country along the Tennessee River in the western part of the State. It attains its maximum thickness in the river valley, and thins rapidly out on coming east. Lower Helderberg in Tennessee consists of a series of light blue limestones, often shaly, highly fossiliferous and frequently containing cherty layers, especially on its upper part. It has a maximum thickness of 70 feet, and is altogether confined to the western part of the State. It is not known in Eastern Tennessee.

From the distribution of the Lower Helderberg rocks it is apparent that the area under consideration was still dry land, and even had during the Niagara period been increasing in elevation. But while this elevation was in process there must also have been some denudation. The top of the Hudson River dome was exposed to the action of the waves as well as aerial conditions during the long period which was occupied in building the Niagara and Lower Helderberg formations and at least the whole of the Niagara and a great part of the Helderberg were built out of the debris of the Hudson River or Nashville rocks, forming the territory, part of which now forms the Central Basin.

West of the Tennessee, the palæozoic formations terminate in an abrupt and broken off manner, as if they had been subject to fracture and afterwards to an erosive action similar to that undergone by a rocky coast line under the influence of wave action. They form an escarpment against which the newer beds of the Cretaceous abut at a considerably high angle.

This breaking off or termination of the Palæozoic rocks follows approximately the course of the Tennessee River valley across the States of Tennessee and Kentucky, but with the exception of only a short distance of about 18 miles in Harding County, Tennessee, the old escarpment formed by the break is not coincident with the course of the river but passes along to the west; the Tennessee having cut a channel out of the older formations to the east.

This old shore line, for it is in reality a shore of very ancient origin and of long continuance, is broken in several places by long narrow bays. The length which these bays have obtained and the position in which they are placed indicate a long continued and at the same time great difference in the drainage system of the country, at the time the waves of the Silurian seas beat upon its beach or broke in spray against the cliffs from what we now find it. The course of the Tennessee River with its subordinate system of drainage has a northward flow, but the old gorges or stream channels disclosed in the palæozoic shore line indicate a southern or south-western course for the drainage of that time. In Benton County a narrow strip of cre-

taceous rock runs into the shore for nearly 10 miles. This represents a break in the older formations and is apparently an old river channel lying between the courses of the modern Tennessee and Big Sandy rivers. In Decatur County there is another old bay much broader than the Benton one but not so long. In both of these bays the head lies to the north-east and the opening into the ocean to the south-west. This is not the direction of the dip of the country which in this part of the State is to the north-west or almost at right angles to the course pursued by the streams which hewed out the old channels mentioned. Streams, however, do not always follow the dip of the beds through which they may have to cut their way, but in most instances they follow the general slope of the country. If then these channels indicate the general slope of the country during the Upper Silurian period, a combination of oscillations must have taken place to arrive at the present state of affairs.

This old shore line indicates a continuance of oceanic conditions over all the area of the States of Tennessee and Kentucky, west of the Tennessee River up to as late a date as the Cretaceous period, and whatever changes the region east of this line may have undergone, none appear to have interrupted the continuity of the sea's occupation throughout Western Tennessee or the Mississippi Valley.

If we turn now to the eastern side of the basin we will find the Highland Rim existing as a broad tract of country extending from the edge of the escarpment back to the Cumberland Tableland, and occupied by rocks belonging to the lower or sub-carboniferous group, the Protean beds occupying the territory immediately adjacent to the basin, and the mountain limestone lying close to and passing under the carboniferous beds forming the tableland. The same sub-carboniferous beds form the surface rock of a great part of the State of Kentucky lying immediately to the north.

The elevation of the Highland Rim has already been given as between 950 and 1000 feet above sea level. From this plateau the Cumberland tableland rises almost precipitously to a vertical height of over 1000 feet or 2000 feet above the level of the sea in Mobile Bay.

Elevations of various points upon Cumberland tableland above sea level at Mobile Bay.

LOCALITY.	ELEVATION.	AUTHORITY.
Cumberland Gap	1636	J. G. Newlee, R. R. Survey.
Pinnacle near "	2680	" "
Pine Mountain	2200	J. M. Safford, Geol. Tenn. '69, p. 73
Ben Lomond	1910	A. M. Lea, R. R. Survey.
Racoon Mountains at Whiteside.	1900	J. M. Safford, Supra.
Lookout Mountain.....	2154	J. M. Safford, Geol. Tenn. '69, p.
Bon Air.....	2029	A. M. Lea, R. R. Survey.
Tracy City	1847	Sewanee Mining Co. R. R.
Highest Ridge near Tracy City.	2161	"
Average of 18 points on R. R..	1846	"
Average Height..	2036	Cumberland Tableland.

Crab Orchard Mountain has an elevation of nearly 3,000 feet, or about 1,000 feet above the general level of the table land.

The two formations—the black shale and the overlying Protean beds of the sub-carboniferous—extend from the Cumberland tableland on the east; west, through Tennessee; north, through the southern and central portions of Kentucky, dividing the coal fields of that State into two divisions, and these beds also extend southward into Alabama. The dip of the underlying Nashville and Trenton beds does not conform to that of the overlying black shale.

GEOLOGICAL HISTORY.

From the data we have, the geological history of the district appears to have been thus:—

During the period in which the Lower Silurian formations were being laid down this part of the continent appears to have formed a division of the great inland sea, or rather branch of the Atlantic Ocean

which extended from the Gulf of Mexico, up through the Mississippi Valley, and covered the greater part of the centre of North America. The whole territory from the border of North Carolina was under water. In a comparatively shallow sea, and under varying conditions of alternately clear and muddy water, and after various oscillations of the sea bottom, the Owee conglomerates, Chilhowee sandstones, the Knox shales and dolomites, and the Trenton limestones, with the associated Nashville shales and limestones were laid down. This closed the Lower Silurian Age so far as this part of the continent was concerned.

At the close of the Nashville or Hudson River period there was a period of great disturbance which resulted in the upheaval of a long line of dome-like structures extending from Alabama in the south-west to Ohio in the north-east, and traversing the States of Tennessee and Kentucky. From South-western Ohio this same upheaval, known in Ohio as the Cincinnati axis, takes a bend round to the north-west and passes into Indiana. The ridge thus thrown up rose higher in some parts than in others with the dip of the strata quaquaversal or radiating in every direction, but in general having a greater angle of dip south-easterly or north-westerly than in the other or longitudinal directions, the two dips in the region of the Basin being southeast and northwest for transverse, and for longitudinal directions northeast and southwest. It is due to this quaquaversal condition of the beds that the elevation is of a dome-like structure, and it is also due to the variations in the dip in the longitudinal section that the Niagara and Lower Helderberg rocks are to be found surrounding the various isolated portions of these ridges, or what may be better regarded as islands in the Lower Silurian sea.

The district now occupied by the Central Basin was the site of one of these domes, or islands with an area of over 150 miles in length, extending from the northern part of Alabama to the centre of Kentucky and from a few miles west of the Sequachee Valley to a circularly drawn line extending from Macon County on the north, to Lincoln County on the south, as its Western boundary. The centre of this Silurian island was according to Professor Safford a few miles to the south-east of Murfreesboro in Rutherford County, near the eastern escarpment and now almost the lowest spot in the whole basin.

The elevation of the summit of this dome was about 1300 feet above the water.

This island immediately upon its emergence from the bed of the ocean gave rise to wave action, and the work of erosion or denudation began. With increasing elevation the land kept ahead of the ocean, but around the base of the island the beds of the Niagara period were being formed out of the waste material. If this increase in the elevation had not taken place the whole island would soon have been reduced to a uniform level and the Niagara rocks the only ones formed at that point. Another slight increase in height and a portion of the newly formed Niagara beds was brought to the surface to be subjected to the tear and wear of the waves and to contribute toward the building of the Lower Helderberg formations in the same manner as the Nashville and Trenton beds have been levied upon to construct them. At the close of the Lower Helderberg the island now considerably increased in size but lower in elevation and more rounded off than when it first appeared seems to have received a little more elevation, and the Helderberg sea bottom became dry land. In this condition things appear to have remained stationary for a long period until the whole territory took a plunge into the ocean again preparatory to receiving the beds of Black shale and the subcarboniferous beds with which the greater part of the States of Kentucky, Tennessee and northern Alabama are overlaid.

These beds appearing again, the age of coal or the true carboniferous period began. Without discussing the origin of coal we may accept the fact that the state of affairs necessary for coal production existed long enough to form a body of material over 600 feet in thickness in the Cumberland Tableland.

This coal forms part of the great Appalachian coal-field which stretches all the way from Pennsylvania to Georgia and Alabama, and extends almost clear across the latter State to the boundary of Mississippi with an extension of subcarboniferous beds into that State. The whole of the western margin of this field is very much broken, and fringed with detached outliers scattered along its boundary. Many of such outliers exist in the State of Kentucky standing in the midst of subcarboniferous protean beds. In northwestern Kentucky there is an extensive area covered with coal-bearing rocks which have

been placed among the subcarboniferous formations, and would, therefore, belong to a much older formation to any of the Pennsylvania or Ohio coals of which eastern Kentucky field is but an extension. The western Kentucky area unites with the coal-bearing strata of south eastern Indiana.

The geography of this part of America during the age in which the coal beds were being deposited appears to have been a long narrow neck of dry land from the region of Cincinnati southward across Kentucky and Tennessee owing to an elevation of the subcarboniferous limestones and shales leaving a depression filled with shallow water and marshes eastward as far as Western New York, and covering the territory now occupied by the Appalachian chain of mountains. To the west the great inland sea flowed along the old coast close to the present Tennessee River Valley.

The carboniferous period having closed and the Permian age begun, a series of disturbances took place which changed the appearance of things over the eastern portion of the North American continent, and resulted in the upheaval of the Appalachian Mountains.

The term Appalachian is the general one applied to the great mountain system which stretches from Maine to the borders of Alabama, its distance from the sea generally ranging from 100 miles in the north, and about 300 in the south. The chain consists of several ranges generally parallel to each other which along with the intermediate valleys form a belt 100 miles wide, of which the valleys occupy about two-thirds. The chief ridges forming the chain are, beginning from the north, in New Hampshire the White Mountains with Moosehillock and Washington respectively, 4,636 and 6,634 feet. In Vermont the Green Mountains attain in Killington Peak, a height of 3,924 feet, and immediately beyond the Hudson come the Catskill Mountains with Round Top and High Peak, attaining elevations of 3,800 and 3,718 feet. From the north of New Jersey as far as Virginia, the Kittatinies and in the same parallels, but nearer the sea, the Blue Ridge run down to North Carolina. In Virginia there are the peaks of Otter, 4,000 feet, and in North Carolina the highest summit of the system Black Dome, 6,750 feet is found. Lastly, there lie more to the westward the Alleghanies proper in Pennsylvania and Virginia, and the Cumberland Mountains on the eastern border of Kentucky and Tennessee.

The Appalachian Mountains are composed of a series of parallel waves having a general direction similar to the coast line of the Atlantic Ocean. The line of maximum disturbance is on their eastern limits; consequently their folded flexures with the inversion of their steep sides are chiefly confined to the great Appalachian valley and the Atlantic slope south of it. The flexures of this type impart a prevailing south-east dip to the whole outcrop. The flexures of the second type which curve more rapidly on the one side than the other, prevail wherever the forces that disturbed the crust were neither excessively intense nor very feeble. It is the characteristic form everywhere between the great Appalachian valley and the Alleghany Mountains. Undulations of the first or symmetrical type occur beyond the Alleghany Mountains where two groups of them may be distinguished, the one set dividing the bituminous coal field into six successive basins, and the other composed of four equidistant and very straight undulations.

These Mountain ranges were apparently raised by an intense pressure exerted from the east.

The long narrow line of upheaval passing through Kentucky and Tennessee lying to the west of the Cumberland Mountains, had its summit crowned by the upper beds of the sub-carboniferous. These beds may have been fractured along the summit of upheaval, and in this way give origin to the denuding agents which planed down the area covered by the siliceous beds and ultimately hollowed out the basin of Central Tennessee.

AGENTS AT WORK IN THE FORMATION OF THE CENTRAL BASIN OF TENNESSEE.

The basin of Central Tennessee began to be formed as soon as the sub-carboniferous beds which formerly overlaid the whole district first emerged from the waters of the sub-carboniferous ocean, and its construction has been going on ever since. The work of erosion, and consequent degradation of the land, attacks the highest points first, and as soon as these rocks were laid bare by an elevation the work began. The elevation becoming greater, the work of erosion and degradation kept on until now. When we consider the enormous amount of denudation which had taken place before the excavation of the main basin began, we are apt to reason that no known cause

at present existing could have acted in such a manner or had anything like a sufficient amount of power to do the work which has been done. When we consider that the beds belonging to the sub-carboniferous extending over an area embracing the greater part of the State of Kentucky, a large portion of the State of Tennessee, and a portion of Northern Alabama have been completely swept away to a depth of 700 feet, and that in addition to this a large tract of this territory was covered by carboniferous rocks which have also disappeared leaving nothing but isolated patches here and there along the eastern border of the district, or to make the statement more comprehensible we may put the area of denudation at 28,390 square miles being for

Kentucky	10,000	Square Miles.
Tennessee	14,390	“
Alabama	4,000	“

we are apt to give thought and credence to the belief that all this work must have been performed by some enormous force—something that is altogether abolished from among the forces of nature at the present time—that in those days there must have been forces at work which have long since ceased to operate. It is remarkable how readily we are prone to ascribe a supernatural cause or some extraordinary and almost miraculous reason for the performance of any work we do not clearly understand. However, in this case there is nothing supernatural, nor yet was there any work in operation or causes at play during the earlier days of this work than there are in operation at the present day. It has been suggested that the Appalachians were raised by successive uplifts, and the force of the water rushing through among the mountains caused the formation of the valleys and gorges in various parts of the mountain ranges. If these mountains rose by successive stages, and the streams had already formed their channels and taken up their positions permanently, then no such a tremendous rush of water could take place. That this was so we have plenty of proof in the gorges of the few rivers which have found their way to the Atlantic Ocean.

If we consider the length of time during which this erosion has been going on and compare the results arrived at with the results of the same cause (erosion) in other parts of the world, we will readily see that it is not in the least necessary for us to call in the aid of any

enormous floods or anything of greater force than the powers at work during the present time. We will find in comparison with other districts that many of them have accomplished a much greater amount of work within a much shorter period of time, and with apparently more inadequate instruments.

The great factor, or at least one of the great factors, and probably the greatest, in the formation of the contour of the surface of the earth is *erosion*, or denudation, or degradation, or land sculpture. To complete the operation under whatever denomination we may place the work, two agents are required—the disintegrating agent and the transporting or removing agent—without the one the other would be comparatively harmless and have little or no effect. Without the transporting agent the disintegrating of the material could only be carried on to a small extent—the mass of disintegrated material would form a protective barrier to the underlying rock and thus prevent any further destruction, and the work of erosion would be retarded until the transportation of the already destroyed material. The removal of this is the work of the transporting agent. The protecting barrier of destroyed or disintegrated matter being removed, another surface is laid bare to the attack of the disintegrating agent. That again is removed, and another destroyed and removed, until the whole of the material has been worn away.

All this must be done by the assistance of the transporting agent, as the disintegrating or destroying agent has no power of removal, or at best an exceedingly limited power due to the action of gravity ; its action is wholly confined to destruction.

The transporting agent has only a very limited power of destruction due altogether to mechanical causes chiefly corrosion. Transportation is chiefly carried on by running water. A small proportion is also performed by the wind, and a still smaller by ice.

The chief factors in erosion are rain, snow, ice, rivers, waves, and tides, and ocean currents. The air in the shape of wind or as a medium through which chemical action attacks the rock, is also to a slight degree a factor in the problem of erosion.

It is, however, with only two of these agents that we have to deal with regard to the formation of the central basin. The atmospheric effects doubtless had something to do with it, but to what extent we

cannot at present estimate. The two more directly interested in the work are rain and running water. These two had most to do with formation of the basin of Tennessee. Ocean currents, it has been gravely asserted, hollowed out the basin. Of the action of ocean currents we have no positive observations. Although they are very powerful agents of transportation, there is a great probability that they have no power as eroding agents. Ocean currents flow for the most part of their course through water and having a bed of water between the current and the bottom, thereby protecting it from any corradng influence the current might have. Whatever planed off the sub-carboniferous and other beds to the level of the Highland rim, or hollowed out the basin, ocean currents had nothing to do with the work.

Transportation as we have already stated is chiefly carried on by running water. It is also carried on to a small extent by the aid of the wind and atmospheric currents. The latter is more or less confined to the sandy shores of the sea and arid sandy districts.

Disintegration is carried on by weathering and slightly, in a mechanical way, by running water. This action of running water has been called corrasion.

The chief agents in weathering are changes of temperature, rain as a solvent and as a mechanical agent, gravity and vegetation.

Sudden changes of temperature affect material of every sort. Frost following a saturated condition will by freezing fracture the hardest rock wherever water has been enabled to penetrate. Softer rocks are disintegrated by the freezing and expansion of the water percolating through their pores.

Rain is an agent of weathering in a two-fold capacity, the one as a solvent and the other from a mechanical point of view. As a mechanical agent, the effects of rain are confined to the power of disintegrating any loosely held or incoherent matter and detaching particles already loosened by frost. As an agent of solution, water is the great solvent, not only inherently whereby many matters are dissolved, but also as an agent whereby various chemical solvents are enabled to attack the different materials composing the rocks coming under its power. While some rocks are disintegrated by complete

solution, many are only divided into grains by a partial solution, whilst fragmental rocks only lose their cementing materials.

Gravity as a factor in weathering is not a very great one. In cases where the various beds of rock are of different textures and hardness, and the harder bed may be overlying the softer, such as may be seen in the case of the Niagara limestones overlying the softer shales of the Clinton, the weathering of the soft underlying beds gradually undermines the hard overlying bed, and in time the action of gravity causes the projecting piece to break off and fall down to the bottom of the cliff. In this way also gravity acts as a transporting agent.

Vegetation.—It is not so easy to determine to what extent weathering is due to vegetation. The plants have a direct tendency to aid, while indirectly plant life has a tendency to retard, erosion. Directly, plants aid erosion by the penetration of the soil by their roots, thereby allowing the admission of moisture to the underlying rocks, and also by the penetration of the harder rocks and thereby in a mechanical way owing to the enlargement of their roots, as well as the admission of water causing fracture. On the other hand, a profuse vegetation has a tendency generally to retard erosion. It is true, disintegration by solution is, owing to the increased power of percolating water, increased, but the soil is protected from the mechanical erosion of the rain drops and rills; transportation, owing to the grasping conservative action of the roots, is retarded and brought almost to a standstill; the action of frost upon the underlying rocks is destroyed by the soil reaching beneath the limit of frost action and the effects of rain drops are spent upon the foliage. The power of the vegetation in any district of retarding erosion lies in the fact that it interferes with the transporting agent just at the place where that agent is weakest.

The power of erosion due to running water is called corrasion. Clear pure water corrades by solution, and mixed muddy water partly by solution but chiefly by mechanical action of attrition. Wherever the declivity is steep and the motion of the water rapid, the corrasion by solution is reduced to a minimum. The increased velocity of the stream due to the increased steepness of the bottom increases the transporting power of the water, and in that manner increases its

power of corrasion. The moving power being the water of the stream and the tools the fragments of mineral, mud or sand held in the water, the more rapidly these tools move the greater the amount of work performed. This, of course, depends on the hardness, size and number of the fragments in transition and also upon the hardness of the rock forming the bottom of the stream. If the fragments be hard and the rock-bedding soft the maximum amount of corrosion is reached. Although the general tendency of corrasion is in a vertical direction, yet under varying circumstances it works in a lateral direction, in which case it forms a flood plain. "As an effect of momentum, the current is always swiftest along the outside of a curve of the channel, and it is there that the wearing is performed, while at the inner side of the curve the current is so slow that part of the load is deposited. In this way the width of the channel remains the same while its position is shifted and every part of the valley which it has crossed in its shiftings comes to be covered by a deposit which does not rise above the highest level of the water. The surface of this deposit is hence appropriately called the flood-plain of the stream. The deposit is of nearly uniform depth, descending no lower than the bottom of the water channel, and it rests upon a tolerably even surface of the rock or other material which is corraded by the stream. The process of carving away the rock so as to produce an even surface, and at the same time covering it with an alluvial deposit is the process of *planation*."—(*Gilbert, Land Sculpture, Geol. of Henry Mt. p. 121*).

In the course of the Cumberland River through the Central Basin there are numerous portions of the bottom of the basin along the margins of the river that come under the denomination of flood plain. The Signal Service have three river stations at which are recorded the height and other particulars regarding the movements of the water. At these are also given the flood plains in the various districts.

Station.	Danger line feet.	Area overflowed.
Burnside, Ky.....	50	2.5 Sq. miles.
Carthage, Tenn.....	40	90. "
Nashville, Tenn.....	40	13. "

In the neighbourhood of Nashville but outside of the immediate area covered by the above 13 miles and lying within the great bends of

the river there are large tracts of land which might be classified as flood plains. The material composing these plains is chiefly of clay and sand with a mixture of fine gravel scattered throughout the beds. This material is of a rusty yellow or orange color and is similar in texture to the low lying islands of sand and gravel formed at various places in the river ; there is, however, no clay in the islands.

The outer margins of the river as it sweeps around these great bends are composed of beds of light blue rock of the Nashville group to the west of Nashville, and of the darker colored Trenton limestones to the east. Both form high embankments varying from 100 to 200 feet in height. Along the limits of the flood plains where it joins the high land the rock wherever visible shews a beveled cut off face and wherever exposed to the air the action of the stream has been greatly supplemented by the action of the atmosphere. The edges are rounded off and even marked in many places-with small channels or waterways for the escape of rain, and the overlying soil has rill marks and rain channels corresponding to the marks in the rock.

The climatic conditions consisting of temperature and rainfall obtaining in the region occupied by the Central Basin together with the material of which the rock is composed and the general drainage system all tend to facilitate the work of erosion.

The direct influences of temperature are comparatively simple. Temperature affects erosion chiefly by its changes. When the range runs so low as to include the freezing point of water, frost contributes its aid to weathering. It is only under conditions in which the changes are great and sudden that rocks are fractured by unequal expansion or contraction.

The range of temperature within the basin includes the freezing point of water. The highest temperature recorded in Nashville between 1871 and 1887 was 104 in August, 1874, the next being 101 in July, 1881. Although it frequently touched the nineties and once reached as high as 99 it never passed the 100 except on these two occasions. In January, 1884, the lowest recorded temperature, —10, for the same period was reached. On two other occasions—December, 1876, and February, 1886, the recorded temperatures were —2 and —7 respectively. Throughout that period the mean of the highest temperatures was 68.3 and the lowest 50.7 with a mean daily range of 17.7 and a monthly mean of 47.2. The mean annual tem-

perature at Nashville is 59.6° and for the seasons: spring, 59.3°; summer, 78.4°; autumn, 59.7°; winter, 41°.

A glance at the annexed table will show that the variations of temperature are not very great, but comparatively uniform and that in only one month in the year does the mean lowest temperature indicate frost. The mean lowest temperature is recorded as 30.1° for January with the next 33.2° for December.

The table II. shews the dates at which frosts made their first and last appearance and the average number of days free from frost in the basin.

I. Table shewing average temperatures at Nashville, Tennessee, (by months) from January, 1871, to December, 1887, inclusive; from observations made by U. S. Signal Service.

MONTH.	Highest and Year	Lowest and Year.	Mean Daily Range.	Mean of Highest.	Mean of Lowest.	Mean Monthly Range.	Mean.
January	74. in 1879	-10. '84	15.8	45.9	30.1	58.9	38.6
February.....	75.0 in 1875	-7. '86	16.3	50.2	34.2	55.3	43.1
March	81.7 in 1882	11.0 '73	18.1	58.3	40.2	52.3	48.9
April	90.0 in 1872	25.5 '75	18.6	68.9	50.4	49.5	59.6
May	90.0 '74,'79	37.0 '77	18.9	79.2	59.7	44.7	69.4
June	99.0 in 1874	49.0 '77	17.6	85.1	67.6	37.8	77.
July	101.2 in 1881	56.3 '82	17.7	89.0	71.3	34.4	80.1
August	104.0 in 1874	55.0 '79	18.1	86.9	69.3	35.6	78.2
September....	98.2 in 1881	41.0 '75	18.7	80.4	61.7	43.6	70.6
October	89.0 1879-81	28.0 '73	19.6	70.8	50.9	48.9	60.5
November	80.6 in 1882	13.0 '72	17.6	56.9	39.3	52.6	47.9
December	77.1 in 1873	-2.0 '76	15.7	48.4	33.2	54.	41.4
Average '71-'87	88.6	24.7	17.7	68.3	50.7	47.2	59.6

II. Table showing dates of first and last frosts from 1871 to 1888 inclusive.

YEAR.	Last frost in Spring.	First frost in Autumn.	No. of days free from frost.
1871	April 23	Nov. 12	202
1872	" 2	Oct. 11	192
1873	" 26	" 21	178
1874	" 30	" 14	167
1875	" 19	" 12	176
1876	" 6	" 7	184
1877	May 1	" 5	157
1878	Mar. 26	" 13	201
1879	April 18	" 24	189
1880	" 12	" 18	189
1881	" 14	" 20	189
1882	May 16	" 24	161
1883	" 24	Nov. 1	160
1884	April 25	Oct. 16	174
1885	May 10	" 22	165
1886	" 1	" 2	154
1887	April 19	Sept. 24	158
1888	" 21	" 24	
Average...	April 24	Oct. 18	176

The processes of erosion are affected directly by the amount of rainfall, and by its distribution throughout the year. A regular and uniform precipitation favors erosion in both its divisions of weathering

and transporting, whereas an unevenly distributed supply, or where the amount is concentrated into a short period of time at the expense of the rest of the year, erosion is retarded. In the dry season weathering is greatly retarded for the lack of assistance from the transporting agent; and in the wet season, although transportation and corrosion are accelerated, weathering is retarded. Weathering is greatly facilitated by abundance of moisture, but it requires to be evenly distributed. If the rainfall be uniformly distributed a greater amount is absorbed by the soil, and by the percolating of the water the rocks underneath are dissolved, or at least partially broken up into a condition fit to be removed as soon as the present overlying soil is taken off. In the case of a concentrated dash of rain coming all together more falls than can be absorbed and it consequently passes off to swell the power of the transporting agent without having done anything to aid in providing material to be transported.

The rainfall within the Central Basin—that is, taking the averages as observed at Nashville as being representative—for the years from 1871 to 1887, shews a remarkably uniform rate of precipitation. The average annual precipitation amounts to 51.88 inches distributed over the seasons as follows:—

Spring	14.09	inches.
Summer	13.47	“
Autumn	10.29	“
Winter	14.03	“

The average monthly precipitation for a period extending over the same length of time is 4.32 inches, August, September and October being the lowest with averages of 3.41 inches, 3.60 inches and 2.79 inches respectively.

Table III. shews the averages of the monthly and daily precipitation from 1871 to 1887.

Table IV. gives us a record of the excessive and heavy rainfalls at Nashville for seventeen years (1871—1887).

III. Table shewing the average monthly and daily rainfalls at Nashville, Tenn., from 1871 to 1887, as observed by U.S. Signal Service.

MONTH.	Average Monthly Inches.	Average Daily Inches.	Average No. of Rainy Days.	Average No. of Thunder Storms.
January	5.27	0.17	13	1
February	5.04	0.18	12	2
March	5.27	0.17	12	3
April	5.10	0.18	11	4
May	3.72	0.12	10	6
June	5.10	0.17	12	8
July	4.96	0.16	11	8
August	3.41	0.11	9	4
September	3.60	0.12	7	2
October	2.79	0.09	7	1
November	3.90	0.13	10	1
December	3.72	0.12	12	1
Average 1871-87....	4.32	0.14	10.3	3.4

IV. Table showing the excessive and heavy rainfalls at Nashville, from 1871 to 1887.

YEAR.	AMOUNT IN INCHES.	DURATION IN HOURS, MINUTES.		DATE.
		H.	M.	
1871	2.23	13	45	April 25-26.
1872	3.45	10	—	April 8.
1873	1.90	5	15	December 2.
1874	2.78	8	10	February 10-21.
1875	2.55	10	35	March 15.
1876	2.65	2	15	August 24.
1877	2.93	12	55	September 17.
1878	2.99	3	06	July 8.
1879	5.09	11	36	July 24-25.
1880	5.20	15	45	February 13.
1881	4.21	20	02	September 15.
1882	3.46	19	41	March 8-9.
1883	5.04	16	21	April 21-22.
1884	2.33	4	47	March 25.
1885	2.25	11	08	July 4.
1886	2.01	1	06	June 2.
1887	3.85	12	30	September 17-18.

The nature of the underlying rock has a greater or less effect upon the rate of erosion. In the case of hard material the rate must necessarily be slow, but where the underlying rocks are soft or the material consists of clay or gravel, the operation of eroding a valley or basin will be comparatively rapid, and erosion will go on until an equilibrium has been established between the rate of weathering and

the power of transporting. In other words, whenever the transporting agent becomes so that it is unable to carry off the amount of detritus provided by the disintegrating force, then weathering will accommodate itself to the transportation by the accumulation of detritus bringing the action of weathering to a balance. Whenever this equilibrium is established, erosion will proceed at a uniform rate depending entirely upon the nature of the material to be eroded.

The rocks forming the bottom of the Central Basin consist of the comparatively soft argillaceous thin bedded rocks of the Trenton and Nashville, easily weathering upon exposure to atmospheric agencies. In many places rounded knob-like hills rise up about 100 or 150 feet above the general level of the plain. These knobs consist of thin bedded light blue argillaceous limestones, and are in some cases absolutely devoid of any detritus ; in others there is a scanty partial covering of gravelly material. Generally though, these knobs have a somewhat slight covering of gravelly soil out of which a stunted growth of cedar is found growing.

Along the streams at the foot of the knob there is usually a small extent of bottom land varying with the size of the creek, but none of any very great extent except where the creeks flow into the river. Along the banks of the rivers, particularly the Cumberland, there are extensive tracts of this bottom land made up of the detritus brought down from the higher grounds by the action of the streams.

The beds of the various creeks flowing from the escarpment are generally composed of gravel of a rusty brown or orange color, and containing fragments of fossils belonging to the beds through which they have cut a passage. In every case the streams have worn and rounded the rock bedding in the sides and bottoms. Even the smallest seem to have a considerable effect.

In the various railroad cuttings the exposures of rock are weathered to a considerable extent. Near the southern end of the Cherry Street Station there is a cutting shewing three beds of thick,

light blue (almost white) limestone. The top bed is weathered, long thin projections sticking out in various ways. The softer portions of the bed have been taken out, apparently by the rain beating against the face of the cutting.

Although for the most part the beds of the Basin are almost horizontal with only a slight dip to the northwest, there are many local dips of various angles and in different directions. This is due to the dissolving of the thin clayey seams found as partings between many of the beds. Wherever these dips are found forming a synclinal valley there is sure to be a small water channel down the bottom, dry mostly, but in wet weather full of muddy water of the same colour as the enclosing beds.

In transportation of the material destroyed by weathering the drainage of the country forms the great agent.

For drainage purposes the area of the Central Basin may be divided into three divisions and named after the three rivers flowing through it.

In the northern division we have the Cumberland River occupying with its tributaries, the Caney Fork, the Stones River and the Harpeth River, a drainage area of over half the body of the Basin. The Cumberland flows along the northern margin of the Basin within a few miles from the escarpment. No large streams join the river on that side, but it is the receptacle for numerous small creeks which flow over the escarpment. The Caney Fork joins the main river just as it enters the Basin, and the Harpeth not until after it has left it—the latter river having cut a channel for itself through the escarpment in a north-western direction to join the Cumberland. The Stones River lies altogether within the Basin. These are supplemented by numerous small creeks and channels forming a complete network of water-courses over the face of the country.

The course of the Cumberland is a very tortuous one. From Port Burnside in Kentucky at the head of navigation to the island below

Nashville the river with its numerous windings is 327 miles and a direct line drawn between the two places would not be longer than 150 miles.

The fall of the river from Port Burnside to Nashville is only 228 feet, or an average of about eight inches per mile for the whole distance. Of this fall, however, 99 feet is obtained in the first 130 miles from Port Burnside to the Tennessee State line, and 40 feet within the next 50 miles.

Slope of the Cumberland River from Port Burnside to Nashville,
from a Survey made by the U.S. Engineer Corps.

	DIST'NCE	TOTAL FALL.	FALL PER MILE.
	MILES.	Feet.	
Port Burnside to State Line	130	99	9 inches.
State Line to Salt Lick Shoal	46	32	8 "
Salt Lick Shoal to Niagara Island.	8	10	1 foot 3 in.
Niagara Island to Double Island	88	59	8 inches.
Double Island to Mansker's Island	24	15	7½ "
Mansker's Island to Nashville	31	13	5 "
	327	228	8 inches.

The average depth of water is about 10.6 feet. The highest water during the last sixteen years was 54.6 feet in January 1882, and the lowest 0.4 below the zero gauge in October 1876. The highest average of depth is 21.3 feet for February, and the month shewing the lowest is October with an average of 2.3 feet.

Average depths of Cumberland River at Nashville from 1871 to 1887.

MONTH.	Average Feet.	Highest and Year.		Lowest and year.	
		Feet.	Year.	Feet.	Year.
January	17.7	54.6	in 1882	2.0	in 1877
February	21.3	46.9	" 1884	3.5	" 1877
March	19.2	49.3	" 1884	3.5	" 1877
April	18.8	49.6	" 1874	5.1	" 1878
May	10.3	34.2	" 1875	2.8	" 1879
June	6.4	27.7	" 1885	0.8	" 1879
July	6.0	30.7	" 1880	0.1	" 1879
August	4.3	17.6	" 1874	0.1	" 1887
September	3.	17.5	" 1874	*0.3	" 1887
October	2.3	10.3	" 1875	*0.4	" 1878
Nvember	6.3	27.	" 1885	*0.2	" 1887
December	11.6	35.4	" 1879	0.7	" 1884
	10.6	33.5		1.5	

The months of January, February, March and April shew the heaviest averages. During these months of 1888 the average mean velocity of the stream was for

January	5,019 miles.	Mean of 51 observations
February	4,194 "	" 65 "
March	5,907 "	" 116 "
April	5,208 "	" 82 "

The average discharge per second was for

January	49,224 cubic feet
February	32,299 "
March	105,474 "
April	70,528 "

These figures probably represent more than double the average discharge if taken for the whole year. The discharge in summer is estimated about 13,000 cubic feet.

None of the streams connected with the drainage of the basin have the drainage area of the Cumberland.

In the central division the Duck River forms the channel of outlet. This stream flows almost through the centre of its drainage area sending out small creeks to both sides. This area is limited to the south by the Elk Ridge, and on the north by a long narrow spur of Nashville rocks. The Duck River is a tributary of the Tennessee. As may be indicated by its drainage area it is less than half the size of the Cumberland, it is not navigable, and no reliable data have ever been kept regarding it.

The Third or Southern drainage division is that of the Elk River. It is divided from the Duck River area by the Elk Ridge, and is limited on the south by the escarpment forming the rim of the Basin along which it skirts very closely. The Elk is a tributary of the Tennessee River.

In Tennessee these streams drain the Highland Rim, and in Kentucky the chief drainage channel is the Ohio River with its tributaries. The whole of the State of Kentucky, with the exception of probably about 1,000 miles lies within the area belonging to the Ohio division of the Mississippi drainage basin which is estimated to be lowered by one foot in 5,000 yards.

The conclusions naturally arrived at from a consideration of all the facts connected with the geological structure of the country under consideration are these. That the territory now occupied by the sub-carboniferous beds was elevated at the close of the sub-carboniferous period; that the greater part of it was above the level of the marshes in which the coal beds were formed; that the Central Basin of Tennessee is a basin of erosion, and that the amount of denudation necessary to form the Highland Rim in its broadest extent and the Central Basin was the work of the present system of drainage.

The rivers and streams of Kentucky have a generally westerly and easterly course and all have cut for themselves deep channels. Some

of them are remarkably crooked with a gentle fall, some of them having not more than three or four inches to the mile, and in places only a succession of pools united by gentle ripples.

The Cumberland River which drains more than half of the Central Basin has an average fall between Port Burnside and Nashville of about eight inches to the mile, but this is due to what might be called a succession of jumps of a foot and sometimes a foot and a half at the various shoals and ripples which occur throughout the course of the river and which, to a considerable extent, impede the navigation of the stream. In reality the current for long stretches of the river is almost altogether due to the impetus given by these ripples or steps.

The area now covered by the Central Basin of the Tennessee was, at the close of the sub-carboniferous period, occupied by a dome-like structure, the apex of which was at least 1,500 feet higher than the floor of the Basin as it now appears. This dome was probably surrounded by smaller ones of the same description. A small dome of this nature and exhibiting the structure of the larger one is to be found in Stewart County. It is called by Professor Safford "Wells Creek Basin." On the principle or general law of erosion that the highest point is always attacked first, the apex of this central dome would be subjected to wear before the other portions of the region. There is every probability also that the harder beds lying upon the surface would be fractured and cracked in various places. These fractures would admit water and form an underground drainage which eroded the underlying soft beds forming the vast series of caverns such as are found underlying the sub-carboniferous rocks of Kentucky. The water falling upon the slopes of the dome would form the drainage which was eroding the overlying hard rocks. In course of time this erosion had so planed and denuded the top and the underground streams having formed a series of caverns connected with their channels that the Cumberland River, on passing through the barrier of less eroded rocks, entered the region of the Basin and found comparatively little resistance by the softer rocks where left standing by the underground waters, undermined the remaining upper beds and eventually removed them. The river, having reached its base level of erosion, its energies were expended in lateral erosion, and the result is that the Cumberland has wandered from side to side

of its drainage area in great bends at each change of course entering a little deeper into its bed rock. At present it now forms great loops or bends, some returning so close upon the other as to make almost complete islands. The present position of the course of the river with regard to its drainage area within the Basin is by no means of a very high antiquity. This can be seen by a study of its channel and the bottom lands lying along it, when it will be seen that it has moved in various ways and shifted its position many times before it assumed its present course. Of course we cannot tell how often it has changed, but we can trace the limits of its latest movements since assuming its present level. During the rainy season the stream is highly charged with fine particles of matter which form a clayey sediment when allowed to settle. Part of this sediment is deposited along the bed and banks of the river in the shape of mud banks and in bars, and part of it is carried to the Ohio River where quite an extensive deposit has been formed within the last few years. This bankforming at the mouth of the Cumberland has rendered the town of Smithland, formerly a river port, quite inaccessible from the river for navigation purposes.

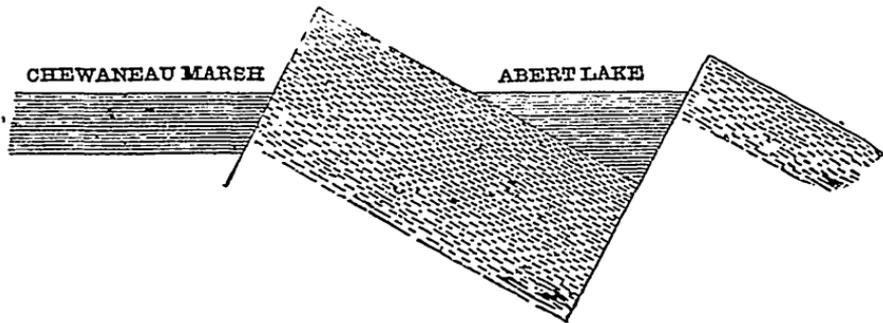
In the central district the Duck River has worked in the same manner as the Cumberland, but not upon such an extensive scale, as its drainage area is not quite so large. In the southern division the Elk River has not covered so much ground as either of the other two, but still its work has been in the same direction.

There can be no doubt but the movements of these streams have been the cause of the deepening of the Basin to its present condition, while the numerous smaller streams flowing over the escarpment have been the chief agents in former times, as they are at present, in the widening of the Basin.

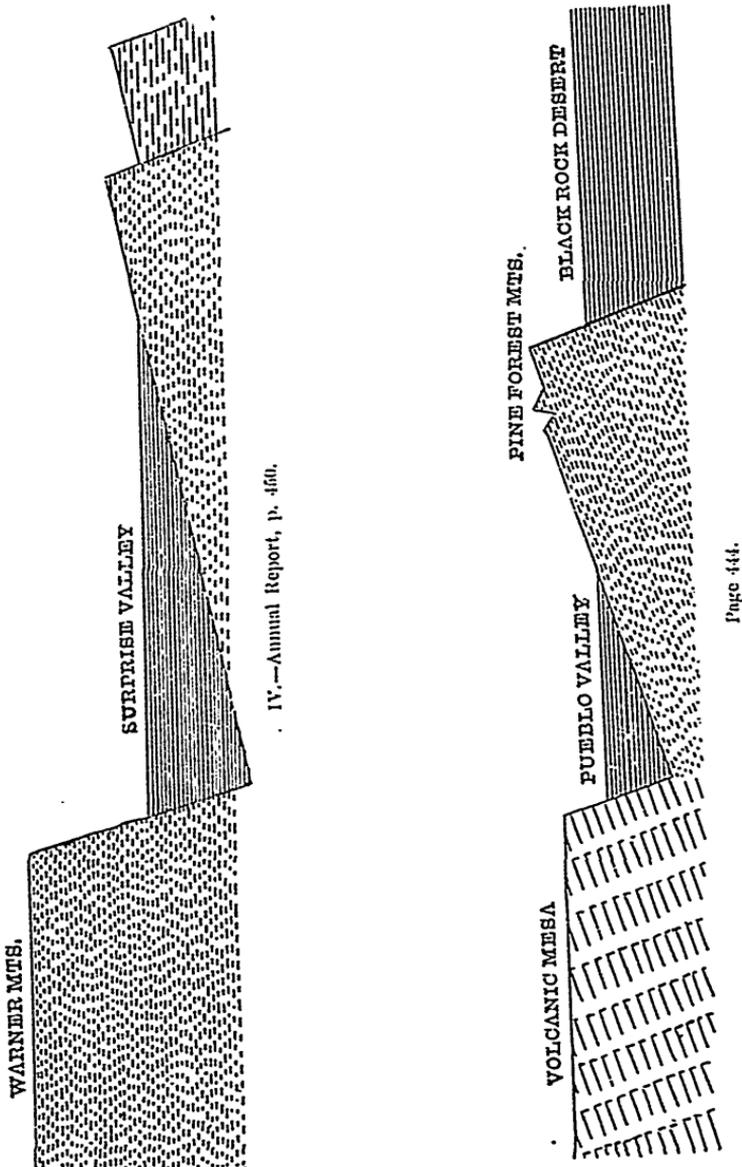
Thus we see that the Central Basin of Tennessee was formed by simple causes operating through a great length of time, and that it is not at all necessary to call in the aid of any unknown factors in performing the operation. Any assumption that some gigantic unknown agency had anything to do with the case is purely gratuitous and unnecessary.

It may be argued that there has not existed a sufficient length of time in which to perform the work. To this it may be answered that

much greater operations have been carried out in much shorter periods of time and with no more effective agents. Numerous instances might be given, but one will be sufficient. According to Powell and Dutton, over the whole Plateau region, an area of not less than 200,000 square miles, an average of 6,000 to 8,000 feet, and an extreme of 12,000 feet has been removed by erosion since the middle Tertiary. All this work has been performed in a little less than half the time consumed in digging out the area covered by the plains of the Highland Rim and the Central Basin of Tennessee.



IV.—Annual Report U. S. Geol. Survey, p. 448.



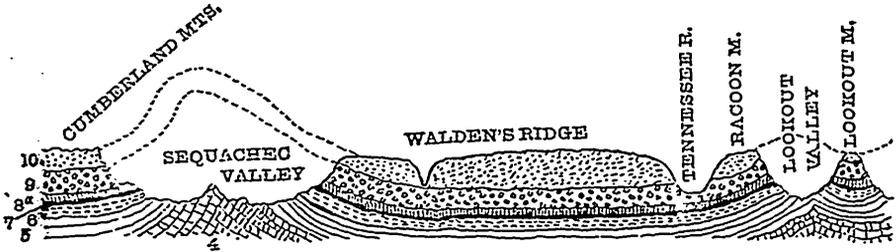
IV.—Annual Report, p. 450.

Page 444.

EXAMPLES OF MONOCLINAL VALLEYS.

From Fourth Annual Report, U. S. Geological Survey:

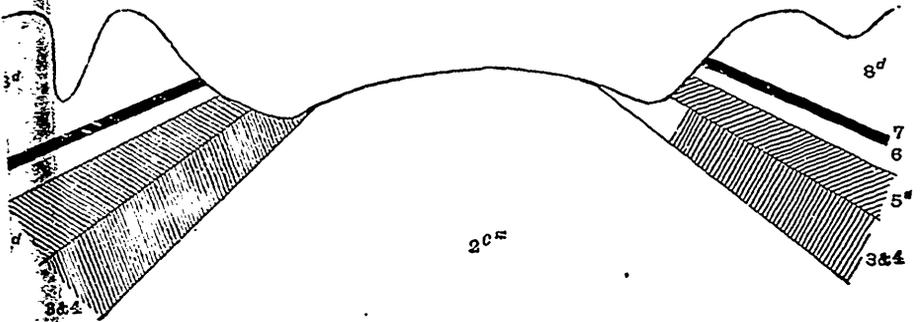
SECTION ACROSS SEQUACHEE VALLEY TO LOOKOUT MOUNTAIN.
From Safford.



4. Knox Dolomite; 5. Trenton and Nashville; 6. Dyestone (Niagara); 7. Black Shale; 8. Siliceous;
9. Mountain Limestone; 10. Coal Measures.

EXAMPLE OF VALLEY OF ELEVATION.

WELLS CREEK BASIN.—From Safford.
Geology of Tennessee, page 147.



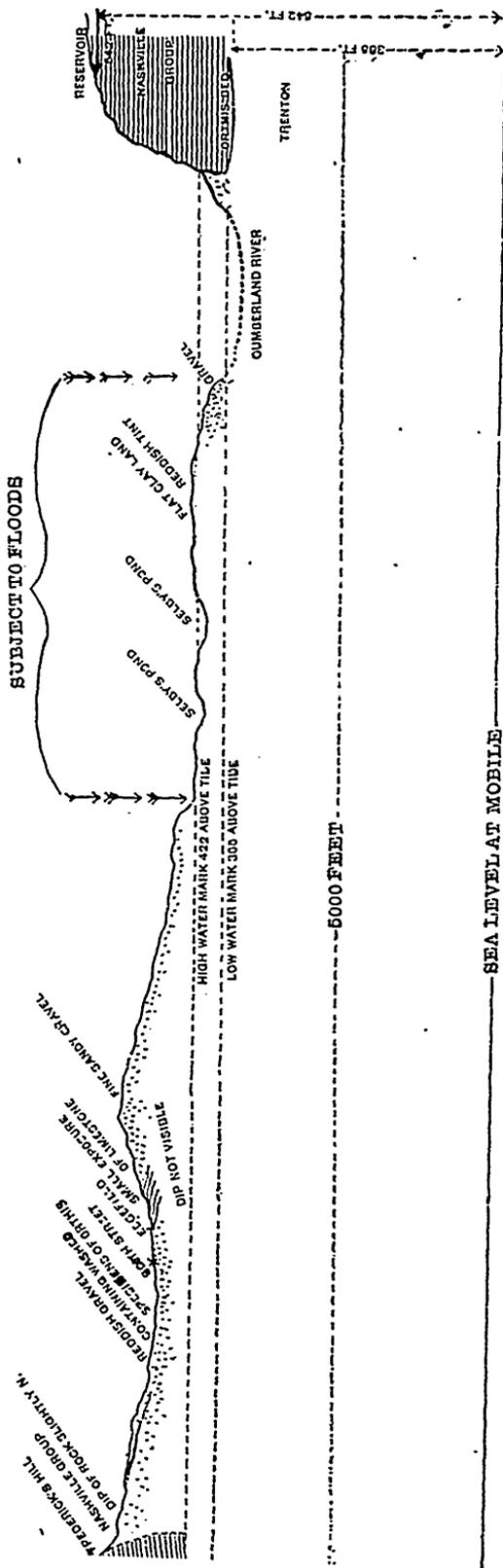
8^d Siliceous; 7. Black Shale; 6. Lower Helderberg; 5^d. Niagara, Meniscus Limestone; 4. Nashville
3. Trenton; 2^c Knox Dolomite.

VALLEY OF ELEVATION.

SECTION ACROSS CUMBERLAND RIVER AT NASHVILLE, TENN., FROM OLD CITY RESERVOIR
TO FREDERICKS HILL IN EDGEFIELD.

Scale { Horizontal 500 feet = 1 inch.
Vertical 200 feet = 1 inch.

29th Oct., 1888.



ERRATUM.—For "20th Street," read "Second Street."

THE WESTERN DÉNÉS—THEIR MANNERS AND CUSTOMS.

By the Rev. Father A. G. Morice, O.M.I., Stuart's Lake, B.C.

So far, very little and, to my knowledge, no reliable information has ever been published concerning the ethnology and sociology of the Indian tribes inhabiting that northern part of British Columbia originally known as New Caledonia. It is not because they have been altogether ignored by English-speaking ethnographers; but for one reason or another, whenever they are attended to in scientific papers, it has never been with satisfactory accuracy. No later than four years ago the Smithsonian Report contained a paper on Anthropology by Otis T. Mason, wherein I found¹ the following, purporting to be a classification of the "Tinnéh or Athabaskan"² tribes, including the Western Dénés.

Western Tinnéh.

Kai'-yüh-kho-ta'nā.
Ko-yu'kūkh-o-tā'nā.
Un'-ā-kho-tā'-na.

Kut-chin Tribes.

Ten'-an-kūt-chin'.
Tennūth-kūt-chin'.
Tat-sah'-küb-chin'.
Kūt-chā-kūt-chin'.
Nahsīt'-küb-chin'.
Vunta'-küb-chin'.
Hai-ān-kub-chin'.

¹First part of the Report, etc., for 1885, page 332.

²At the risk of appearing unnecessarily fastidious may I be allowed to remark here that either term, Tinnéh or Athabaskan, seems ill chosen to designate that vast family of aborigines they are made to represent? Athabaskan is local and consequently should not be applied to the whole stock, whilst Tinnéh, if anything, does not mean what it is intended for. Indian languages, especially that of the tribes in question, are exceedingly delicate, and a very light phonetic shade, which the uninitiated will often fail to perceive, always changes the sense of the word. Tinnéh, which evidently stands here for Déné, "men" (the name most of the tribes call themselves by) would rather remind a Western Déné of the berry of what is vulgarly called "kinnikinnik" (*Arctostaphylos uva-ursi*) than of the genus *homo*! Others give them the name of Tinné, calling them thereby "Four" persons).

Eastern Tinneh.

K'nai-a-kho-tana.

Ah-tenā'.

Nehannees.

Abbā-to-tenāh.

Acheto-tinneh.

Khün-um-āh.'

Carriers.

"Takūlli."

Tsilkotinneh.

Now, I daresay the learned Professor has been misinformed, inasmuch as Dr. W. H. Dall's list, which he quotes and seems to adopt is incorrect and incomplete. It is incorrect because, among other things, it puts down the Tsilkotinneh (or more correctly Chilhōtins) as belonging to the Carriers (Taxelh, not "Takulli") from whom they are distinct. Moreover, those tribes noted under the title of "Western Tinneh" have no existence but on paper. As for the Nehannees, I suppose Dr. Dall means the Nah-anés; but I strongly suspect that the seven "Kut-chin" tribes; which he gives as specifically different, are only so many sub-divisions of the same tribe, all of whom speak the same dialect probably with local idiomatic peculiarities. Indeed, their very name, not to speak of reliable authorities, would lead me to form this opinion. "Kut-chin"¹ is a verbal suffix which, when in connection with a denominative name is expressive not of ethnological variety, but of topographical location. Its appearance at the end of certain words denotes that the aborigines who designate themselves thereby are philologically, and thereby ethnographically, so homogeneous as to preclude the possibility of their being classed as different tribes of the same stock.²

¹The "toh" pronounced with a peculiar smacking of the tongue. To prevent typographical difficulties I shall avoid as much as possible the giving of aboriginal names in the course of this monograph. I am not acquainted with the system of Indian orthography suggested in a volume of the Smithsonian Miscellaneous Collections, and even should I have it ready for reference I doubt whether it would prove adequate to the accurate rendering of the multifarious sounds of the Déné languages.

²This suffix varies with the different tribes. Its equivalents on this (west) side of the Rocky Mountains are *tingkwotin* in Chilhōtin, *ten* and *kwoten* in Carrier, *t-chene* and *kwo-tcheneir* Sékenais.

On the other hand, Dr. Dall's classification is incomplete, since it omits the Tsékenné, a tribe whose habitat is on both sides of the Rocky Mountains, whilst, of eight clearly distinct eastern tribes, he notes only two and that under aboriginal names, the genuineness of which is to me of more than doubtful character.

Some ethnographers, for reasons known to themselves, regard the T'simpsons, who lately migrated from this (North Pacific) coast to an Alaskan Island, as an offshoot of the Déné or Athabaskan stock. But even a slight knowledge of their language and physical characteristics ought to convince any one of the fact that they are altogether heterogeneous thereto.

This being admitted, it remains with me to state which tribes are to the subject of this paper, and conformably with the Canadian Institute's Sociological Circular to give some account of their social condition, customs, ceremonies, etc. The subject is rather comprehensive, and even without attempting to treat it exhaustively I fear I will have to give its exposition perhaps unexpected extension.

I.

Let me, however, premise that I shall content myself with speaking of the Western Dénés, excluding from my subject those tribes which have their fishing grounds on the north coast of British Columbia and which form by themselves a group apart. Our Dénés belong to a race of aborigines occupying a vast territory. Without mentioning the Navajoes who, advanced sentinels of a delayed army, wait in New Mexico for their kinsmen of the north to rejoin them under more favored climes, one can hardly travel from Fort Macpherson within the Arctic Circle to the plains of the South Saskatchewan without meeting with representatives of that great family. On our (west) side of the Rockies they are divided into four tribes speaking as many dialects. They are :

1st. The Chilxotins¹ actually about 460 in number, occupying the valley of the river called after them, and the bunch-grass covered plateaus that skirt it on either side between 51° 10' and 52° 40' north latitude, and from the western banks of the Fraser to the Coast Range of mountains.

¹"Inhabitants of Young Man's River."

2nd. The Carriers or Taxelh,¹ numbering 1,600 and whose territory borders on that of the Chilxotins in the south, and extends as far up as 56° north latitude, leaving to a band of Sékanais part of the forest land intervening between said latitude and about 57° north where we find

3rd. The Nahaués,² who may number 700 and hunt over a territory, the northern limits of which (about 65°) are the southern frontiers of the Loucheux³ hunting grounds in the extreme North-west Territories. Lastly we have in our district a number of

4th. Tsekemé⁴, more commonly called Sékanais who roam over the Rocky Mountains on either slope and the adjacent forests and plains from about 54° to 60°, north latitude. At present there are not more than 250 of them in British Columbia.

To these might be added the Beaver or Tsatens who trade at Hudson's Hope and Fort St. John's, Hudson's Bay Company's posts on Peace River, which, politically speaking, belong to our Province though east of the Rockies. But as (save a few individuals of that tribe) I have seen very little of the tribe, and to adhere to my resolution to speak only of what I have knowledge derived from personal intercourse, I shall refrain from alluding to them. Nevertheless, most of what shall be said of the Sékanais in the course of this monograph, may also be understood as largely applicable to that tribe.

All these tribes, especially the Chilxotins and Carriers, were originally quite numerous. In fact, if we are to credit the old men among them, and even the Hudson's Bay Co.'s employés who were early in this country, it would be necessary to almost decuple the existing numbers in order to obtain an idea of the population as it stood at the time of the discovery of the country by Sir Alexander Mackenzie in 1793. Repeated domestic and foreign wars and contagious diseases, which have several times in this century played havoc among them, have greatly reduced their numbers.

¹This word Taxelh is exotic to the Carriers' language, and, although very often used by them, they contend it was unknown among them before the advent of the traders. It is untranslatable.

²"People of the Setting Sun or West," as named by the Eastern Dénés. The Carriers and Sékanais call them Tseloné—"People of the end of the Rocks," because the band which is best known to them inhabits a plain north of a spur of the Rocky Mountains, which our Indians believe to be the extremity of the whole range.

³The so-called "Tukudh" or "Kut-chins."

⁴"Inhabitants of the Rocks."

Before proceeding further, would it be presumptuous on my part to suggest as a partial corollary of the foregoing the following classification of all the Déné or Téné¹ tribes based on personal observation and the knowledge of two of their dialects, and, in so far as the Eastern tribes are concerned, on the works of Rev. E. Petitot, a learned ethnographer and philologist, who has passed twenty (1862-1882) years of assiduous study among them?

CLASSIFICATION OF THE DENE TRIBES.

THEIR NAME.	THEIR HABITAT.	SUPPOSED POPULATION.
<i>Western Dénés.</i>		
Chilhotins (toeni) ¹	Chilcotin River.....	460
Carriers (toné)....	Stuart's Lake, North and South	1,600
Nah-anés (téné)....	Stickeen River and East	700
<i>Intermediate Dénés.</i>		
Sékanais toené ...	Rocky Mountains	500
<i>Eastern Dénés.</i>		
Chipewayans (déné)	Lake Athabasca, etc	3,000
Cariboo-eaters(déné)	East of Lake Athabasca.....	1,200
Beavers (dané)....	Peace River	800
Yellowknives(déné)	North-east of Great Slave Lake	500
Dog-Ribs (duné)....	Between Great Slave and Great Bear Lakes.	1,000
Slaves (déné)....	West of Great Slave Lake & Mackenzie Riv.	1,000
Bad People (diné)..	Old Fort Halkett	200
Hares (déné; adéné)	Mackenzie, Anderson & MacFarlane Rivers.	600
<i>Northern Dénés.</i>		
Loucheux (dindjyé).	Mackenzie River, 67° northwards	400
“ “	Alaska	4,000

¹E in these and other Déné words corresponds to the French e of *je, me, te*, etc. U has the sound of the Italian u (oo).

The words within parentheses are the respective expressions used by the different tribes to say “Men,” and thereby designate themselves when not referring to the country they inhabit. The remarkable homophony of these terms (which is easily explained by the fact that they are root words) is, however, somewhat misleading, inasmuch as it conveys an idea of philological similarity which is far from existing between the various dialects. Their lexical differ-

¹D and t are interconvertible.

ences on the contrary are so wide that the Carriers and the Sékanais, though geographically neighbours, can scarcely understand a word of each others' language unless they have previously learned it by personal intercourse.

Many of the remarks I am going to offer on the social status of the western tribes should be understood as applying to their original condition when no missionaries had as yet (20 years ago) endeavored to civilize and morally coerce them into giving up the most obnoxious of their customs. It would scarcely be to the point to speak of them as they are at present, since, being generally progressive in disposition, they are socially speaking pretty much as we have made them. However, the Sékanais and Nah'anés, owing to their nomadic mode of living and the consequent difficulty to produce permanent effects upon them, may be said to have to this day almost preserved their original social status.

II.

The American aboriginal type is too well known on this continent to require a description from me. Our Dénés, in spite of the characteristics which particularize them into various tribes, do not materially differ from it. Suffice it to say that whilst the Chilixotins are generally of low stature, broad shouldered and not unlike the Chinese in their physical features; the Carriers are, as a rule, rather tall and stout without being corpulent, while most of them possess a fine physique. On the other hand, the Sékanais and Nah'anés, especially the former, are slender and bony, with hollow cheeks and almond shaped eyes shining with opidian brightness.

Of course, tattooing prevailed everywhere. The face was particularly the object of would-be ornaments in the shape of incrustated crosses or birds on the cheeks, the forehead or the temples. But more commonly they consisted of parallel stripes, more or less numerous, on the chin or the cheeks converging to the mouth corners. On exceptional occasions, such as dances or "potlatches" the Dénés had recourse to charcoal to render themselves apparently more redoubtable. And the young folks had vermilion to enhance their natural beauty, and it may safely be conjectured that they did not use it sparingly.

Everybody knows that one of the characteristics of the aboriginal facies is the almost total absence of beard. Nevertheless, our Dénés evidently thought that nature had provided them with too much of that appendage of manhood so much prized by the Aryan races. So, to correct its work, they assiduously picked off the few hairs that would grow on their chin and upper lip with small copper pincers, which they constantly wore suspended from their neck. In the same way, they used to trim their eyebrows, giving them the tiniest possible shape.

As for extraneous ornaments of every day wear, they consisted mainly of *haliotis* ear-rings and nose pendants often of enormous size, hanging from the perforated septum. These were common to both sexes. The wives and daughters of influential persons wore, also, bracelets hammered out of copper bartered from the coast Indians. A sub-tribe of the Carriers did not consider these "jewels" sufficient. Among them, to attain the *plus ultra* of feminine beauty and be reputed something in society circles, women added to the tattooing, ear-rings, nasal pendants and bracelets, a blunt wooden peg or tabret passed through the lower lip, thereby preventing its contact with the teeth so as to give it the utmost possible prominence, somewhat after the fashion of the Papuans of New Guinea. This circumstance led to their being called "Babines," or "Lippy" in corrupted French, by the early French-Canadians in the North-West Company's employ, which name they have retained to this day.

In common with the Nazarenes of old, men and women parted their hair in the middle and wore it at full length (except when in mourning), the men letting it fall on their back tied together in a knot when in repose, and rolled up like that of the Chinese when travelling, while women had it resting on the forepart of their shoulders in two skilfully plaited tresses adorned with a species of small, elongated shell, (*Dentalium Indianorum*) which was highly prized among the natives, and which they obtained from the coast Indians¹. On grand festival occasions, persons of rank and influence wore wigs made of plaited human hair in its natural length, inter-

¹The Nestorian Bishop of Samarkand, writing to the Catholics of Bagdad, says of the Tartar Kérmites: "They do not wash their faces, nor cut their hair; but plait and tie it together at the top of their heads."—*Vide, Aboutfarage Chron: Syr. in Assemani*. Volume III, part 2, chapter ix, page 488.

laced with quantities of Dentalium or Hyaqua shells. Sometimes these ceremonial wigs were ornamented with stout bristles taken from the sea lion's whiskers, trimmed so as to look like horns worn on the forehead.

As for their wearing apparel, without being strictly uniform, it may be said that in no case was it of a very complicated pattern. Besides the "pagne" or breech cloth which was seldom removed, they wore a sort of tunic or loose vestment of beaver, lynx or marmot skin, with the fur next to the body. The outside was painted in variegated designs in vermilion and adorned with numerous fringes to conceal the seams and bands of dentalium or dyed porcupine quills. A pair of leggings reaching to the thigh, together with mocassins, which, in the case of the poor were of salmon skin, completed their costume. Unlike their kinsmen of the Great Mackenzie Basin, they had no hood attached to their coat or tunic; but instead, wore a head-dress made of a small ground-hog skin and fashioned somewhat like a Scotch bonnet.

The women's wearing apparel differed only from that of the men by the length of their tunic, which was ordinarily covered with a skin cloak or a woven rabbit skin robe falling to their feet.

Washing may be said to be a European custom introduced among them. They clean their hands only, which they wash by filling their mouths with water and then squirting it over them in intermittent streams¹.

III.

Considered in their social condition and daily pursuits, a portion of the Western Dénés are nomadic and part may be described as semi-sedentary. To the first class belong the Sékanais and Eastern Nah'anés, the Chillyotins, Carriers and Western Nah'anés forming the second. Thus, whilst their mode of living prevents the Sékanais from dwelling in houses and congregating together in villages, our Carriers pass the winter in lodges accommodating several families, and

¹ This reminds the comparative Sociologist of a similar custom prevailing among the Tartars or Moguls of the Middle Ages. William of Rubruck, (St. Louis' envoy to the great Khan, 1253) says that "They never wash their clothes. Cleanliness is in no more favor with the men than with their ladies, and their mode of washing their faces and hands is by filling their mouths with water and squirting it over them."—*Relation des Voyages en Tartarie*. Benjamin.

are also gathered in regular villages. And here I must remark that our tribes have scarcely any national economic policy; but have generally copied, wholly or in part, from the alien tribes with whom they have been in contact. Until a short time ago, the Chillixotins, like the Shushwaps their eastern neighbours, used to pass the cold season in semi-subterranean huts rotund in form. An aperture in the centre of the mud covered roof to which an Indian ladder (a log chopped off every foot or so for steps) led, served the double purpose of a door and chimney. Imitating the Atnas or coast Indians with whom they had commercial relations, the Carriers lived in houses or lodges formed of slender poles, low in height and covered with spruce bark. These had an entrance at both gable ends, the fire place being in the centre to which corresponded an opening in the roof to let the smoke out. Salmon skins sewn together made a good substitute for boards and were used as doors¹. Generally, they kept the spoils of their heraldic animals, fowl or rodent, nailed to the wall in the inside, whilst in the case of leading members of the tribe, they had their totem carved in wood and exhibited on the outside summit of the gable. (See figure 1.) The Sékanais were less pretentious. Even to this day, they content themselves with circular coniferous branch huts or lodges which they construct and abandon at a moment's notice, whenever their incessant peregrinations after food and peltries call therefor.

Unlike the Esquimaux² who sleep in a state of absolute nakedness, our Dénés roll themselves in their blankets, their feet to the fire, with almost all their clothes on. Making due allowance for their particular ideas of propriety, they are generally modest in deportment and chaste in privacy, despite the fact that several

¹ Compare these with the nomadic Moguls' "rolling habitations": "The houses they inhabit are placed upon wheels and constructed of a kind of wooden latticed work with an opening at the top that serves for a chimney. . . . Before the entrance there is suspended a piece of felt."—*Rubrick's Narrative in Abbé Hue's Christianity in China, Tartary, etc.*, Volume I, page 178.

² In a letter from the Rev. Mr. Morice, dated July 25th, 1853, occur the following words: "Concerning the passage in my paper which refers to the Esquimaux as sleeping naked, I have not in view the Labrador Esquimaux, who if I mistake not, have been semi-civilized by the Moravian brethren, but the Tchigh't or Esquimaux of the Anderson and Mackenzie Rivers, who are still in their primitive state. Now, I take the liberty to refer you, by permission, to Mr. McFarlane who passed part of his life as an H. B. Co's officer among said aborigines, and who, but yesterday, assured me that both in winter and summer the men, women and children of either sex, sleep stark naked."—*Ch. S. Cu.*

couples live together under the same roof and without partitions in the house.

Should I have to sketch rapidly our Dénés' moral features, I think I could, by ignoring some necessary exceptions, give them credit for relative morality, great honesty, intense fondness of their offspring and a general gentleness of disposition, not excluding, however, occasional freaks of irascibility. But to qualify these lines and give their true portrait, I should immediately add that they are prone to lying, addicted to gambling¹, naturally selfish, cowardly, and at times very lazy, especially the stronger sex.

Besides were I required to particularize in two words the ethnic peculiarities of each tribe, I would state that the Chilhōtins are the most violent and manly of the whole group; the Carriers, the proudest and most accessible to progressive ideas; the Sékanais, the most superstitious and naive. As for the Nah'anés, though speaking a language different from, but allied to, that of the Sékanais, they are considered by our Carriers so closely similar to the latter in their physical and moral characteristics, as to receive in common with them the name of Lhtaten (Inhabitants of Beaver dams,) by allusion to their chief occupation, trapping and hunting.

IV.

With the view of having the family and tribal organization obtaining among the Western Dénés properly understood, I must refer at once to the clans or gentes into which, like the Iroquois and most of the American Aborigines, nearly all of them are divided. These to the number of five, form a kind of very strict relationship, to which, to the present time, they have held very tenaciously. Each of these clans has one or several particular heraldic emblems or totems, the toad, grouse, crow, beaver, salmon, etc.; the image of which formerly received special consideration. This organisation outsteps the village limits, and members of the same clan are to be found in localities very wide apart. But however remote their respective places, they still claim mutual kinship.

Now, from time immemorial, a fundamental law in their social constitution has been for individuals of the same clan never to inter-

¹This of course, must be understood of those who are still out of the reach of missionary influence.

marry. So it is that endogamy is looked upon with horror among them. Indeed, I think I am warranted in affirming that marriage with a consanguine, unless a very close one, was preferred to matrimonial union with a co-clansman. As it is, agnation and consanguinity in the direct or collateral line on the paternal side were considered powerful barriers to sexual relations, males and females descended from the same stock being always regarded as brothers and sisters. But at what particular point the offspring of a common or collateral¹ branch would be deemed sufficiently distant to admit of matrimonial union is more than I can say, none among the natives themselves being able to satisfactorily solve that question. All I can say is that as long as the common ancestors of two individuals were remembered, the latter were easily dissuaded from contracting marriage together, even to the fourth and perhaps the fifth degree of consanguinity, especially if in the direct line. I do not mean to say that there never were tacitly allowed deviations from this law, nor absolutely any intermarriage in the same clan. But the repugnance which such unions inspired only goes to show that in this case, as in others, the exception confirms or proves the rule.

Such was not the case, however, with consanguinity in collateral lines by the mother's side, cousins of that class, even as near as the first degree, being by a time honored custom, almost bound to intermarry. And here it is as well to state at once that, in common with nearly all the primitive people, mother-right is the supreme law regulating succession among nearly all of the Western Dénés, and I may add that here² it admits of no exception whatever. On the other hand, another ordinance of their social code forbids titles as well as landed property to pass by heredity into a different clan. Therefore children of a notable among them belonging to their mother's clan, could never inherit from their father. But if the latter had nephews by a sister, one of them was *de jure* his successor, this nephew belonging through his mother to his uncle's clan. Now, by way of compensation, and to permit the notable's children who could not otherwise inherit from him, to enjoy at least, as much as was lawful of their father's succession, one of his daughters would be united in marriage with her inheriting maternal first cousin.

¹ On the father's side.

² At Stuart's Lake.—*Ch. S. Cm.*

As for affinity consequent upon either lawful or unlawful sexual relations, it was simply ignored. Nay, I should say that it was rather considered a powerful incentive to marriage, except when the regulations of the clan organization interfered so as to make the two relatives fellow clansmen. Thus it was, that in the case of a deceased brother's wife, the Dénés treated her conformably with the directions of the Jewish law, and the nephew considered himself in duty bound to espouse her.

It would be difficult to give here a complete table of agnates and cognates as named and ranked by the four Tribes under review, some of whom receive different names according as they are called by a male or female, or relatively to their comparative age. I shall, however, confine myself to a few remarks embodying the more characteristic peculiarities in their mode of reckoning kindred relationship.

1° A large proportion of our Dénés never go beyond the second degree in computing their progenitors or offspring, whether in a direct or collateral line, and in no instance do they go beyond the third degree—more distant relatives in either line being then called respectively grand-father and grand-mother if ascendants, or grand-children if descendants.

2° Grand-uncles and grand-aunts both maternal and paternal are also called grand-father and grand-mother.

3° Although they possess and sometimes use words meaning brother or sister without any reference to their relative age, they more generally designate them elder brother and elder sister, or younger brother and younger sister.

4° A son is called *syé* by his father and *syaz* by his mother who also calls her daughter *syatsé*, while her father when referring to her¹ always uses *stsé*.

5° Both nephews and nieces are called *stsu* by their maternal uncle and *skwaz* by their maternal aunt, while either paternal uncle or aunt will call their nephew younger brother and their niece younger sister.

¹These and the following Aboriginal terms are in the Carrier dialect. This not being a philological paper, I have deemed it superfluous to have them accompanied with their Chilkotin and Sikanais etc., equivalents.

6° *Schi* stands for paternal uncle and *spizyan* for paternal aunt ; *sez'é* meaning my maternal uncle and *sake*, my maternal aunt.

7° Maternal cousins of both sexes are *szit* to their co-relative male cousin and *sunté* if male or *szit* if female to their co-relative female cousin, whilst paternal cousins are always called brother or sister in the indefinite mood.

8° *Schi* does duty for grand-children of any sex and also for the other offspring alluded to in the first remark. In the same way, brother-in-law and sister-in-law receive the common appellation of *sre*.

The clan organisation obtains also among the Western Nah'anés, who have frequent intercourse with the Coast Indians from whom it is derived ; but it is unknown among the Sékanais and Eastern Nah'anés, who owing to the geographical position of their territory, have adhered to their primitive usages and kept aloof from foreign practices. As a consequence father-right is the only law which regulates succession among them.

V.

Marriage in the Christian sense of the term, is rather a misnomer when intended to designate native unions such as were contracted before the advent of the Missionaries in the Country. Co-habitation would better answer the purpose. In fact, it is the corresponding expression they employ themselves when referring to a man married to such and such a woman. They say *yeraeta*, "he stays with her." For as there was no valid contract and no intention on either side to consider their union as a permanent connection, divorce resulted as a matter of course whenever one of the partners was tired of the other. In that case, the *ci-devant* husband would take back anything he had bestowed upon his so-called wife, and both of them would try life with a new partner. Naturally the man, especially if in easy circumstances, would have a better chance of success than his former wife. Supposing children had been born to them, divorce was more difficult, but by no means impossible. In that event, the father would ordinarily take possession of the offspring. For among the Indians, as among many of their civilized brethren "might is right," and as they are exceedingly fond of their children, the late husband

would rather see them temporarily in a stranger's hands than entrust them to their own mother's custody.

Except among the Carriers, early marriages are in favor among the Dénés, oftentimes the female being barely pubescent when mated. Among the Sékanais nothing was simpler or more expeditious than the contraction of marriage. Whenever a young hunter had made up his mind on mating a fair child of the forest, with scarcely any previous courting, he would in the day time simply ask the girl of his choice: "*Will you pack my beaver snares for me?*" To which, if she refused him, she would make answer: "No, there are plenty of women, ask another one." But if agreeable to the maid, she would at once answer without any conventional blushes: "Perhaps, ask my mother." Upon which the lad would not ask her mother, but the girl would immediately tell her about it. Then, following her parent's advice, she would hasten to erect a branch lodge alongside their own primitive habitation,¹ and in the evening, the affianced youth (such was he after the proposee's answer) would on entering it hand her his "beaver snares." Without further ceremony, they were man and wife. Supposing the woman proposed to was the former wife of the man's deceased brother, there was no declining his offer, she was bound to accept his "beaver snares."

The preliminaries, if not more complicated, were at least more difficult and tedious among the Carriers. According to their etiquette, the intended wife had absolutely nothing to say for or against the projected union. Whenever a youth of a different clan had singled her out to be his future wife, he would not exchange a word with her, even when proposing, but installing himself at her father's home, he would begin to work for him, not failing to present him or the girl's most influential relative with anything of value which might come into his possession, either by hunting or otherwise. Meantime he would never tell them the reason of such unwonted liberality, neither would they ask him, but they easily guessed it. When after one or two years wooing to . . . his intended wife's parents, he thought a well deserved "Yes" was likely to reward his efforts; he would demand her from her father or guardian through the instrumentality of an obliging friend. If agreeable, the suitor was thereby

¹ A Sékanais will never dwell under the same roof as his married children!

married. If not, then the recipient of his favors was bound to return an equivalent in kind.

Naturally enough, after having won his wife at such a cost, the young husband was not ready to reject her without sufficient provocation, and it may easily be conjectured that the prospect of having to recommence anew a protracted courtship, must have tended not a little to render the matrimonial tie, if not sacred, at least more durable among the Carriers than it was among the Sékanais. However, it must be said that in case the wooing party was well connected, the procedure previous to acceptance was somewhat curtailed, and frequently almost entirely dispensed with.

Polygamy flourished to a great extent among all of the tribes. The more exalted the man's rank, the more numerous would be his wives. The father of the present chief of this place (Fort St. James, Stuart's Lake) had as many as six wives at one time. Nevertheless, there was always one, not necessarily the first in priority of co-habitation, who was regarded as superior to the others whom she then called her younger sisters, receiving in return the title of elder sister from them. Even polyandry was in honour conjointly with polygamy among the Sékanais; but remained unknown to the Carriers.

A peculiarity perhaps worthy of notice is that an Indian woman will never say "my husband" when referring to her mate; but will invariably say "he" or "this child's father." Even men are quite as prudish and will seldom be caught saying "my wife" in speaking of their partner. Likewise both men and women feel a great reluctance to tell their names and will generally rather use a round about description than the appropriate vocative.

VI.

I need hardly say that among the Dénés the status of woman after marriage was seldom preferable to her previous condition. For I take it to be granted that, among most of the non-Christian peoples of the day, as well as the various nations of antiquity, woman, under one form or another, is, and has ever been, very little short of her lord and master's slave. While still a girl, she had of course, to render her mother such menial assistance as lay in her power; but then she

was generally taken good care of, well fed and well clothed, so as to command a higher price in the bachelor's market. Now that her fate is sealed, she must be the real factotum of the household.

And well might she consider herself enjoying a holiday life, even though very busy, when at her new home; but it is chiefly when travelling that life must become rather burdensome to her. Then her lot is to pack all the family impedimenta, while her husband, gun in hand, gaily precedes her on the way trying to have an occasional shot at game to diversify the menu of the evening meal. However, let us not pity her beyond measure, for as she never knew or even dreamt of a better fate she does not murmur herself, neither does she ever complain of her husband's ungallant conduct. Besides, her ability for this kind of labor has been developed from childhood, since among the natives even the little ones are trained to carry some of the family goods and chattels.

Her capacity for carrying heavy burdens lies in her ability to preserve an accurate balancing of the load rather than in any great muscular strength. The pack rests on the back, between the shoulders, supported by a leather line which passes in a broad band across the forehead and is secured by the ends of the line being tied across the chest.

It would however, be wrong to conclude that her daily toil is over when at dusk the couple stop for the purpose of camping. Then all the work in the way of gathering firewood, erecting the temporary lodge, cooking, etc., must be attended to by her, the man's duties and attributes among the Dénés, when in their primitive state, being restricted to hunting, eating and sleeping.

One must not however, infer from this that her lot was such that she had absolutely no influence either in the family or the village circles. Oftentimes the woman did exercise much influence, but then it was not owing to her position as wife or mother, but generally on account of her birth and her father's rank. Her marriage conferred no right or privileges upon her, nor did it give her any claim to her husband's personal or landed property. Man and wife were never regarded as a moral unit, as customary among us; but just in the

same way as during their union, they continued to have their respective names, even so did the property of each ever remain distinctly personal.

This, among the Dénés, is twofold : private and personal, as clothes, canoes, dogs, etc., and real or permanent as are the hereditary estates. For to the rank of Tœnezoi or notable are attached hunting grounds, the limits of which are very clearly defined. These are, by right, held in proprietorship by the titular only ; but by a sort of tacit concession, other heads of families of the same clan as the legitimate proprietor share the usufruct thereof during his good pleasure. In fact, they may be said to be, though of inferior rank, his co-associates, hunting with and for him and receiving of the spoils only what he is pleased to let them retain. As already stated, a woman by the fact of her marriage, obtains no claim whatever to these lands, since they could not be alienated or made over to a different clan, but, upon their owner's death, they pass regularly into his nephew's possession, failing whom, then to one of the previous titular's brothers, or, if there is none living, to his sister or any fellow clansman before designated by him.

As for the private property of the deceased notable, until quite recently his widow could not inherit even the least fraction thereof, nor could she hold her own personal chattels, dress or working implements ; they would be ruthlessly snatched away from her, nolens volens, by her late husband's relatives, who would also claim and divide among themselves all of the deceased's goods, even though his orphaned children might thereby suffer. To be exact, however, I must add that in case the deceased was the wife, her former husband, unless he were a notable, would hardly be better treated. Even in these exceptional cases, the survivor would be expected, if only for decency's sake, to make presents to his former wife's relatives.

Adoption is practised among the Dénés ; but without any ceremonial formalities, and does not involve the right to succession and heredity thereby usual among most civilized people. Supposing the dead notable to have left no brother or nephew, any other acceptable member of his clan, even his sister would succeed him rather than his adopted son, and then owing to the latter being regarded as belong-

ing to his adopting mother's clan. In this case however, he could claim the right to joint use of the hunting grounds together with the heir who had inherited their real proprietorship.

Landed property is unknown among the Sékanais and Eastern Nah'anes who are governed by father-right. Among them the eldest son, or failing him, a surviving brother succeeds the deceased father of a family as leader of the band while engaged in hunting. On the other hand, although groups of related families ordinarily hunt in the same mountains, streams or lakes as their ancestors, they do not regard them as their exclusive property and will never contest the right of others to hunt or trap thereon.

VII.

As previously stated our Dénés and, as a rule, all races of Aborigines I may say, are very fond of their little ones and, as a consequence, Infanticide has been exceedingly rare among them. Nevertheless, a native custom now happily discontinued, required an exception in cases of twins, one of whom had to be disposed of, as two children at one birth were thought portentous of ill and not much less than a natural monstrosity.

When the period of confinement arrived, the mother would be delivered of her child without the help of a midwife, in any place and under any circumstances—in her lodge or even while travelling, and apparently without any pain. This was the almost invariable experience in former times; but truth obliges me to add that among the Carriers, the most civilized of the four tribes, women have not gained much by the change in their diet and mode of living, inasmuch as painful accouchements and even death, at childbirth, are becoming unhappily of too frequent occurrence; still-born children are also more numerous than formerly.

Circumcision is unknown among the Western Dénés, and I have never heard of any practice in favour among any tribe which could be construed as a remnant thereof.

Formerly children were named a short time after their birth by their parents or any person who was believed to have received, while

dreaming, supernatural communication as to the name they should be known by. This was usually, except in the case of girls, indicative of some peculiarity, the recalling of which was supposed to bring good luck in hunting. When the child's parents were of rank or influence, he was, at the occasion of one of their ceremonial banquets, held up in the midst of the crowd by his or her maternal grandmother and given a name previously borne by a maternal ancestor.

It is a well known fact, that among the Aborigines of both North and South America, mothers never carry their infants in their arms, but uniformly pack them on their back. Our Dénés are no exception to this rule. The Chillyxotin mothers manufacture as receptacles for their babes, pretty little osier baskets or cradles generally placed in closely fitting deer hide coverings, wherein the infant is tightly laced, much as a little mummy. A birch bark conduit leading to an orifice in the narrow end of the cradle prevents its contents from remaining in an unhealthy condition. In this respect they are decidedly ahead of the Carriers who only use swaddling clothes firmly secured around the infant.

Parental authority, either maternal or paternal, may be correctly qualified as nil or thereabouts, except among the Carriers and Chillyxotins, when it is a question of marriage. The parents are under any circumstances very averse to inflicting punishments on their offspring when young, and cannot well expect to be able to control them when they become full grown.

"Fecund-like an Irishwoman," the female Déné would soon glory in a numerous family were she only to take proper hygienic precautions and wean her child after a reasonable period of suckling. But, even at the present time, unless physically unable to do so, she will nurse it as long as three and four years, sometimes longer! However, were it not for periodical visitations of contagious diseases formerly unknown, the native population would soon increase in a fair ratio, as will be seen by the following table of the births and deaths of this place for the last years. The population was exactly 140 by the last (31st December 1888) census.

TABLE OF THE BIRTHS AND DEATHS AT NAKAZTLI (STUART LAKE).¹

YEAR.	DEATHS.	BIRTHS.	EXCESS OF DEATHS.	EXCESS OF BIRTHS.
1885.	3	8	0	5
1886.	3	4	0	1
1887.	1	4	0	3
1888.	5	6	0	1
TOTAL.	12	22	0	10

Even more satisfactory data could be recorded of other Carrier villages whose population are in conditions more favorable to natural increase. But I regret to be unable to furnish the reader with vital statistics of the four tribes or any whole tribe. However, I think the above a fair specimen of the average variations in the native population as far as the Carriers are concerned. As for the Chilixotins, it must be admitted that they do not keep abreast of the Carriers in natural increase, whilst it is certain that the Sékanais who used to hunt on this side of the Rocky Mountains have, for the last few years, been declining in numbers at a rather disquieting rate.

VIII.

The staple food of the Western Dénés before the introduction of civilization and its concomitants, may be described under three heads: Fish, Meat and Berries, to which correspond the co-relative pursuits of Fishing, Hunting and Collecting.

Salmon is to the Carrier and Chilixotin what seal is to the Esquimaux, rice to the Chinaman and wheat to the white man. Give them a large run of salmon, and abundance with its logical associates, rejoicing, feasting and dancing reign in the camp; cut off the supply, and there will be famine and desolation, silence in the village and melancholy in all hearts.

Only two species of salmon are believed to come up as far as Stuart's Lake through the Fraser and its affluents; they are the red

¹Children who died in the year of their birth are not counted in the above table. It is also but proper to note that, though last year an aggravated form of measles attacked all the children of this village below, and some above, the age of 15, yet, thanks chiefly to the adoption and enforcement of stringent and prudent measures, only two of them who were at the time away with their parents in the woods succumbed to the disease.

fleshed salmon (*Salmo Quinnat*) or suck eye and the large white fleshed salmon (*Salmo proteus* . . .) called *Kes* by the natives. The first species is to them the fish par excellence, and so they call it *thallo*, the water-fish. To catch it, the river is staked across in its whole width, as is practised by the Kamtschadals, and the fish are driven into hurdle corrals terminating in long bottle-shaped baskets from which escape is impossible. To preserve them they also follow the Kamtschadals' method. After having cut the fish open and extracted the spine and vertebræ with the flesh adherent thereto, they dry it beneath a rough pine covered shed, by the action of the sun and air largely aided by the fire and smoke underneath.

In some places where the stream contracts to an insignificant width and in escaping from its rocky embankment produces a fall deep enough to temporarily impede the salmon's course upwards, the Carriers simply bridge the fall over and with bark ropes, suspend therefrom a sort of lattice, seven or eight feet wide, the lower extremity of which is curved up like a pot-hanger. When the fish attempts to jump over the fall, he strikes the lattice barrier and drops back into the basket-like bottom.

To get the *Kes* or white fleshed salmon which is not so gregarious, the Carriers use a bone harpoon of a somewhat unique pattern of which figure I will give a correct idea. Standing on rocks or light scaffolding projecting in the river—they spy the fish as it winds its way up stream and spear it with said harpoon fastened for the purpose to a shaft 12 or 15 feet long. In shallow streams, they cautiously wade in the water and dexterously launch their weapon at the fish, thereby securing for it increased velocity and additional length of reach. Instead of the harpoon the Chilixotins employ a double dart made of mountain sheep's horn (figure 3.) which, when it fastens in the flesh of the salmon, detaches itself from the forked shaft to which it is securely tied by a plaited raw-hide line.

They also obtain small fish, such as trout, white fish, carp, *késœl* (a small species of salmonidæ), etc., by means of nets which, when thoroughly of aboriginal manufacture, are made of the spun fibre of nettle, red willow bark or of a semilignous plant they call *hwonœth'a*, the *Epilobium angusti florum* of Botanists.

When engaged in the salmon fishing they ordinarily congregate at the most suitable place near their respective villages in order to make and repair in common the barriere or wood pole staking across the stream while the "kuntzi" or cylindrical baskets are individually set by heads of families in the place assigned them by traditional right. In the same way when trout fishing is conducted on a large scale, as is usual when in the fall of the year, they gather their winter supply, each family or aggregate of homogeneous families, has its own particular spot in the rivers or in the vicinity of islands in the lakes from which they are not at liberty to wander in search of a better position.

Fishing in the winter is a rather uncomfortable occupation. Having previously cut a hole in the ice of about one foot in diameter¹ our Déné stretches himself thereover on the frozen surface. He then holds up with the left hand a small stick to which is suspended bone imitations of fry (figure 4.) which he gently oscillates in the water, so as to give them a life like appearance. He will patiently wait well wrapped up in his blanket for the larger fish to bite, even though it may be 30° or more below zero of Fahrenheit. If fortune favours him, he speedily spears his fish with the bone harpoon already spoken of, which in this case is only four times larger than that of figure 2, and fixed in a short handle.

A more interesting mode of fishing is when, during the cool spring nights, the Carriers lazily glide over their country lakes carrying in their canoes flaming pine torches which have the effect of attracting fish of every description, and by dazzling and, as it were, charming them, render them an easy prey to the harpoon.

The Sékanais disdain fish of any kind and regard fishing as a degrading occupation unworthy of a hunter. They live almost entirely on moose, cariboo, bear, marmot or beaver meat with lynx and rabbits in their season.

IX.

Before the North West Company's advent in the country, there was very little fur-hunting done save what was indispensable to the family's subsistence and clothing, and even then among the two

¹ Formerly this was done by means of heated stones.

most southern tribes, it was done only in summer time. For, strange as it may appear, before Sir Alexander MacKenzie's discovery of New Caledonia in 1793, snow shoes were unknown except among the Sékanais and Nah'anés. Locomotion among the Western Dénés is ordinarily by walking in very narrow paths though the Chillixotins and Southern Carriers now travel not unfrequently on horseback. More commonly however, the Carriers utilize as public high-ways the numerous lakes which dot their country, whether it be summer or winter time. They use "dug-out" canoes made of the hollowed out trunk of a large cotton-wood tree (*Abies subalpina*). There is no artistic merit in their design, which is of a rather rough description, for we must not forget that "dug-outs" are among them a recent importation from the East.¹ In the beginning of this century they used only birch bark canoes.

Another mode of travelling, proper to the cold season, is by means of light toboggans or sleds drawn by three or four dogs trotting along in Indian file. These animals (which are now of different breeds) are very serviceable to the natives; for, even during the summer, when families are en route for their hunting grounds, their canine companions are compelled to assist the women in packing part of their master's baggage, firmly secured with lines to their sides.

The chief object of our Dénés' pursuit when hunting is beaver. Since they have learned the commercial value of fur, they have waged such a constant war on this valuable animal that he is practically and rapidly verging towards ultimate extinction. It is during the winter months, as well as after the opening of the spring, that beaver hunting is practised on the most extensive scale. Once they have found his lodge, an indispensable preliminary to secure his capture is to discover the exact location of his path or trail under ice. It appears that he follows well marked routes when swimming from, or returning to, his winter quarters. These our Dénés easily find out by sounding the ice in different directions with cariboo horns. Their well exercised ears readily discover by a peculiar resonance of the ice where the rodent's usual path lies. So, at a given point, they cut a

¹ Some sixty or seventy years ago, a party of Iroquois having crossed the Rocky Mountains reached Lake Tatt'h'a in two wooden canoes which at once excited the curiosity and covetousness of a band of Carriers who killed the strangers for the sake of their canoes. These having been brought here (Stuart's Lake) served as models for the building of the first home made "dug-outs."

hole wherein they set their *babiche* beaver net, taking care to attach thereto a switch—the chief end of which, issuing from the water, is provided with several small bells.¹ Then the hunter (should I not say the fisher?) proceeds to demolish the beaver's lodge, in order to drive him off. Should the game not be found there, the same operation is repeated at his adjoining provision store. When the undulations of the water tell of his presence therein, he is frightened away to where the net is set. Supposing that the beaver is swifter than his hunter and reaches the net before the latter, the efforts he will make to extricate himself therefrom will agitate the small bells before mentioned, and the hunter will immediately make for the hole and draw him out before he has time to cut himself clear of the net.

In the spring—besides occasional shooting—spearing and trapping are the two modes adopted in catching the beaver. To spear him, they employ a bone barbed harpoon, such as that delineated in figure 5 which, being securely fastened to a long shaft, is launched at the game from a distance to ensure greater speed and impetus to the weapon.

When trapping they resort to no remarkable device save that, with the object of attracting the beaver, they dilute the mud contiguous to the steel trap in one of the beaver's favorite haunts, with pulverized castorum which they keep in decanter-like birch bark bottles, figure 6.

More nomadic game such as lynx, martens, fishers, etc., are captured by means of snares in their most beaten paths.² The larger game—bears, moose and cariboo, etc., are usually chased with dogs, often for a full day at a time before they are brought to bay and shot. Bears are also frequently taken in snares.

The Sékanais, owing to the peculiar topography of their country, hunt cariboo on a larger scale, and with more satisfactory results. They previously set in a continuous line 40 or 50 moose hide snares in suitable defiles or passes in the mountains frequented by the animals. Two of the most active hunters are then deputed to watch at either end of the line, after which the hunters, who usually number

¹ These have replaced the beaver nails and pebbles of former times.

² The larger proportion, however, of fishers and martens are taken by means of wooden fall traps.

fifteen or more, drive the band of deer or cariboo to where the snares are set and, by loud shouting and firing of guns, they scare and thereby force the reluctant game to pass through the noose which at once contracts around their necks. The deer immediately scamper away with the moveable sticks, to which the snares are attached, and which, being soon caught among fallen or standing trees or other obstacles, cause the caught animal to stop suddenly with the result of being strangled to death in a short time.

Besides the aforesaid game, which is indigenous to the country occupied by the four tribes in question, every recurring spring and fall bring the Carriers large numbers of geese and many varieties of ducks to diversify their daily diet. For a couple of weeks or more, there is shooting in almost every point of the compass and generally not without effect. As for grebes which every spring gather in very large numbers at the outlet of the lakes and more particularly of this (Stuart's) lake, a more economic plan is acted on to effect their capture. Taking advantage of the fact that these water fowl are very gregarious and will seldom migrate northwards before the lake is free from ice, the natives set common fish nets on the surface of the water and, manning eight to ten canoes at a time, they surround and drive them into the nets. This is a very exciting exercise and at the same time prolific of good results, as a catch of a hundred head at a single drawing of the net is not deemed very marvellous.

The grebes having been stripped of their feathers, their fat is extracted when raw and converted into cakes of more or less consistency, part of which is called in requisition from time to time to do duty as "*piment*" to season their preserved berries.

X.

The Dénés find a valuable resource in the various species of berries which yearly ripen in profusion in almost every part of their immense forests. Conspicuous among them, either by its abundance or its property of long keeping, and its consequent value as an addition to the native stores of winter supplies, is the service-berry (*Amelanchier alnifolia*). Indeed the Carriers often designate it by the simple appellation of *mi*, that is the fruit. Every fall, the women gather large quantities of them in birch bark baskets. These berries are preserved

either sun-dried or compressed into thin cakes somewhat resembling large flat plugs of tobacco. This is done by a process which, if primitive, is not the less complicated. When the fruit has been collected in sufficient quantities, they build on the ground a sort of large boiling vessel with spruce bark supported by sticks driven into the soil. This being filled with service-berries, they throw in heated stones which in a few moments, will have the double effect of boiling and pressing down the fruit whose juice escapes through a narrow conduit at the bottom side of the boiler into an adjoining flat vessel also made of the same material. When the liquid is thus all extracted, the residue of the larger vessel is thoroughly kneaded; after which it is spread out in thin layers on willow hurdles previously covered with *epilobium* leaves and then exposed to the action of the sun and air. By frequently sprinkling the residue with the juice of the berry it coagulates into large cakes of almost uniform thickness. These when thoroughly prepared will keep for years, and when sprinkled over with a little sugar, it is of tempting succulency even to others than Indians.

They also treat in about the same way the *yenthami* (*Vaccinium uliginosum*, bog blue-berry), a species of small blue-berry, very sweet and juicy when fresh; but these they boil in common kettles and spread the jam on small hurdles without having previously extracted the juice. Several other species of berries which it is not necessary to enumerate are also preserved in a similar manner.

Another welcome addition to the Dénés' larder is the *Kennih* or *cambium* layer of the scrub pine (*P. contorta*). This they get at by barking the tree with a cariboo horn or shoot thereof (figure 7.) and then scraping off the cambium in thin ribbon like shavings which, after undergoing the usual drying process, will retain for quite a time much of its original freshness, although indubitably savouring of gum, or perhaps owing to that flavour, it is considered very wholesome. They also eat the growing shoots of the willow herb, (*Epilobium heracleum*) and other plants indigenous to their country.

Besides the above mentioned berries and economic plants, many roots containing more or less starch, were formerly, and are still to a great extent, sought after, dried and stowed away. The Chilixotins

and Southern Carriers have two species of potato-like tubers, identical in nature and taste, though differing in shape and name. One (*esrouh* in Chillxotin) is elongated and closely resembles a diminutive "lady-finger" potato. The other is spheroidal and called *suntî* by the Chillxotins. Both kinds are dug out by the women with T-shaped sticks and dried in large quantities. These edible roots are not found in the Sékanais' nor in the greater part of the Carriers' territory. But the latter possess a substitute in the root of a species of fern not so plentiful, but of a larger size. They call it *'ah*. It is not dried but eaten fresh and baked *à l'étouffée* in this wise: The natives dig out a hole about three feet in diameter in the ground, pave its bottom with heated stones over which they strew chips of alder bark, and then fill it up with the roots. The whole is then covered with earth and the roots will be ready for the table (or rather the mat) ten or twelve hours later, that is, when entirely cooled down. They claim that this root when thus prepared is really most excellent and it is greatly relished. They also eat the esculent bulb of a kind of reddish lily (*Tsachœn*¹).

It is almost needless to mention the fact that none of the Déné tribes originally cultivated the soil. Of late years, however, the Chillxotins and Carriers have made laudable efforts to raise potatoes and a few vegetable roots wherever practicable. The former, whose land and climate are more adaptable to agriculture, now reap tolerably good wheat crops. They also possess large bands of cayouse horses which graze annually on the famous bunch grass of their extensive table-lands. As for the Nah'anés and Sékanais as a rule, they know horses only by name (*Chicho*, big dog) and have never yet grown a single potato.

XI.

A paper, however imperfect, on the Sociology of Indian tribes would hardly be complete without at least a reference to their arts and industries. As these were not of a multifarious nature among our Dénés, I shall be rather short on that head. Besides, I have already, in several instances, touched upon some of their industries,

¹This is the *Erythronium Esculentum* which, according to Lapèrouse and other travellers, the Kamtschadals and the Yenissei Tartars so greatly relish.

and here I take the liberty to refer the reader to what I have said of their costumes, their habitations, the implements they use in hunting and fishing, and their divers methods of preserving berries and edible roots.

The Carriers who, since the advent of the whites, have proved to be the most amenable to civilization, of the four tribes treated of may be said to have been formerly the least industrious. Among them we find no trace of basket work of any kind, and they formerly imported from the coast some of the most useful of their working implements such as axes and adzes. Owing to the absence of mountain goat in their country, they also depended upon the Sékanais and the Atnas for their supply of spoons and other household utensils which, among the Aborigines, are usually manufactured from the horns of that animal.

Birch bark was substituted among them for willow basket work. They employed it in making vessels or dishes of any size and shape; the fibrous roots of spruce split in four parts was used in lieu of thread. One kind of these vessels, remarkable by the absence of any seam (the bark being simply folded up on its four corners and so retained by a split encircling switch) did service as a kettle or boiler. Therein they boiled meat or roots as they now do in tin and copper kettles, but with the difference that they had to keep it away from the flames. They are still loud in their praise of its usefulness as a rapid boiler. On grand occasions, they were replaced by large spruce bark vessels built on the ground or square wooden boxes imported from among the Atnas wherein, when filled with water and meat, heated stones were repeatedly thrown until the meat was boiled.

Instead of bark vessels, the Chillyotins use spruce root for making neat and sometimes elaborately ornamented baskets and other vessels which are impermeable to water. Indeed one kind, which may contain eight or nine gallons, serves to keep water for household purposes. I regret to be unable to minutely describe their method of weaving the spruce splints, not having any of these baskets in my collection of Indian curiosities, and having neglected to watch their mode of working when stationed among them in years past. I had ample opportunities to do so. However, I am strongly inclined to believe.

that they are coiled or woven according to the method described and illustrated by Professor O. Mason in the Smithsonian Report for 1884,¹ but with this difference that all those I have seen among the Chillixotins are broad-mouthed and wallet-like instead of having the shape of a jar characteristic of the specimen illustrated by the learned Professor.

Another industry more diffused among the Western Dénés is the weaving or knitting of rabbit skins into robes or blankets. They begin the process by cutting each skin with the hair on in one single narrow strip which they knit or rather twist and weave on wooden frames of the required size.

Their mocassins, gloves and mittens are of cariboo or deer skin dressed in this wise: After having subjected the skin when fresh to a slight drying process, they scrape off any particle of flesh or fat adherent thereto with a bear bone chisel-like tool such as that illustrated by figure 8. Then, the hair is removed with a scraper formed of the tibia of a cariboo (figure 9.) after which it is thoroughly rubbed with the brain of the animal and put aside until needed for immediate use. In that event, after having passed a night soaked in cold water, it is subjected to several rinsings in warm water alternating with repeated scrapings until, being quite dry, soft and pliable, it is given the form of a bag and placed over a fire or rather the smoke of vegetable detritus started in a hole in the ground. When it has been thus thoroughly smoked on both sides, it is ready for use.

The same process is followed when tanning or dressing moose skins except that owing to the peculiar tenacity of the hair, a short curved knife is used instead of the bone scraper. Out of these skins they make the bear and cariboo snares mentioned in a previous paragraph. These snares consist simply of babiche-like ropes twisted together into a line which is outwardly protected from moisture by the inner bark of the red willow wrapped around it. The Chillixotins plait, instead of twisting these lines and thus obtain very neat and strong ropes.

As if conscious of their inferiority as workmen, the Western Dénés made but few attempts at carving. Yet, in some of their

¹ Annual Report, etc. Part ii., p. 294. Plate v.

ceremonies they used wooden masks and castanets or rattles which were not devoid of merit as works of art. I have none of these in my possession, and will simply refer the Sociologist to the specimens drawn in Plates vi. and ix. illustrating Mr. G. M. Dawson's monograph of the Kaidah Indians.¹ The masks of our Dénés, minus the ears, were identical in shape with those of the aforesaid Plates, whilst their rattles were only somewhat plainer in design than those used by the Kaidahs.

The Déné knives were ordinarily made of the common arrow-head flint, but those made of beaver teeth were more esteemed.

As already hinted, axes were not home-made, at least among the Carriers, and the few cutting tools then in use among them were in the possession of the notables alone. The *commune vulgus* had recourse to fire in order to cut their firewood and the few slender poles or logs required for the erection of their lodges. With the exception of the Chilhōtins, they did not even know of the elongated stone hammer, formerly so common among other American aborigines.

As for copper they obtained it by barter with Indians from the coast; but its use among them was restricted to the manufacture of trinkets, bracelets and hair-pincers. *Apropos* of copper, the Carriers of some localities have the following legend respecting its discovery and introduction among them. They contend that in times not very remote, all the Indians (themselves among the rest) congregated at a certain point of the sea coast around a tower-like copper mountain, emerging from the midst of the water. Their object was to decide which tribe should become the possessor thereof. When all had united in shouting, the mountain, after a time, began gradually to totter and the Kaidahs who are blessed with big heads and strong voices, caused it to fall on their side. "Thus it was," they add, "that those Indians won or secured the copper mountain, and we have ever since been obliged to have recourse to them for what we require of that metal to make bracelets for our wives and daughters."

¹ Geological Survey of Canada, Reports for 1878-79. Appendix A.

XII.

The only pursuit for which our Déné may be said to have been amply provided with home-made implements was war and its allied occupation, hunting. The offensive weapons in use among them were arrows, spears, lances and *casse-têtes*.

Their arrows were of two kinds: bone and flint. The first were made of the front teeth of the beaver reduced by scraping to the required shape. They were reputed the most effective. Figure 10 represents flint arrow heads of different sizes, forms and material. They are produced here for the sake of comparison with those used by the mound-builders of Illinois and other States of the American Union with which they will be found identical in shape and material, though a distance of at least two thousand miles separates the aborigines who made them. These arrow points are all drawn to the natural size and they are therefore somewhat smaller than those of the mound-builders. The two marked A and B may be described as the typical arrow-heads of the Western Dénés and are of the blackish resonant flint generally used in the fabrication of aboriginal weapons. C and D are composed of a semi-translucent bluish variety of siliceous stone not so common and consequently more prized than the ordinary arrow flint. E represents the most beautiful of all the Déné arrow-heads in my possession. It has been ingeniously chipped from a hard crystalline species of flint, and its form and finish display evidences of, I should say, exceptionally good workmanship. Some are also formed of a whitish siliceous pebble; but the points made therewith are, as a rule, of a rather rough description.

The Dénés likewise used another sort of offensive weapon which they called *Lthhíladínla*, that is, "fixed at the end of the bow." Its name explains its nature. It was of common flint chipped to the shape of figure 11 and sometimes of figure 12. They brought it into requisition when too closely pressed by the enemy to shoot, and used it as a spear. Besides, they possessed also the regular spear or lance of which figure 12 is a reduced representation.

All these weapons were obtained by chipping the flint with a moose molar tooth without any previous blocking. As a rule, these abori-

gines used only loose pieces of the flint, which were collected for or by the notables, and then handed to the village arrow-smith for reduction to the required size and shape, and, as a finishing process, the edges were generally sharpened by friction on a hard stone.

However, the only really polished stone implement of Déné manufacture was the *caeth* or "casse tête" of which figure 13 will give an idea. The specimen thereby illustrated is of a hard granite stone. A variety of that weapon, similar in form, but more elongated (being at least twice as long) was usually made of cariboo horn.

Apart from the common arrows, the Carriers made use of two other varieties of missiles of Sékanais origin. Both kinds were made from Cariboo horns. The first of these called *kachankweth* (cut arrow) by the Carriers, was awl-like in form and not less than six inches in length. The broader extremity thereof was hollowed out to receive a wooden shaft which served to dart it off from the bow like a common arrow, with this difference however that, when in motion, the horn point detached itself from the shaft. This projectile was deadly and intended only for use against an enemy or for killing large game. To shoot smaller game such as grouse, rabbits, etc., they had recourse to a curiously wrought triple arrow fastened to the shaft similar to that delineated in figure 14.

As defensive weapons they used two kinds of armours and a shield. The latter was oval in form like the Roman clypeus and generally made of closely interwoven branches of *Amelauchier alnifolia*. They gave it the name of *kelathen* (that which is held with the hand).

While on the war-path, they also wore a kind of armour or cuirass consisting of dried sticks of the same kind of wood, arranged in parallel order and kept together with babiche lines interlaced in several places. This was common to the Kaidahs and other coast Indians. Another sort of armour, indigenous to the Déné nation, was the *peasta* (wherein one sits). This had the form of a sleeveless tunic falling to the knees so that it afforded protection to the whole body save the head:—in hard fights the Dénés invariably shot kneeling. The armour or cuirass was of moose skin which, when sewn according to the proper pattern, was soaked in water, then repeatedly

rubbed on the sandy shores of a stream or lake and dried with the sand and small pebbles adhering thereto, after which it was thoroughly coated with a species of very tenacious glue, the principal ingredient of which was boiled isinglass obtained from the sturgeon. Being again before drying subjected to a thorough rubbing over sand, it received a new coating of the aforesaid glue. When this process had been repeated three or four times, it formed an armour perfectly invulnerable to arrows over the parts which were thus protected.

All these weapons and armours were in use among the Western Dénés, immediately prior, and even for some time subsequent, to the discovery of their country by Sir Alexander MacKenzie's party.¹

XIII.

It would scarcely be proper to speak of war as an institution obtaining among the pre-historic Western Dénés. Although the various tribes despised and mistrusted each other, general fights were rare enough, and as surprises constituted the main part of their system of warfare, it followed that success was, as a rule, on the side of the assailants. Sometimes the whole population of a village would be massacred in a single night. In that event, the victors would chant their hymn of victory, generally improvised on the spot and composed of the last words uttered by their victims. After their return from the fray, they would also repeat it dancing for several nights in succession. In no instance was scalping resorted to, at least, on this side of the Rockies.

Such general massacres, however, were not of very frequent occur-

¹ Abbé E. Petitot in his "*Appendice relatif aux armes de pierre des Indiens arctiques*" presented in 1875 to the Paris Geographical Society states that the Dénés of the Great MacKenzie Basin know only by tradition some of the above described war weapons, as well as the wooden masks spoken of in the previous paragraph. The two most northern tribes of the whole nation, the Loucheux or Kut-chins and the Hares contend, he says, that they formerly dwelt among a powerful nation which oppressed them and whose warriors wore the *peaxta* which he graphically describes without knowing that it was used here but a comparatively short time ago. Would not this be evidence tending to prove that the aforesaid Dénés migrations might have been North-Eastwards instead of Southward as, I think, is commonly believed? The learned Abbé is evidently mistaken when he affirms that none of these defensive weapons were used by the Dénés since their probable arrival on this continent. Because Samuel Hearne and MacKenzie who travelled in time of peace did not actually observe any of these weapons and cuirasses among the natives they visited, it does not follow that they were not used by them when on the war path. Indeed, many of the present older inhabitants of this lake, have seen in actual use all of the arms, offensive or defensive which I have endeavoured to describe.

rence. More commonly (and I should say quite often), the brothers and near relatives of a man whose death was attributed to the secret machinations of a *Tœyén* or medicine-man of a different village, would go armed cap-a-pie and kill the supposed author of their relative's death. As a natural consequence, his co-clansmen would come *en masse* to avenge his murder and then a regular battle would take place, inasmuch as both sides would be prepared for the occasion. The logical result of this was that security was rather precarious and friendly intercourse, even between neighbouring villages, was not as frequent as the short distance separating some of them would lead one to expect.

In no case was a whole tribe found united and, *a fortiori* two allied tribes confederated, against a common enemy. And this leads me to enter upon the subject of the Dénés' social institutions.

I may as well state at once that no form of government, in the strict sense of the term, nor any political organisation of any kind ever existed among them. Not only were the various tribes of the same stock entirely independent of one another, but even no tie of any sort ever connected the different villages of the Carriers, Chilhótins and Western Nah'anés. The clans or gentes outstepped indeed the village limits; but they were social rather than political. For, though a member of anyone of them could claim recognition from any person of the same clan, however distant his village, he owed allegiance to no constituted head thereof.

Authority was represented in each locality by the college of *Tœnezas* or notables which, *mutatis mutandis*, may be compared to the nobility of European nations. Their rank was strictly hereditary and was shared in by their children who were called *œzkezaz*. The possible successor to the position however, was only the *tœneza's* eldest maternal nephew, whom he would generally bring up and educate himself in view of his future position. Should he have no such nephew, a younger brother, or failing him, even a maternal niece would regularly succeed him.

The notables were the sole proprietors of the tribe's hunting grounds, and as their name indicates ("the only men" is the nearest

equivalent therefor), they were regarded as the only men entitled to be heard upon any topic of interest to the tribe. Theirs was the privilege to use a hereditary name, to which was attached a particular song handed down from generation to generation; to dance first to the tune of said chant; and the privilege also of wearing insignia distinctive of their rank; to be assigned an honorable place in the ceremonial "pot-latches;" and, lastly, the right to pacify belligerents, settle disputes and otherwise exercise some authority in their respective villages.

By "authority" however, I should not be understood as meaning the strict right or power to command with the implicit co-relative of absolute and instantaneous obedience—except when it was a question of territorial rights. As there was scarcely any sanction to their injunctions, and no definite punishment for disregard of the same, it follows that the power of the notables was more persuasive than obligatory. Nevertheless, some instances are related of notables who shot dead fellow villagers, who were unmindful of their orders, without having had to answer "tooth for tooth" for the blood they shed. On the other hand, it was very seldom that their orders were despised, especially if seconded by some influential person—the natives instinctively submit to properly supported authority.

There were more than one of these notables belonging to the same clan and village and they were all of the same rank. It frequently happened indeed that one of them exercised prominent authority in the village, more generally than otherwise on account of his reputed wealth and liberality—but even such notable was more *prior inter pares* than the possessor of the titles and attributes distinctive of the modern chiefs.

This organization was common to all the Western Dénés except the Sékanais and Eastern Nah'anés who pass their lives in incessant peregrinations, at the command of their natural leaders, the eldest among the fathers of the families ordinarily concerting with the whole band.

XIV.

The Dénés of the old stock were generally long lived. As a proof of this, I need only to adduce the fact that last year there died at this place a man who remembered the arrival in this country of Sir Alexander MacKenzie in 1793. Many of the diseases which have since proved so fatal to the aborigines were then unknown. Those which sometimes visited them, had in the vegetable kingdom their known antidotes, the quintessence of which may be comprised in the word "purgative." They possessed also valued astringents in the castorum pods of the beaver and in the roots of heracleum, etc.

When these remedies, joined to the incantations of the "medicine-man" failed and death seemed imminent, the moribund's relatives were hastily summoned around his death bed. Supposing he was a *taneza* the above mentioned hereditary family song was struck up by some person outside of his clan and was continued by exo-clansmen till he expired, while his relatives would then rend the air with many doleful wailings. As soon as he had passed away, two young men also of a different clan, were deputed to announce the news to the neighbouring villages. All of the people of these places that were fellow-clansmen of the departed notable were then expected to make presents to the messengers as a compensation for their trouble, after which the whole population would turn out in a body and come forward to mourn the defunct *taneza* around the remains and at the same time console his relatives. To this end, while the deceased co-clansmen were lamenting their loss, a man of another clan would rise from the crowd and commence to dance to the tune of an improvised song. This was intended as a diversion to the mourners' feelings, and, as the strictest point of the Carriers' moral law is "nothing for nothing," the latter would immediately throw at the dancer any object he might intentionally mention in his chant and which thus became his property. This dance and giving away being repeated several times on several consecutive nights, the strangers would, if in winter-time (or even during the summer, if the mourners were not prepared for the occasion) return to their respective villages, and the remains would be provisionally placed at some distance from the habitations under a bark roof-like "shelter" by the side of which the widow

would erect for herself and children a small hut of similar form and material.

Thenceforth hers was a miserable lot indeed. From the very moment of her husband's decease to the time (two or three years later) of the final giving away of property in his honor, she was the slave of her brothers-in-law and sisters-in-law, one of whom would at once cut her hair to the roots and take care to renew the operation whenever needed as a badge of the abject condition of her widowhood. She was also obliged to wear ragged clothes, and in case she was young and likely to re-marry when the period of mourning ceased, decency constrained her to pollute her face with gum lest her guardians (so they were called) should suspect her of desires unsuited to her condition. Meantime, she would be her master's real factotum and the women especially would endeavour to render her life as unbearable as possible, leaving her no other "privilege" (!) than that of nightly bewailing in as loud tones as she could for her departed husband.

Men who had lost their wives were obliged to undergo the same ordeal, though treated somewhat more humanely than the weaker sex.

When the future successor of the dead notable had succeeded in gathering a goodly amount of dressed moose and other skins and provisions, the inhabitants of all the surrounding villages were invited to witness the cremation of the corpse (such was the way the Carriers and Western Nah'anés disposed of their dead). The funeral pile being kindled in the outskirts of the village by men not belonging to the deceased's clan (who were paid on the spot by the latter's relatives) the widow was obliged by custom to embrace the remains of her late husband even though surrounded by the flames, amidst the howlings and wailings of his fellow-clansmen. When momentarily withdrawn by the bystanders, etiquette demanded from her repeated endeavours to burn herself along with the remains. Supposing she had not been a good wife, she was in many cases jostled by the mourners, and sometimes horribly disfigured with the view to diminish her chances of re-marriage. The cremation over, a bark hut was built on the spot and everybody would retire except the widow who had to dwell there during the period of her bondage. In the evening following the cremation, as a rule, would take place the "pot-latch" according to the rites which shall be described in the next paragraph.

Among the Carriers, the late notable's relations would, on the morrow, while shedding many a dutiful tear, carefully pick up from among the ashes of the pyre, the few remaining charred bones and hand them to the widow, who would, till the time of her liberation from her widow's bondage, constantly pack or carry them in a small satchel. Hence the name (Carriers) of these Indians. Men though reduced to a modified bondage during the mourning period for their wives, had not, however, to submit to this latter formality.

The procedure just described was—barring the ceremonial peculiar to a notable—the same in the case of all ordinary Carriers. But it differed widely among the Sékanais. These Indians, owing to their dislike to fish and their need of securing fresh supplies of meat, could never remain for any length of time at the same place. So, when they thought the death of a sick member of the band was certain to occur in the near future; they simply placed close to him as much provisions as they could spare, and, having erected with coniferous branches a sort of barrier to shelter their path from his gaze (which was considered ominous to the party), they would abandon him to his fate. Should he die before their departure, they would lower his hut down upon and thus cover his remains and start at once for another locality. Supposing the deceased was an influential person dear to the band, they would hollow a kind of coffin out of a large spruce tree and suspend his remains therein, on the forks formed by the branches of two contiguous trees. Some instances are also recounted in which the remains of such persons were closed up in a standing position in the hollow trunk of a large tree while in its natural state. The lid or door of these primitive coffins was usually formed of a split piece of wood which, when strongly laced with long switches of red willow, held it to the trunk of the tree in its original shape.

Bondage consequent upon widowhood was not practised by the Sékanais, nor were the various ceremonies accompanying succession to rank and title observed among them.

XV.¹

The most inveterate among all the ceremonial customs of the Carriers, one which in some localities has remained proof against prohibitions from both the civil and religious authorities,—is their practice of giving extravagant repasts or “pot-latches” (Chinook word, meaning “giving away”) in honor of their dead. When intended to commemorate an untitled person, one banquet suffices, and is the implicitly observed signal for the termination of the mourning and the liberation of the widow from bondage. But when given in honor of a deceased notable and as a visible signal of his nephew or brother’s succession to his title and prerogatives, there are no less than six well defined courses successively given by his successor conjointly with his co-clansmen. Owing to the importance attached to these festivals by the natives, and despite the apparent puerility of some of their details, I feel I shall have to speak at some length of each of the six.

1. Supposing that a Tœneza has passed away, the first in the series of banquets given in his honor will take place three or four days after the arrival of the invited or expected strangers and may be repeated for several nights in succession. It is only of secondary importance and is called *Lhiz thœn hanutsewælhthih* (“or the taking away from the ashes”) which means that the mortal remains are thereby removed from the “fire-place” where they had been lying since the notable’s decease. It is given by the latter’s future successor according to the following ceremonial which is strictly adhered to in the case of all subsequent or any banquets.

¹ As prefatory to this paragraph, I would beg leave to remind the comparative Sociologist of the ostentatious banquets in vogue among most of the ancient people, Assyrians, Persians, Egyptians, Greeks of the heroic period, etc., as evinced by the sacred Books, Genesis xlii; Judith xii; Esther i; Daniel v; Homer’s Iliad and Odyssey (passim), etc. The student of antiquity will also remember that in such repasts it was customary to give each guest his separate portion and to show one’s regard for any person by helping him to a larger share than the other guests. In this manner Joseph treated his younger brother Benjamin, (Genesis xliii). So did Agamemnon act towards Ajax and Eumœus to Ulysses, (Iliad, book vii and Odyssey, xiv.)

In more recent times, we see the same custom prevailing among the Mongols who have many traits of resemblance both moral and physical with our Dènes. Thus when the princes and generals of their vast empire assembled in 1245 to elect a successor to Ogotai Khan, eating and drinking to excess formed a conspicuous part of the proceedings. Then also “every day they put on garments of a different colour distributed by the sovereign,” says Plano Carpini, an eye witness. Again, “This ceremony (that of enthronisation) was followed by an enormous banquet . . . This feast was renewed every day for seven days in succession.” In Huc’s Christianity in China, Tartary etc.” Volume i, page 146 and 148.

Everything being ready in one of the largest houses, the aspirant notable's maternal nephew (that is, his own presumptive heir) proceeds to call in every member of any but his uncle's clan, which he accomplishes by striking the ground with a ceremonial staff at the feet of the person thus invited without uttering a word. The future notable's fellow clansmen being reputed co-invitors with him go in of themselves. The *commune vulgus* being assembled in the lodge (before the notables who though the first invited are the last to come), the latter are introduced by the master of ceremonies who, pointing with his staff to their respective places (which is strictly defined by traditional usage), calls them individually by their hereditary names¹ repeating in loud tones for instance "Qi! qi! Rahul, qi! qi!" The interjections accompanying the proper name (Rahul) are of ancient origin and never used in common parlance. Then begins the repast or rather distribution of victuals, double or treble portions being allowed the notables present, the whole accompanied with copious libations of liquid bear's grease for the distribution of which ladles and spoons manufactured from the horns of the mountain goat, similar to those represented by figure 16, are brought into requisition. At the termination of this banquet, the aspirant notable tears a few dressed skins of leather in long strips of the width necessary to make mocassins, which he distributes to the assistants, taking care to give double size to those intended for the notables. This last distribution is in the Carrier's estimation the most important part of the whole proceedings, inasmuch as it is regarded as paramount to the atoning for the notable's death, and is practised whenever one wants to wipe out shame or remove grief.²

2. The second "potlatch" is given when a new supply of eatables and skins has been collected, and is in every respect but its aim identical with the first. It is intended as a celebration in honor of the deposition of the remains of the late Tæneza in the appointed place of respect in the house, even though said remains may have been previously cremated. So far, his successor is considered merely as an aspirant to his late uncle's title.

¹ This is never done except on special occasions, every notable having besides, at least, one other name.

² Sometimes whole suits of dress are thus publicly given away.

3. *Tsæx tæzdillih*, ("the imposition of feather down.") This is one of the most important of the whole series and is tantamount to the aspirant successor's elevation to the rank of notable. It is given only after an interval of long and hard hunting by himself and his whole clan. Prior to the great banquet and distribution, a sufficient number of exo-clausmen, erect according to his directions, a rectangular fencing around the spot where his uncle's remains were cremated, taking their daily meals in a trough shaped carved vessel, the exclusive property of leading notables.¹ Then follows the distribution of eatables, of which the greater the quantity, the more powerful will be the influence of the future Tøneza. The population of all the surrounding, and sometimes very distant villages, is usually convoked for this grand festival which marks the red letter day *par excellence* in the Carrier's Calendar.

When everybody but himself and fellow clansmen have retired, the skins they are going to give away next day are counted and they agree among themselves as to those who shall be the chief recipients; after which emerging in Indian file, they proceed to place swan's down on the heads of those they intend to honor on the morrow. Etiquette requires that nobody be excepted from this ceremony. The persons thus marked out then give them a substantial supper.

Next day witnesses the aspirant notable's confirmation as successor to his uncle's rank. In the morning all the people are assembled in the usual way in the largest lodge or house in the village wherein the aspirant having on none but the most indispensable vestments, stands silent facing the pile of dressed skins which he is about to give away. After a short time his assistant takes swan's down from a small satchel made of the skin of that bird's neck and sprinkles it slightly on his hair. This being done, he takes one of the piled up skins, and, having previously extended it to the general gaze, puts it on the new notable's shoulders as one would a mantle; which ceremony he repeats in connection with every other skin taking care that all present have an opportunity afforded them of counting the same. At the very instant that he places the first skin on the new Tøneza's shoulders, one of his exo-clausmen intones the late notable's chant

¹ These were given the form of a salmon or other totem animal of their possessor, and were similar to the carved troughs used in the Solomon Islands to prepare and pound food, cf. Proceedings of the London, (England) Royal Geographical Society, June, 1888, page 361.

(for which service he receives immediately a whole skin) which is taken up by the entire assembly except the latter's relatives who commence at once a strain of deafening lamentations. The new dignitary being now fairly laden with multiple mantles, they are then taken from his shoulders. This is the signal for the cessation of the singing. After this, all the dutiful tears are dried up as if by enchantment, whereupon the master of ceremonies blows swan's down on his head by means of repeated insufflations, thereby producing white undulating clouds significative of his new dignity; then he helps the notable to tear and distribute the whole pile of smoke dressed skins, not forgetting to set aside double sized strips for any absent notables. Henceforth, he is a real and accepted *tœneza*; but to enjoy all the prerogatives of his rank, he will have to make three more distributions.

4. *Natlh'adita* ("he sits down"). This is equivalent to the notable's enthroning. It is a distribution of clothes or skins, intended as a fee for the privilege of sitting at the traditional place of his predecessor, and is made on the occasion of his assistance at the next banquet given by a notable of a different clan. When entering the festival lodge the new *Tœneza* is followed by his wife packing the skins he is about to distribute. These are extended in a line by young men so that they may be duly counted by the crowd. "These he will give away on the occasion of his Enthronisation," will shout one of them, to which the crowd will answer in loud acclamations: *Sæmotget! Sæmotget!* words of ancient origin indicative of admiration and used only in this connection. After the distribution, the notable sits on his appointed seat of honor.

5. Now, should it become known that the following summer would witness the giving of the last of the series of banquets commemorative of his predecessor's death, on a certain arranged winter evening, while the new notable is sitting together with a band of young men in his house with closed doors, all his fellow notables and villagers congregate outside, and, at a given signal, the whole crowd breaks into vociferous applause upon which a song is struck up within (accompanied by a tambourine) by the aforesaid band of young men as singers. Then a *tœneza* wearing the insignia of his rank, the wig and ceremonial apron, will dance while keeping profoundly bowing

to the host and singers, and without interrupting his dance he will proceed to his place near the master of the lodge. All the notables present will then follow in their turn observing the same ceremonial. Should there be a female notable among them she will have precedence over any untitled member of the crowd. Instead of a wig, she wears a lofty crown-like head-dress,¹ adorned with strips of her totem-animal's skin and other ornaments. Her ceremonial apron is also much shorter than that of the male notables which falls to the feet and has the lower edge fringed with hanging beaver claws or small pebbles which during his dance produce a continual rattling sound.² She does not dance however, on entering the house; but bowing low keeps time with her head-dress to all the sounds of the tambourine. When all the assistants are gathered around the notable thus honored, he serves them a frugal supper after which they disperse to their respective homes.

6. This is the last and most important of all the festivals intended to commemorate the late notable's death. Previous to its celebration, people of the surrounding villages are invited to construct a new lodge for his successor, while the notables carve in the woods, away from the eyes of the curious, two wooden masks representing respectively the face of a man and of a woman. Meantime the most skilled workmen of the village carve out of a large cotton-wood tree two huge toads or grouse according to the clan to which the new *Tæneza* belongs. These different works have to be completed on the eve of the great banquet when the population of distant villages have congregated for the occasion. In the night when all are assembled in the new house, the notables who made the masks, concealed behind a screen formed by skin curtains, adjust them to the face of two young men whose persons are carefully concealed by blankets. After this the curtain is lifted up and the notables proceed to the centre of the assembly and commence—attired in their insignia—to dance in a group whilst the masked jesters make with their heads all sorts of comical movements. The chant used on this occasion has a peculiar

¹ So did the Mongol women of the Middle Ages, according to William of Rubruck: "The costume of the women," he says, "does not differ greatly from that of the men, except that they wear a very lofty 'head-dress.'" *Relation des Voyages en Tartarie, Bergeron.*

² This peculiarity reminds us of the *mepil* of the Jewish high priest, the most noticeable part of which was its fringe composed of little bells of gold alternating with coloured pomgranates. Exodus xxviii, 31 and 34.

rhythm and time. The dance over, the notables retreat behind the curtain which falls and hides them from view.

A new mask is added on the occasion of every subsequent funeral banquet given by the same notable, so that the number of jesters present at these festivities indicates the number of banquets given by him since he succeeded his late uncle.

Next day, in the morning, takes place the grand banquet, which sometimes lasts a whole day. On this occasion, the late *toneza's* personal goods which to this day have remained untouched, are exhibited one after the other in full view of the crowd and amidst the lamentations of his relatives, care being taken not to name the deceased. Then also his charred bones, which so far have been daily packed by his widow, are suspended within the satchel to the rafters of the new house, after which, in the course of distributing eatables, his successor rubs his greasy hands on the widow's hair and covering her with a new blanket which he presents to her, says: "I hereby liberate thee; so thou mayest return to thy kindred and marry if thou pleasest."

On the morrow, prior to the general distribution of clothes and skins, not to let the medicine-men pass unnoticed amidst such solemnities, and to ensure their good will against any malady or ill which may befall the assembly, they are requested to make their preventive "medicine." With this end in view, four or five of the most famous capture (?) while dancing the soul or shade of each assistant and restore it to his head with solemn insufflations.

A peculiarity of the final distribution is that the *totem*, toad or grouse, having been placed at either side of the door, each new comer belonging to another clan than that of the host is bound by custom to present said totem with clothes and hunting implements which thereby become the new notable's property. Part of these he will, after the ceremony, divide among his fellow clansmen, keeping for himself only what he thinks he will be able to re-fund by offering to the totem of his present guests an exact equivalent on the occasion of the next banquet given by them. This will be observed by all the partakers of these so-called presents, which are really nothing but an exchange of property from clan to clan.

Then will follow the grand distribution of skins and clothes, after which the host will divide among his predecessor's relatives, all the latter's personal property and even present them with his own wearing apparel, reducing himself to a state of almost perfect nakedness. Then as a finale, the deceased's remains will be deposited in a box suspended on a carved wood column such as (though generally more ornamented than) those delineated in figure 15.¹

XVI.

The above mentioned and any other dances were usually performed by a single person—generally a man. He would usually dance in a kind of jumping way, making with hands and head occasional gestures

¹The Government Reports on Indian Affairs do not distinguish the different kinds of pot-latch but state many facts from which one may form an idea of the magnitude of these feasts. In November, 1883, at Lacksem, Valde's Island, B.C., a pot-latch was held which lasted a week and at which more than 2000 Indians and half-breeds were present. The entertaining tribe's savings of several years are said to have been given away, one young man contributing goods to the value of \$400, (Report, 1884, p. 97). A Chief named Lohah in 1885 gave a pot-latch to about 2500 persons of different tribes at the village of Comeakin, B.C. He feasted his guests for over a month, then sent them away with his accumulated savings of the five previous years. 3000 Indians and half-breeds partook of a pot-latch at the Quamichean Agency, B.C., in June, 1886. It lasted a fortnight and impoverished the entertainers. The goods usually distributed consist of skins, horses, personal clothing, guns, canoes, blankets and in late years money. On one occasion in 1876 we read of \$15,000 worth being distributed in presents, chiefly blankets which among the Indians west of the Rockies was then the standard of value (Report, 1876, p. 36). In another case the gifts consisted mainly of 134 sacks of flour, 140 pairs of blankets, apples and provisions=\$700.

For some years the government has been trying to put down the pot-latch. The reasons assigned are: first, that it is wasteful in the extreme and impoverishes the givers; second, that by collecting together a large number of persons who are under no rule and are given to excess, it forms a danger to the public peace. At length an act was passed and was brought into force by proclamation of the 1st of January, 1885. It abolishes the pot-latch and makes its celebration a misdemeanour. It deals in a similar manner with another feast called *Tamanauas*. We have no detailed account of it such as Mr. Morice gives us of the pot-latch, but the *Tamanauas* would seem to consist of a Medicine Dance somewhat like the Thirst Dance of the North-West Crees and to be accompanied with lacerations. The more distant tribes of British Columbia preserve their ancient customs, and the older chiefs in places where civilization has penetrated defend their practices by arguments such as these:—"We have laboured for the goods, they are ours; why may we not give them to our friends? The white man has his feasts, his theatres, his churches. He is not hindered. We have only the pot-latch and dances for seasons of joy and sorrow, for entertainment and amusement. The pot-latch is long established, it relieves the agony of the deceased's surviving kindred and calls forth the sympathy of friends and neighbours. The presents ensure us a hearty welcome wherever we travel and are themselves but a return in kind for others which we received at other times. Is it not unjust to prohibit so ancient and so beneficial a custom?" Nevertheless, the pot-latch seems in a fair way towards extinction. I should mention that Mr. Lomas of the Cowichan Agency has been trying to convert the pot-latch into an Annual Industrial Exhibition, and has met with considerable success.

meant as an illustration of the chant executed by the crowd who kept beating time by clapping their hands one against the other. Besides, on grand occasions Indian tambourines were also used as an accompaniment to the singing.

Religious dances were unknown. The nearest approach thereto was the dance performed on the occasion of an eclipse. The Dénés believed this phenomenon to be due to the presence of gale or scab on the sun or moon. To preserve themselves from that dread malady and hasten the luminary's re-appearance (or cure), they would cautiously go out of their habitations, avoiding noise and loud talk, and then, ranging themselves one behind the other, they would start a kind of propitiatory dance to this effect: bending under an imaginary weight though carrying only an empty bark vessel, they would strike in cadence their right thigh, repeating at the same time in piteous tones "*Hanintik; ge!*" "Come back therefrom."

On such occasions the Chilhōtins neither danced nor sang; but among them men and women having their clothes tucked up as when they travel and leaning on a staff as if heavily laden, they walked in a circle till the end of the eclipse.

Another observance formerly in vogue among the Carriers was the *thé'tsœlrwœs* (precipitate exit). This was analogous in character to, if not identical with, a practice of which we read as having existed among certain European and Asiatic nations, the *Lycanthropia* of the ancients, the *Loup-garou* of France, the Persian *Ghoule* the Teutonic *Wehr-wolf*; all probably the result of a simulated ecstasy of superstitious origin. In the case in question and on the occasion of a large gathering of aborigines, a band of men would suddenly run out of a lodge and, simulating madness, would, amidst wild yells and incoherent songs, make frantic efforts to bite the passers-by or, failing in this, they would seize upon a dog and devour him on the spot.

Ordinary amusements consisted of the *nœzaz*, or throwing of long polished sticks on the snow, the distance reached determining the winner; and gambling which is of two kinds: *nœta* and *alté*. The first game which greatly resembles the *tsi-mei* of the Chinese¹ is played by a group of natives one of whom concealing in his hands

¹L' Empire Chinois, par l' abbé Huc.

two small sticks or bones differently carved keeps jerking his arms and body to the tune of a particular song, so that he may give as little indication as possible to the rival players as to which hand contains the winning stick. A tambourine or some appropriate substitute, such as a tin-pan, is continually beaten as an accompaniment to the game.

This is not the case with *allé* which is played (or rather was played, for it has fallen into desuetude) silently by only two partners with a multitude of small sticks and which is too complicated to be described here. A few other games were also played formerly, but not so commonly as those just referred to, so that I deem it unnecessary to do more than simply mention the fact.

The chants accompanying these games and dances were, musically speaking, of the poorest description,—aboriginal music being of a very primitive character. They are generally composed either of a single musical phrase repeated *ad infinitum* or of a few musical phrases without co-relation or cohesion undergoing the same sempiternal repetitions.

These chants may be classified under two heads: those with ancient words and those with modern or no words. The first are those traditional songs which, among the Carriers, are the exclusive appanage of the notables and are transmitted from generation to generation. They claim that the words thereof are remnants of their primitive language. They are at present quite unintelligible. Although each of their component sounds is familiar with the Dénés' vocabulary, yet a close comparison with the actual Carrier, Chillxotin, Sékanais and three Eastern dialects of which I have complete dictionaries before me, fails to give a clue as to their original meaning. This circumstance is of itself strong evidence in favour of the high antiquity of the "melodies," as well as of the words: for since they have preserved the latter with such scrupulous care amidst the gradual variations of their language, I do not see why they should not be supposed to have also taken particular pains not to change the former. The two specimens given here will explain themselves better than could an extended description from me. Let me however remark that aboriginal rhythm is so different from ours that it is impossible to set it to time.

O! peyohyé é! suuxa lhoelha moella ehwe git-gé scemta,
 eh-we git-gé scemta, eh-we git-gé scemta, eh-we git-gé scemta,
 la! ha! é! la! ha! yé! é! la! ha! yé! é! la! ha! yé!
 Toëmsi lu - yé lhweyeno scem-ta, toëmsi luyé lhweyeno scem-
 ta, yi! hé! hé! yi! hé! hé! yé! yi! yé! yi! hé! hé!

Following are two other examples of native music, the first of which is the "melody" used in playing *næta*, and the second, one of the Dénés' pastime songs which, as will be seen, are little more than polished yells, both are without words.

Etc.

In fine, I give below for the sake of comparison the great "barcarolle" or boating song of the Carriers. It is of modern though Déné origin, and this circumstance will explain the fact that in spite of the irregularity of the finale, both rhythm and melody are more consonant with our musical ideas and evince intercourse with white singers.

A! ti - ha tiz - tlé? cha - la - i! ti - ha tiz - tlé?
 cha - la - i! seni ndœ - ta cha!.... a - ha! tiz -
 tlé, cha - la - i! seni ndœ - - tu cha!..... (1).

XVII.

Apart from the superstitious dances of which mention has been made in the preceding paragraph, the Western Dénés observed no religious ceremonies. They made no sacrifices, worshipped no Deity and had no definite *cultus*, unless we dignify with that name the shamanism of the Northern Asiatic races which obtained among them. True, they vaguely believed in a kind of impersonal and undefined Divinity, not quite pantheistic; but rather more so than individual, almost co-essential with the celestial forces, the cause efficient of rain and snow, winds and other firmamental phenomena. They called it *Yuttœere* ("that which is on high") in Carrier. But they did not worship this power—they rather feared it and endeavoured to get out of its reach, or, when this was impossible, to propitiate it and the spirits who were supposed to obey it, with the help and through the incantations of the *nellgên* or conjuror. This shaman was credited, when exercising his mysterious art, with the power of controlling the coming or departing of evil spirits. Even when not actually conjuring, he was believed to be able to kill by his mere will any objectionable person. His services were called into requisition in time of famine, to prevent tempests, procure favorable winds, hasten the arrival of salmon and ensure its abundance; but more generally in case of sickness which they believed to be concrete (not unlike the microbes of modern chemists) and always due to the presence or ill will of spirits.

¹"A! how is it that she goes like a fish, chalai! my mind is sick, cha, etc., etc

When worked into a state of trance by personal exertions, the singing of his own magic chant, the incessant beating of drums and the rattling of the castanet with which he accompanied his dance, the shaman would declare himself to have fallen under the control of his familiar genius. Therefore, pointing its image (fish, bird, mammal, etc.) in the direction of the patient, he would dance towards him and drop on his head his spirit's representatives which (eye witnesses assure me) would at once fade away. Then sucking that part of the body which most ached, he would take out of his mouth either a thorn, a bug, a toad, etc., which he would exhibit as the cause of the complaint. Then, after a momentary recess from the patient he would dance back to him and lo! the image of his genius would come back of itself to his outstretched arms, and the patient would shortly feel all right.

In desperate cases, when the patient had already lost consciousness and death seemed to be fast approaching, the conjuror, if he was at all acquainted with his art, would, in the course of singing and dancing, suddenly fall apparently senseless to the ground and feigning sleep, he would dream and be supposed to have gone to the regions of the ghosts. In badly articulated words he would be heard beseeching the moribund's shade or self to return to his body, for the sake of his friends, etc.; after some little time he would awaken at the proper moment, and cautiously and noiselessly take said shade in the hollow of his hands, and with repeated insufflations restore it to the patient's head. Was this really an effect of an over excited imagination on the part of a half conscious subject, or was it due to preternatural forces? Be this as it may, the elderly men all assure me that in such cases the moribund immediately revived.

To the proper understanding of the foregoing, I must say a word concerning aboriginal psychology. The Dénés believed man to be vivified by a soul which to them was nothing else than his natural warmth (*nezal*) and which as such died with the body. But besides this, they credited every human being—indeed many still hold to that belief—with the possession of another self or shade (*netsin*) which was invisible as long as he enjoyed good health, but appeared wandering about in one form or another whenever disease or death was imminent. In order therefore to prevent either the one or the

other, their endeavours would be directed towards catching it back. With this end in view, they would hang up in the evening the patient's mocassins previously stuffed with feather down, and next morning, should the down be warm, they would with great care and silence put them back on his feet with his supposed shade therein. Whenever the moribund lay unconscious they believed his double to have departed for the land of the shades or spirits, though after death it received another name (*nezul*) and was then supposed to be the impalpable form of the man's previous self. We thus see that the immortality of the soul, though in an imperfect manner, was admitted by these people.

Concerning the state of these shades and the regions they inhabit after death, their notions were rather vague and contradictory. Though all of them seemed to agree that their condition was miserable, since their only food was dried toads (which among the Dénés are the uncleanest of animals) yet they do not seem to have known or imagined much regarding the regions in question.

The following myth may however give a fair idea of the belief entertained by the Carriers on this subject.

“A long time ago two young men having got lost in the woods, reached in the course of their wanderings a certain spot where the trunk of a tree entirely hollowed out by age and decay was lying on the ground. Out of curiosity they crawled in to see where it led to as only one end was visible. After some hard walking on all fours through a dark subterranean passage, they reached a place full of snakes, toads and lizards. Much frightened they endeavoured to go back; but could not—it was an awful place. Yet, summoning up their courage they hurriedly ran through it and after more underground journeying, the road widened and darkness ceased. Then they suddenly found themselves to be on the top of a hill commanding the view of a broad river on the other side of which stood a village. This consisted of innumerable board houses, some of which were black, others red—it was the abode of the shades who were then enjoying themselves on the lawn. Nobody could have an idea of their number and they were making a deafening noise, caused by the interest they seemed to take in their sport.

“At this sight, one of the young men ran away and hid himself in the bush. As for his cousin (such he was), perceiving several

black and red canoes hauled on the other side of the river, he halloed for somebody to come and take him across. But the tumult was such that they could not hear him. At last, after repeated efforts to attract attention, having inadvertently yawned, one of them heard the movement of his jaws.¹ Having apprised his fellow spirits of the fact some of them at length came across to fetch him.

“But he had no sooner stepped into their black canoe than he sank down with the part his foot had touched which seemed to be elastic. Which seeing, the spirits at once smelt him. ‘He does not smell of smoke,’ they said, and then they learned that he had not been burnt. Therefore, madly seizing him in their fleshless arms, they tossed him up in the air as one does a ball, until nothing remained of his former self but his empty skin. In that state they threw him in the river where a big fish swallowed him at once. His cousin who all this time had been in hiding then set out to return to the land of the living and this time without any fear of the snakes and toads, for his sojourn in the regions of the shades had made him another man. While in the act of crawling back in the hollow tree through which he had entered, he heard a terrific voice calling: “Grandson! grandson!” Then at the end of the subterranean conduit, he came upon a giant who adopted him as his grandson. After a very long series of wonderful experiences with this new grandfather, he finally went up above and it is he that we now see standing on the moon.”

Such is the Déné myth, or rather part of myth or legend, for what they narrate of this couple is far too long to be repeated here. Now is it not strange that we should find here among hyperborean Indians, the belief in this very Tartarean river which plays such a role in the mythologies of ancient Rome and Athens? Is there any noticeable difference between this broad river of the Dénés and the Styx-*atra* of Virgil? And does not their hero's experience in the infernal regions offer remarkable analogies with those ascribed by the Greeks and Latins to Theseus and Hercules, Orpheus and Æneas? It is also worthy of notice that this belief of the Dénés, as evinced by the

¹ To understand this particular circumstance of the Dénés' legend, one must know that the nation regard yawning as ominous, and believe it to be a calling back of the departed ghosts to earth.

above legend, that entrance to the abode of the shades is denied to those who have not received the honors of sepulture (typified among them by cremation) was common to most ancient nations, and is still to be found among several modern barbarous people.

But I perceive that I am becoming didactic when I intended to content myself with the mere exposition of facts. Let us be brief.

Metempsychosis was believed in by the Carriers and the Sékanais and very likely by the two other tribes also, though I could not positively affirm this. It amounted in their estimation, to the regeneration of persons who had led a virtuous life and were supposed to be rewarded therefor by a new birth. Transformations into beings of a lower order however, than that of their former condition, were repugnant to their psychological ideas.

They also attached to dreams the same importance as did most people of antiquity. It was while dreaming that they pretended to communicate with the supernatural world, that their shamans were invested with their wonderful power over nature, and that every individual was assigned his particular *nagwal* or tutelary animal-genius. Oftentimes they painted this genius with vermilion on prominent rocks in the most frequented places, and these rough inscriptions are about the only monuments the immediate ancestors of the present Dénés have left us.

XVIII.

Closely related to a people's religious beliefs are their superstitious observances, and, as a rule, the more the former have deviated from original truths, the more will the latter be found to have developed both in number and relative consideration. This is strictly true of the Western Dénés who, lacking even the primordial notion of a Supreme Being, were encumbered with a multitude of vain observances to which they attached the greatest importance. I have already in the course of this monograph incidentally hinted at some of them. Yet, before bringing it to a close, I feel that I shall have to add a few words on this subject. To avoid the tediousness necessarily resulting from a long nomenclature of apparent trivialities,

I will make a choice and confine my remarks to a few of those ceremonial rites which may be of interest to the sociologist.

Prominent among these are the observances peculiar to the fair sex, and many of them are remarkably analogous to those practised by the Hebrew women, so much so that, were it not savouring of profanity, the ordinances of the Déné ritual code might be termed a new edition "revised and considerably augmented" of the Mosaic ceremonial law. Among the Carriers, as soon as a girl had experienced the first flow of the menses which in the female constitution are a natural discharge, her father believed himself under the obligation of atoning for her supposedly sinful condition by a small impromptu distribution of clothes¹ among the natives. This periodical state of women was considered as one of legal impurity fateful both to the man who happened to have any intercourse, however indirect, with her, and to the woman herself who failed in scrupulously observing all the rites prescribed by ancient usage for persons in her condition.

Upon entering into that stage of her life, the maiden was immediately sequestered from company, even that of her parents, and compelled to dwell in a small branch hut by herself away from beaten paths and the gaze of passers-by. As she was supposed to exercise malefic influence on any man who might inadvertently glance at her, she had to wear a sort of head-dress combining in itself the purposes of a veil, a bonnet and a mantlet. It was made of tanned skin, its forepart was shaped like a long fringe completely hiding from view the face and breasts; then it formed on the head a close fitting cap or bonnet, and finally fell in a broad band almost to the heels. This head-dress was made and publicly placed on her head by a paternal aunt, who received at once some present from the girl's father. When, three or four years later, the period of sequestration ceased, only this same aunt had the right to take off her niece's ceremonial head-dress.

¹Might not this distribution be considered as a coincident equivalent vestige of the animal offerings prescribed by the Book of Leviticus, chapter v., for the expiation of sins (including legal uncleanness)? One should not forget the greatly altered circumstances in the midst of which the Déné now live, nor the fact that their only domestic animal, the dog, is to them as to the Jews, an unclean animal. On the other hand, having lost the knowledge of an only God through probable peregrinations among, and commiscegenation with, shamanistic asiatic races, they have no constituted priesthood, to receive these offerings and may reasonably be supposed to have substituted therefor the aggregate of their equals.

Furthermore, the girl's fingers, wrists and legs at the ankles and immediately below the knees, were encircled with ornamental rings and bracelets of sinew intended as a protection against the malign influences she was supposed to be possessed with. To a belt girding her waist were suspended two bone implements called respectively *Tsænkuz* (bone tube) and *Tsiltset* (head scratcher). The former was a hollowed swan bone to drink with, any other mode of drinking being unlawful to her. The latter was fork-like and was called into requisition whenever she wanted to scratch her head—immediate contact of the fingers with the head being reputed injurious to her health. While thus secluded, she was called *asta*, that is "interred alive" in Carrier, and she had to submit to a rigorous fast and abstinence. Her only allowed food consisted of dried fish boiled in a small bark vessel which nobody else must touch, and she had to abstain especially from meat of any kind, as well as fresh fish. Nor was this all she had to endure; even her contact however remote with these two articles of diet was so dreaded that she could not cross the public paths or trails, or the tracks of animals. Whenever absolute necessity constrained her to go beyond such spots, she had to be packed or carried over them lest she should contaminate the game or meat which had passed that way, or had been brought over these paths; and also for the sake of self-preservation against tabooed, and consequently to her, deleterious food. In the same way she was never allowed to wade in streams or lakes, for fear of causing death to the fish.

It was also a prescription of the ancient ritual code for females during this primary condition to eat as little as possible, and to remain lying down, especially in course of each monthly flow, not only as a natural consequence of the prolonged fast and resulting weakness; but chiefly as an exhibition of a becoming penitential spirit which was believed to be rewarded by long life and continual good health in after years.

These mortifications or seclusion did not last less than three or four years. Useless to say that during all that time marriage could not be thought of, since the girl could not so much as be seen by men. When married, the same sequestration was practised relatively to husband and fellow villagers—without the particular head-dress and

rings spoken of—on the occasion of every recurring menstruation. Sometimes it was protracted as long as ten days at a time especially during the first years of co-habitation. Even when she returned to her mate, she was not permitted to sleep with him on the first nor frequently on the second night, but would choose a distant corner of the lodge, to spread her blanket, as if afraid to defile him with her dread uncleanness.

The birth of a child was also the occasion of temporary separation from her husband.² It is noticeable that this was more protracted after the birth of a female than after that of a male child.³ Moreover, after this seclusion, custom obliged the parents to make an offering in the shape of a distribution of clothes, meant as a final purification for the mother and a sort of redemption of the child.⁴

Boys who attained the age of puberty had their wrists, ankles and legs below the knee encircled with rings made of sinew twisted with feather down. To neglect this rite would have been in their estimation to call for precocious infirmities which would have hindered the young man from performing the duties of a good hunter.

The distinction between clean and unclean animals was as strictly defined among them as it was among the Jews.⁵ In the same way, until quite a recent date, no woman would partake of blood⁶ and both men and women abhorred the flesh of a beaver which had been caught and died in a trap, and of a bear strangled to death in a snare, because the blood remained in the carcase.

I think also that we may appropriately find in an ancient custom of the Chilhyotins, that of public flagellation, an unconscious fulfilment of this precept of the Mosaic law: "They shall lay him down and shall cause him to be beaten before them."⁷

¹ Compare with the prescriptions of Leviticus xv., 19.

² Cf. Leviticus xii., 2.

³ Ibid xii., 4, 5.

⁴ Ibid xii., 6.

⁵ Cf. Leviticus xi.

⁶ Ibid. *passim*.

⁷ Cf. Deuteronomy xxv., 2.

Various other observances—whose name is legion and frequently of a puerile nature—were formerly in vogue among the Déné hunters, but as they are of no particular interest to the sociologist, I will refrain from enumerating them.

XIX.

Such as I have described them were, even as recently as twenty years ago, the Chillixotins, Carriers, Sékanais and Nah'aués. Such, to a great extent have remained the two last named tribes. As yet, the only representatives of our race among them have been, with few exceptions, the missionaries, gold miners and the Hudson's Bay Company's officers and employees. Among the exceptions are two villages of the Southern Carriers which happen to be in the vicinity of small white settlements. Be it said to the shame of modern civilization, this proximity has proved in every way detrimental to the aborigines' moral and material welfare. Intoxicating liquors unscrupulously proffered them have demoralized the unfortunate natives, while immoral relations between their women and the whites have engendered maladies previously unknown and which have deprived the former of that fecundity which was formerly their pride. However, let us not exaggerate; even in this respect they have stood their ground much better than many Indian tribes which I could mention.

In places where the white race is practically identified with the Hudson's Bay Company's people, the Dénés have fairly progressed. With the exception of the Sékanais, they now dwell in comfortable log houses, built after the style of the country, have neat enough stables for their horses and cattle and they cultivate what will grow in small clearings near their villages, without abandoning their former and more lucrative pursuits,—hunting and fishing. The Hudson's Bay Company, which in most places has retained the virtual monopoly of the fur trade among them, treats them paternally, helps them liberally in cases of distress and scrupulously avoids the sale of hurtful stimulants to them.

Although the Dénés, and especially the Carriers, literally crave for knowledge, yet, owing to the paucity of missionaries among them, religious instruction is about all that can be given them so far. In these latter years however, an effort has been made by the writer of

verbs of locomotion, verbs of incubation, etc., etc. But to do so would be to enlarge beyond the scope of the information asked for by the recent circular of the Canadian Institute which I have endeavoured to answer through these pages, and then, according to the French proverb, "*A chaque jour suffit sa peine.*" On the other hand, what is not done to-day may, with God's help, be accomplished at some future time.

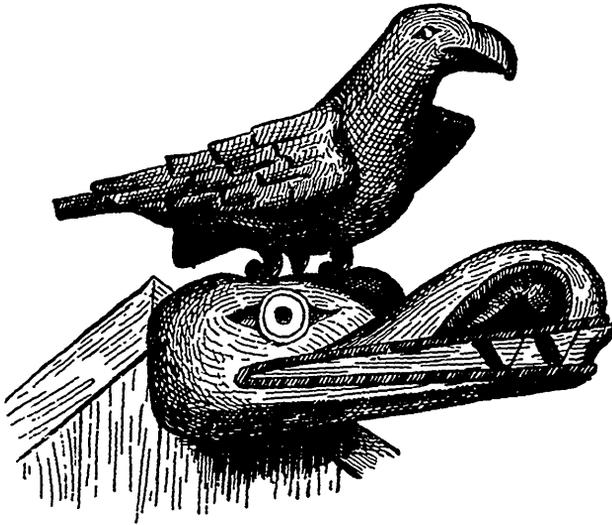


FIG. 1.--CARVED TOTEMS.

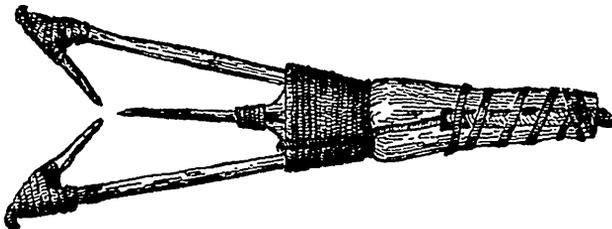


FIG. 2.--CARRIER HARPOON ; $\frac{1}{8}$ SIZE.



FIG. 3.—CHILHYOTIN DOUBLE-DART; $\frac{1}{4}$ SIZE.

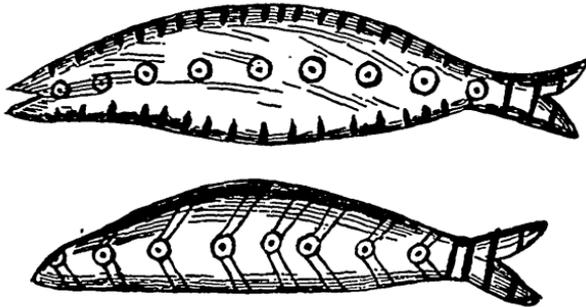


FIG. 4.—BONE COREGONE FRY, (used as bait); NAT. SIZE.



FIG. 5.—HORN DART ; $\frac{1}{2}$ SIZE.

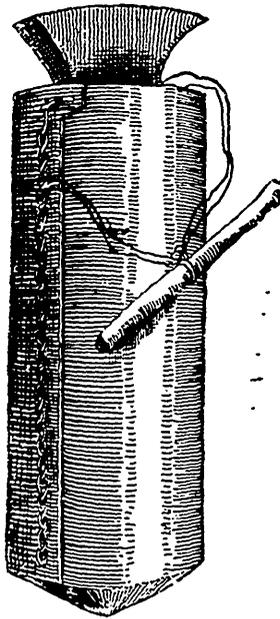


FIG. 6.—BARK BOTTLE ; $\frac{1}{2}$ SIZE.

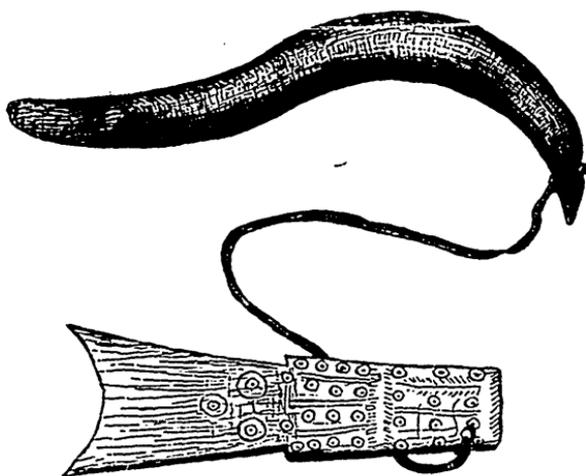


FIG. 7.—BARK PEELER AND CAMBIUM SCRAPER; $\frac{1}{2}$ SIZE.



FIG. 8.—BONE CHISEL OR SCRAPER; $\frac{1}{3}$ SIZE.



FIG. 9.—BONE SCRAPER; $\frac{1}{3}$ SIZE.

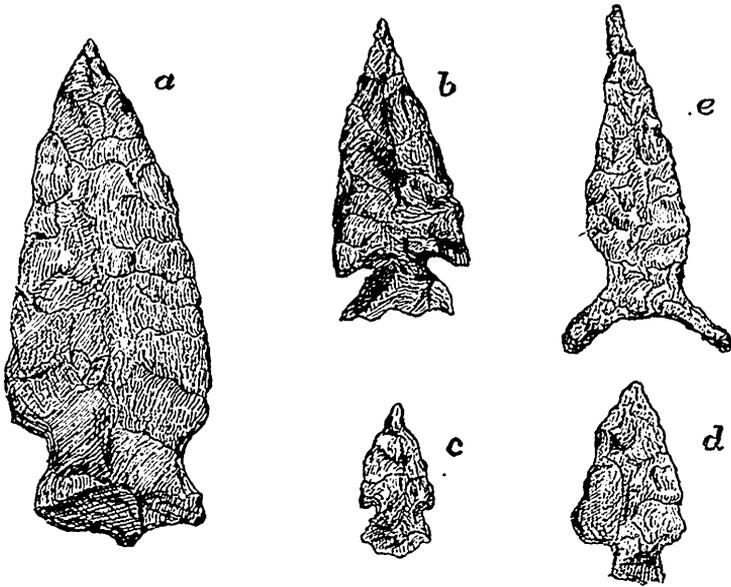


FIG. 10.—DENE FLINT ARROW-HEADS; NAT. SIZE.

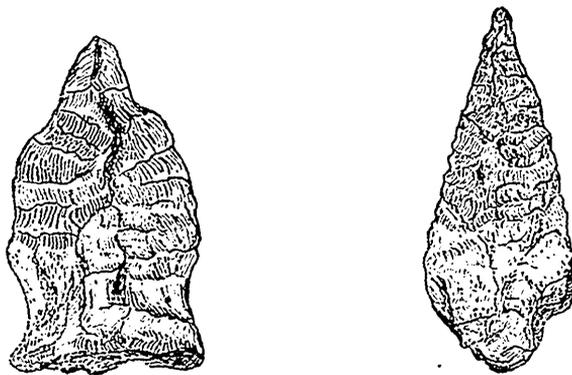


FIG. 11.—BOW-POINT; NAT. SIZE. | FIG. 12.—SPEAR-HEAD; $\frac{1}{3}$ SIZE.



FIG. 13.—STONE "Casse-tou;" $\frac{1}{2}$ SIZE.

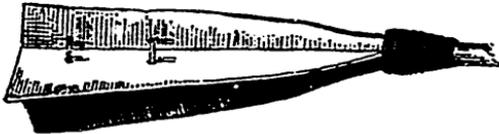


FIG. 14.—BONE TRIPLE ARROW; $\frac{1}{2}$ SIZE.

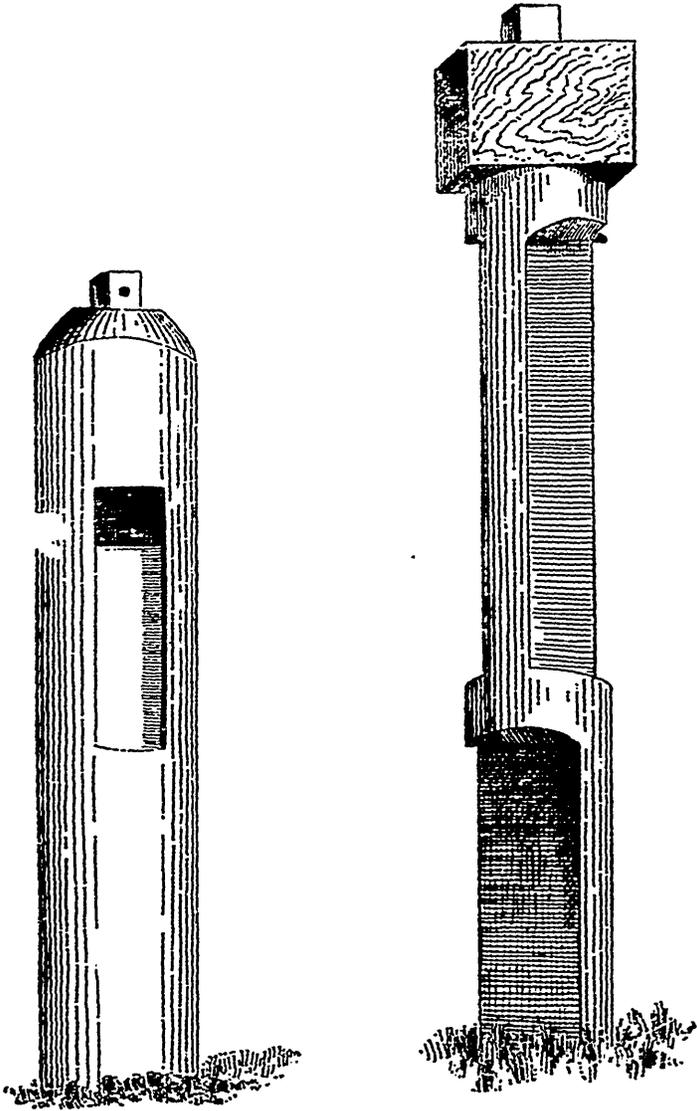


FIG. 15.—FUNERAL POSTS.

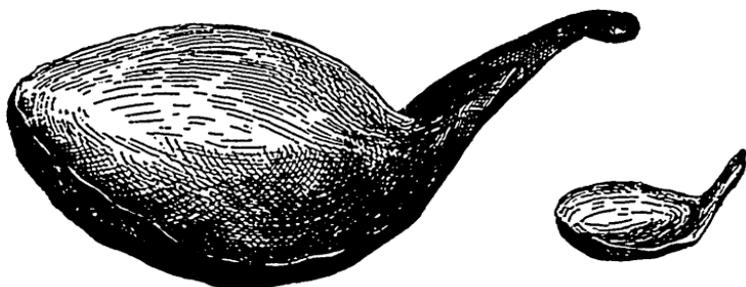


FIG. 16.—HORN LADLE AND SPOON; $\frac{1}{2}$ SIZE.

BRIEF SUMMARY.

Introduction to Paper on the Western Dénés.

- I. Classification of Tribes, population and habitat.
- II. Physical characteristics—wearing apparel.
- III. Habitations, &c.,—moral characteristics.
- IV. Clan organization, exogamy, ranking of relationships.
- V. Marriages, contracting of.
- VI. Effect of marriage on property and succession.
- VII. Birth and care of children—vital statistics.
- VIII. Modes of hunting.
- IX. Fishing.
- X. Preserving berries.
- XI. Arts and Industries.
- XII. War implements.
- XIII. War and social organization.
- XIV. Modes of disposing of the dead.
- XV. Solemnities.
- XVI. Amusements—specimens of Déné music.
- XVII. Religious beliefs—medicine-men.
- XVIII. Superstitious observances.

Conclusion with sentences in the Déné language written with newly invented characters.

ERRATA.

Page 110, Line 17 from the top—	for Nahanis	read Nah'anés.
" 110, bottom line	" t. chene	" t-chené.
" 112, Line 6 from the top	" Nah-anés	" Nah'anés.
" " " 10 " " "	" Tsekenné	" Tsekenné.
" " " 15 " " "	" Tsatens,	" Tsatens.
" 113, " 12 " " "	" Nah-anes	" Nah'anés.
" 114, " 2 " " "	" Sëkanais	" Sëkanais.
" 115, line 4 from the bottom	for Dentalium Indianorum	read der.talium indianorum.
" 116, " 1 " " top	" Dentalium	" dentalium.
" " " " " "	" Hyaquia	" hyaqua.
" 125, " 6 " " "	" Tænezoi	" Tæneza.
129, " 2 " " bottom	" hwonath'a	" hwonølh'a.

[The following letter dated 30th June, 1888, was received from A. Bowen Perry Esq. Inspector, North-West Mounted Police, Prince Albert, North-West Territory.—CH. S. COM.]

SIR :—

I have to acknowledge your Sociological Circular of June '88. I fully agree with you as to the importance of the work with which your circular deals. Such information as you require must be obtained speedily for the state of the Indians is changing most rapidly. Old customs are passing away ; their ceremonies are almost of the past, certainly with many tribes ; their family customs are assimilating to those of their white brethren ; and in fact in almost every section named in your circular the information to be obtained will be of a hearsay character. I speak more particularly of this district of Saskatchewan. The Indians are all Crees with one exception, a small band of renegade Sioux from Minnesota.

Missionaries have for many years labored among the Cree Indians and with no little success. The Crees have for some time devoted themselves to farming and abandoned their nomadic life. Schools have been maintained. These influences combined with the strong and successful attempt of the government to break up old habits and customs have effected a complete change in the Indian character and habits. Not always for the best it must be admitted. With civilization, disease has been introduced, immorality has increased and physical degeneration ensued. It seems that physical degeneration universally follows the semi-civilization of the Indian. The causes are many. Change of food, from fresh buffalo meat and fish to a diet of badly baked bread and bacon. The bread is unleavened ; the flour being simply mixed in water and half baked in a frying pan or in ashes. Consequently the bannock as the bread thus made is called, is very indigestible and unfit for food. Again in their old life they wandered about from place to place, lived in lodges which afforded plenty of ventilation. Now they live the year around, or the greater part of it, for some of them take to their lodges in the summer,

in small log huts, ill lighted, unventilated, half filled with smoke and crowded together. Dirty and careless in their habits, it is not long before the hut becomes filthy and the ground around saturated. Remember that the huts are clumped together and the unhealthy state of the present Indian habitation on a Government Reserve is apparent. The agents and employees of the Indian department do what they are able to encourage the Indians to build larger houses and keep more cleanly habits, but as far as I know with little success. Disease marks them for her own; if of a contagious or infectious nature it runs its course; for the last two or three years measles have prevailed amongst the Northern Indians, and with a deadly result. Preventible diseases are most terrible. Amongst the Southern tribes of the Territories especially it is the exception to see a healthy well developed Indian child. The Northern tribes have not suffered to the same extent but still have not escaped. What appears to me to be another cause for the physical degeneration of the Indian is the want of exercise. When the Indian was compelled to earn his own living by the hunt he was compelled to live in the open air and to take sufficient exercise to develop himself physically. Now the Treaty Indian, relying on a paternal Government for rations, spends his time lazily about the Reserve exerting himself unwillingly and gorging himself with unwholesome food which is lavishly provided on some of the Reserves.

If I might suggest, it would be perhaps well to have the present state of the Indians authentically recorded. The change from barbarism to civilization is interesting and the gradual development will illustrate one of the Social laws. It is not always well to trust to official reports and government records to record the true facts of the Indians' state. They seldom deal with what will be of historical value nor do they always give unvarnished and plain statements.

As an offshoot of the Indians I would call your attention to the half breeds both English Scotch and French. Their origin and history are but little known, their habits and customs in the past unregistered. Having been in contact with the French half-breeds for the past three years I have become possessed of some very interesting facts concerning them. Equally with the Indian their future is problematical. I therefore think that your Institute might investigate the offshoot of

the Indians as well as the Indians. I shall be very happy to give any information in my power which may be of any use. There are many gentlemen in the Territory who would be able to give you varied interesting and accurate information, and thinking it possible that their names may not be known to you, I take the liberty of giving you a list which you will find enclosed.

The subject which you have undertaken to investigate is most extended and I believe that it will be a reproach to the literary men of Canada and Canadians generally if the question be not thoroughly exhausted and the results accurately recorded.

You have my hearty sympathy.

Critical note on Mr. J. B. Tyrrell's paper, entitled "Catalogue of the Mammalia of Canada exclusive of the Cetacea," by Ernest E. Thompson.

Being one of the members of the Institute who objected to the publication of Mr. Tyrrell's paper on account of its being without value as a zoological contribution, I have been asked to put my objections in more specific form for publication as a part of the Proceedings and as a fitting commentary on the paper. But since a full extended critique on the errors and vague generalizations of which it is chiefly composed, would far exceed the limits of allotted space, and would result in a paper more lengthy than the original, I will point out briefly the wrong principles on which it is based and will give a few examples of the matter that chiefly is reprehensible in the catalogue.

The only value that a scientific paper in this field can have, must come either from its new facts or from its carefully compiled and collated facts, and of course in both cases absolute precision and correctness are essential.

In the case of compiled facts, it is, not merely a rule of courtesy, but an inflexible law of scientific writing that all quotation and assistance must be acknowledged with due credit to its proper authority. It is hardly credible that any one will deny what is so fully accepted by all experienced writers, and yet it appears as though Mr. Tyrrell had set out with the express intention of running counter to these principles throughout his paper.

Passing over without comment the general vagueness in all matters relating to geography, and the annoying omission of dates in nearly all references to time, I will briefly direct attention to a few characteristic paragraphs. The Panther (*Felis concolor*) is given as, "Found in rough wooded regions in Southern Quebec, etc." If the writer has any reliable records of his own for this, surely he should have given them, or if he has it on other authority he should have given

his authorities. In all probability the statement is true but without data of any kind it is scientifically worthless.

Similarly, of the Elk (*Cervus canadensis*) he says, "up to a hundred years ago an inhabitant of Eastern Canada, etc." "Eastern Canada" is vague enough to defy criticism almost, since it may mean anywhere east of the Red River which is about the central line; but if Mr. Tyrrell really has any reliable records of "Elk" in what is commonly understood by "Eastern Canada," this was the proper place either to give them if unpublished or to refer to them if already in print.

In the same manner he has treated a great number of the species, eluding specific criticism by taking refuge in vagueness and never giving credit for quotation excepting in the case of some of the Seals. The whole of his paragraph on *Hesperomys leucogaster* is taken verbatim or nearly so from the present writer's paper on the Mammals of Manitoba, but no hint is given that it is a quotation. A similar remark applies in the case of *Synaptomys cooperi*. It is difficult to understand how the writer justifies such plagiarism.

The Wood Hare (*Lepus sylvaticus*) is given as, "Becoming quite common throughout Ontario," whereas in the Northern nine-tenths at least of the Province this species is unknown.

The remark on the Pouched Gopher (*Geomys bursarius*) is one of the most flagrantly ignorant of any; he says, "originally described from a specimen brought from Eastern Canada." This Gopher was described by Shaw from a skin "supposed to have been brought from somewhere in the interior of Canada." The *Geomys bursarius* is an animal of the Mississippi valley—it was observed in Southern Manitoba by Kennicott but it is very certain that it was never taken within many hundreds of miles of the region that Mr. Tyrrell seems usually to mean by "Eastern Canada."

He gives the Black Squirrel (*Sciurus carolinensis*) as ranging "as far west as the north shores of Lakes Huron and Superior." It would be exceedingly interesting and valuable, if he would give substantial proofs of this surprising statement, etc., etc.

The avowed purpose of this article is to put on record, my objections

to Mr. Tyrrell's paper and the above examples have been given as representative of nine-tenths of the matter it is composed of; but it is only fair to conclude by indicating such passages and endeavors as are worthy of commendation. Its chief value is as a philological contribution, his records of the Indian names cannot fail to be of use, though even here his besetting sin greatly detracts from the value of the work, for he adopts no special alphabet and uses no diacritical marks, so that the pronunciation is left pretty much in the same state of uncriticisable uncertainty that is characteristic of the paper.

In one or two instances however our author has given us notes that are suggestive of the real observer, and whenever he has done so we get a glimpse of capabilities for doing work of considerable value. I might instance his remarks on the Wapiti, Buffalo, Hoary Marmot, Blue Fox,—though by the way he has apparently not read Mr. Nelson's article on the subject—and on several of the Seals—with quotations here properly acknowledged.

It is always a pleasure to welcome a beginner in any field, and it is to be hoped that Mr. Tyrrell will not misunderstand what is meant for quite friendly criticism, but will recognize the absolute necessity of reproof when so many vital principles of scientific work are violated; and further we cannot but hope that in the near future we may be favoured with something from Mr. Tyrrell's pen that shall be more worthy of one whose travels have been so extensive and whose opportunities and capabilities are so much beyond the average.

SPECIAL NOTICE

Respecting the Publications of the Canadian Institute.

In answer to numerous enquiries concerning the Publications of the Canadian Institute, and applications for missing numbers, the attention of Members and Correspondents is requested to the following:—

1. The FIRST SERIES began August, 1852; concluded December, 1855; contains 41 numbers in 3 vols. 4to. It has for title, "The Canadian Journal; a Repertory of Industry, Science and Art; and a Record of the Proceedings of the Canadian Institute." Vols. II. and III. of this series can still be supplied. Vol. I. is nearly out of print.

2. The SECOND SERIES began January, 1856; concluded January, 1878; contains 92 numbers in 15 vols. 8vo. It has for title, "The Canadian Journal of Science, Literature, and History." This series can still be supplied, except Part 5 of Vol. XV., which is quite out of print. Of Vols. X., XI. and XV. but few copies remain.

By inadvertence, No. 85 (November, 1873), Vol. XIV. of this series immediately follows No. 79. There is, however, no lacuna between these two numbers, as is shown by the fact that the paging is consecutive.

3. The THIRD SERIES, commenced in 1879, has now reached its Seventh Volume. Its title is "Proceedings of the Canadian Institute." Parts 1 and 2 of this series are entitled "The Canadian Journal: Proceedings of the Canadian Institute."

Vol. I, Third Series, contains 5 Fasciculi.	
" II, " " " 3 "	
" III, " " " 4 "	
" IV, V and VI, each " 2 "	

Of Vol. I., Parts 1 and 3, and of Vol. II., Part 1, are out of print. Of Vol. II., Part 2, very few copies remain. Of Vol. III., Part 1 is out of print.

4. Only two Annual Reports of the Institute have been published in a separate form, viz., for 1886-87 and 1887-88. These are out of print.

5. Missing numbers will be supplied on application, except those mentioned above as out of print. The Institute will be glad to exchange the back volumes of its publications for an equivalent of those of any Society with which it exchanges.

6. A liberal price will be given for the following:—Vol. I. First Series, Vols. X., XI. and XV., and especially Part 5, Vol. XV., Second Series, Vol. I. Parts 1 and 3, Vol. II. Parts 1 and 2, Vol. III. Part 1, Third Series. Persons having any of the above, and being willing to part with them, will please communicate with the Assistant Secretary.

