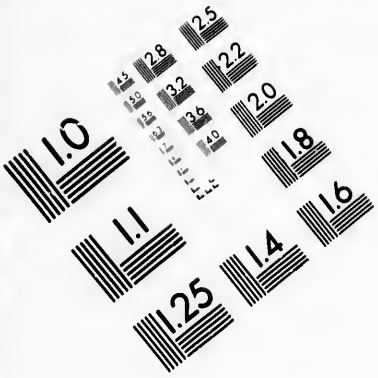

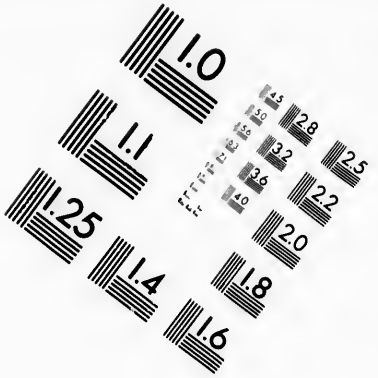

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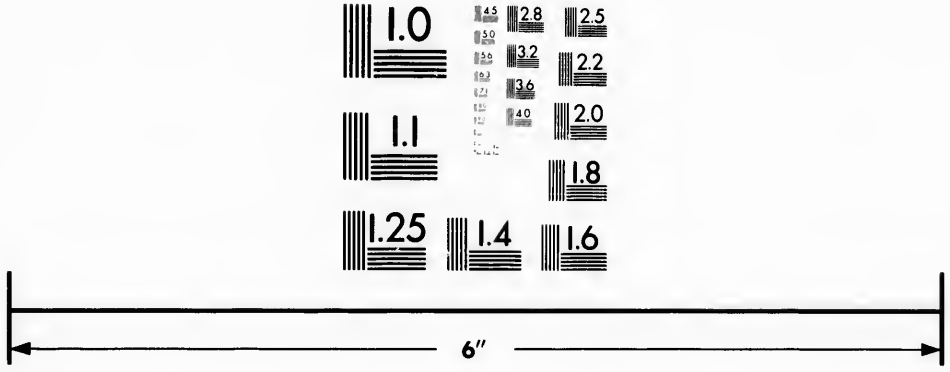

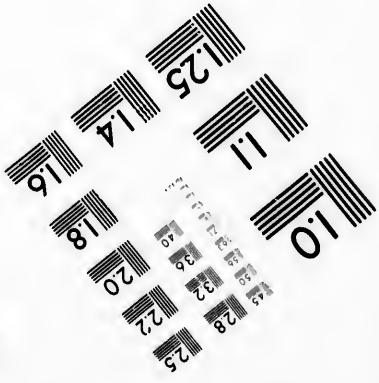

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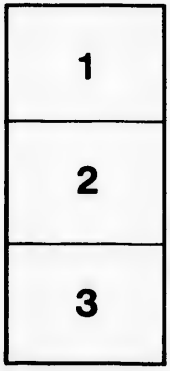

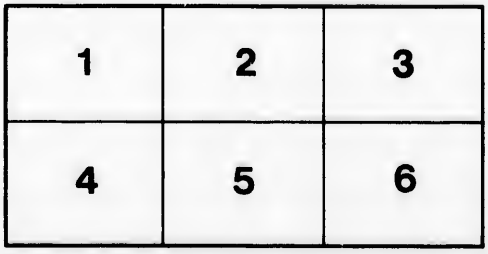

SELKIRK

STONY RECORDS,

—OR—

Lessons + from + a + Limestone + Quarry.

LECTURE

DELIVERED IN CONNECTION WITH THE

YOUNG PEOPLE'S ASSOCIATION

—OF—

KNOX CHURCH, WINNIPEG.

MARCH 10th, 1884, BY

J. HOYES PANTON, M. A.

Winnipeg:
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1884
(21)

OUR GEOLOGY.

Interesting Geological Facts Relating to the Red River District.

LESSONS FROM A QUARRY.

The following interesting and instructive lecture on the above subject was delivered by Mr. Panton before the Young People's Association of Knox Church on Tuesday evening, 11th inst. The lecturer said:

Having consented to give a lecture in connection with the Young People's Association of Knox Church, I am about to undertake the duty which that promise incurred. The selection of a subject is one of the difficulties I met at the very outset of this task. However, as scientific problems command much attention in the present age, I considered a few words about something in that department of knowledge would not be without interest to the members of the association and others present on this occasion. To some geology presents itself as a study made up of unpronounciable names only understood by those who have had special training in scientific study. This is a mistaken notion, and I hope that I shall be able to show you that geology at least presents many attractions to any one who is ready to exercise his observation upon the objects connected with it around him.

On this account I ask my hearers to bear with me while I examine the stones of a quarry a short distance from Winnipeg, and endeavor to gather some lessons from the revelations we shall glean from them. In order that my remarks upon the rocks at Selkirk may be more readily understood permit me at the outset to state some general truths recognized in geology.

These remembered will assist greatly the proper consideration of the rocks.

FIVE IMPORTANT FACTS IN GEOLOGY.

1. Rocks may be divided into three principal divisions eruptive, metamorphic and aqueous.

The eruptive, sometimes spoken of as igneous referring to their origin. They do not occur in true strata but in the form of irregular masses, never showing marks of a sedimentary origin and never containing remains of animals or plants. They are often crystalline and show marks of their being of igneous origin. In this group we find the granites, traps, lavas, and serpentines.

Metamorphic.—The rocks of this class are also more or less crystalline, but usually show a stratified structure. They seem to have been deposited in layers and afterwards to have undergone a great change, likely through the influence of heat, pressure, and moisture. In this group we find gneiss, (much the same in composition as granite, but the minerals in layers) mica, talc, slate, crystalline, limestone. Nearly all of the rock mineral east of us in the vicinity of Rat Portage, and extending hundreds of miles northwest and southeastare metamorphic, also many of the boulders scattered throughout the northwest belong to this class.

Aqueous, sometimes called sedimentary.—The rocks of this division make up by far the greater portion of the earth's surface. They have been formed by the agency of water, as we see deposits now forming beneath the sea from materials derived from the shore and hardened by agencies which time will not permit me to describe. These sedimentary or aqueous rocks are characterized by always occurring in beds or strata, and often containing remains of animals or plants in the form of fossils.

Any rock or fragment comes under one of these classes.

2. The rocks of the earth's crust are usually in layers, which in many cases, as already mentioned in connection with the aqueous, have been formed at the bottom of a body of water, so that where we see rock now there likely was water, and where water is at the present time may have been dry land.

3. These layers, which compose the

earth's crust are grouped into various divisions, the names of which are often taken from the locality where the rock is largely represented. This is exemplified in such names as Devonian, Silurian and Cambrian divisions. It is usual to apply the term age to the most comprehensive divisions, hence we have Azoic, Palæozoic, Mesozoic, Cenozoic, and Anthropozoic ages, names based upon the condition of life at the time. The name system is applied to less comprehensive groups, as Laurentian, Cambrian, Silurian, Devonian, etc., systems names derived chiefly from the places where these occur. The smaller divisions are groups, formations, series and strata.

4. These divisions have their characteristic fossils, which serve at once to identify the age or system to which the rock belongs. Consequently if fossils are present the age of the deposit is readily determined.

5. An important fact concerning the layers of rock is that they always occupy the same position relative to each other. For example, if we represent the series of rocks by 1, 2, 3, 4, etc., the lower numbers occupying the lower position. We never find 3 below 2 or 8 below 5. Remembering this, it will be easily understood that as soon as we obtain a few characteristic fossils we can with considerable certainty make out the position of the rock in the geological series.

Supplied with these five facts regarding the rocks which make up the earth's crust, we shall proceed to the consideration of the out-crop found at Selkirk.

SELKIRK QUARRY.

The exposure from which the data placed before you this evening has been derived is situated a short distance from the Selkirk station on the south side of Cook's Creek and east of the track. At this place Major Bowle's quarry is found. Here an excellent exposure of limestone occurs. The stone is of a greyish white color, and effervesces strongly on treatment with cold acid in striking contrast with Stony Mountain limestone, which remains unaffected under similar treatment, but readily acted upon if the acid is heated. When burnt the Selkirk stone produces a white variety of lime. A moment's examination reveals that the rock material is in layers, that the stone is not crystalline, and that remains of animals are embedded in it. With these data before us, we at once conclude that the rocks are of aqueous origin; hence belong to the division called Aqueous, Sedimentary or Stratified rocks.

Before examining the rock in position, or the innumerable fragments lying around, for the purpose of determining the system to which these rocks belong, let us observe some superficial characters worthy our consideration.

APPEARANCE OF THE QUARRY.

The earth over the quarry appears like a mound which might attract the notice of a devotee in search of Indian relics, leading him to think something of archæological interest lay beneath. Examining the position of the elevated ridge which has been dug into by quarrymen you will at once perceive that the strata on the east side of the quarry is quite horizontal, while that on the west is very much inclined, dipping westward at an angle of 30°, and down the centre there appears a distinct break with the fissure several feet wide, filled up with loose rock material. This is very observable in the southern part of the quarry, and it certainly shows that at some time this place has experienced an upheaval from some subterranean force. This convulsion likely occurred after the "glacial period," because the deposits of that time also show a disturbed appearance, which could only have occurred after the glacial deposit had been laid down.

GLACIAL PERIOD.

I would fain say something about that wonderful period put down as extending over a period of 160,000 years, when this great continent was ground over by an immense glacier, or river of ice, wending its way southward, which, as a warm climate, was heralded in by milder days, gradually receded northward, and the southern districts became freed from its icy grasp. For a lengthened period the unmelted portion formed a barrier to our Red River and forced it to empty south by the Mississippi.

A LAKE COVERS RED RIVER VALLEY.

During these days a nameless lake of great magnitude covered the Red River Valley and along its bottom settled rich alluvial deposits derived from the regions through which rivers emptying into it passed. At last the great ice dam passed away, melting under the influence of a warm climate and the waters of the great lake found an outlet to the north through Hudson's Bay. The lake disappeared leaving us a good heritage, the fertile valley traversed by a river whose waters

flowing in an opposite direction mingle with the waters of the north.

But my work is with the stones of the quarry and to these I must direct your attention rather than the enhancing story of that icy age.

Having gathered up a number of the fragments lying on every side at the quarry, and examined carefully the rock in situ, we observe that innumerable remains of primeval life are readily obtained and that these traces of early life are chiefly the remains of corals, cuttlefish, a few shells and some crablike creatures as are represented on the diagrams before you. When we compare these with the characteristic forms of life found in the different layers of the earth's crust we at once discover that they belong to what is known as the silurian system.

SELKIRK ROCK SILURIAN.

Consequently here at Selkirk the greyish limestone, comparatively soft, capable of yielding very white lime and readily cut into ornamental stone for building purposes is of aqueous origin (once the floor of an ocean) and rich in traces of life peculiar to rocks of the silurian system. Now turning to our diagram we observe that this layer of rocks occupies the 4th place in the geological series while the loose deposits above the rock belong to the 11th and 12th systems.

The question which naturally presents itself is what has become of the intervening strata represented by the 5th to the 10th systems? These are found in other parts of the world. Their absence is accounted for as follows :—

ABSENCE OF ROCK FORMATIONS ACCOUNTED FOR.

1. The locality may have been raised above the sea at the close of the Silurian period, and continued so while other places were submerged and in a position to receive further additions to their state. We must remember that before a stratum of rock can be formed, that in most cases it is necessary that the place upon which it is deposited be beneath a body of water, especially when the rock contains the remains of marine organisms.

2. The deposits may have been formed and afterwards were worn away by long periods of time. But we can scarcely imagine whole series of rocks, so completely swept out of existence as not to leave a vestige of them.

3. Some have thought that the place may have been located in deep water and situated beyond the reach of deposits being added, while they were forming nearer the shore, where rocks are more rapidly formed by the action of the sea upon the coast. One thing is certain, that after the formation of the Silurian deposits found at Selkirk, there was a great break in the formation of rock in this part of the Dominion. In other parts we find that formations thousands of feet in thickness were deposited, while the banks of the Red River remained the same. Rocks of later date are represented elsewhere, while here not a trace of them is found. Throughout the formation of the Red sandstone system, our strata appears to have received no additions. During the great coal-forming period, nothing seems to have been added to the Selkirk layers. The period of chalk-building passed away, still those at Selkirk appear to have not been increased. Whole series of rocks thousands of feet in thickness were built up and great periods of time passed away during which the deposits of this quarry lay above and beyond the influence of the sea. But when the glacial and past glacial times appear the limestones of Selkirk received a covering.

GEOLOGICAL HORIZON OF SELKIRK QUARRY.

As already observed fossils are quite numerous in the quarry, confined to comparatively few orders and characteristic of several formations found in the Silurian system. We have no hesitation in considering these rocks as Silurian but there is some difficulty in assigning them to the respective formations of that system hitherto they have been placed among the lower Silurian, (Trenton formation) but the fossils found in the quarry last summer would seem to indicate a higher geological horizon and it is likely further examination will show that this outcrop contains strata of upper Silurian as well as lower.

Before entering upon a description of some of the most common and important fossils found at Selkirk, I shall endeavor to explain fully what is meant by a fossil, how they are formed and the inferences we can conclude from their presence in rock.

FOSSIL DEFINED.

A fossil may be defined as "any body or the traces of the existence of any body whether animal or vegetable which has been buried in the earth by natural causes," or the relics of plants or animals imbedded in rocks. They may be formed as follows :—

FORMATION OF FOSSILS.

1. The body of the animal or the plant or only a portion may be imbedded without further change. This is the simplest form, and fossils of this kind are comparatively recent.

2. Casts or moulds of the body may be made. This will occur under circumstances like the following: The animal becomes entombed in a deposit. In the course of time it decomposes and passes entirely away. The space once occupied by it, now empty, fills up with infiltrating material, such as lime compounds or other substance soluble in water. There will now be a perfect cast of the body, which will be revealed when the rock is broken up. If no infiltrating material reaches the cavity then a mould of the object is left. This mode of fossil formation frequently occurs with remains of shells, of which, in some rocks, excellent casts and moulds of the shells are found.

3. Replacement is one of the mostcommon ways in which fossils are formed, and gives rise to the most perfect forms we obtain. As in the preceding mode the body is imbedded in a deposit, but as particle by particle is removed while decomposition of the object is taking place they are replaced by infilitrating substances, which may be compounds of lime, iron, or silica in solution. Finally the organism is completely replaced and a fossil results which is a perfect representation of the entombed object. So perfect is this process that the very structure of the eye is retained. Some of our petrified wood from the west has been replaced by siliceous material so completely that the structure of the rings of growth and medullary rays are preserved.

Many springs at the present time contain these infiltrating compounds to such an extent that objects placed in them soon become petrified.

4. Impressions, such as tracks, rain-drop marks, etc., also may be considered as fossils indicating the former presence of their cause. These are preserved as follows: Imagine a muddy flat, bordering and partially under the sea, especially at high water, but bare when the tide recedes. At low tide a large portion of it will be exposed for at least six hours, and some of it for twelve. During the time of exposure birds and other animals may walk over it, leaving distinct foot-prints upon the soft mud. A heavy shower of rain would no doubt leave innumerable markings of the rain-drops. If all this should occur at a time followed by some hours of strong sunshine, we can easily imagine that the mud would harden so as to retain the footprints. With the returning tide the whole is covered with another coating of silt-like material. This process continues as often as the tide ebbs and flows, but sometimes more effectively than others. After a time the bed solidifies through the influence of pressure, heat, or the presence of hardening compounds within it, and a hard compact rock results. This, many years after, when the place has undergone some geological changes, becomes an exposure of rock, like our Selkirk quarry of to-day. Its layers are readily distinguished, and when split up the footprints of the birds that waded along the tidal shore long periods of time before, are observed. This mode of forming traces of footprints is well illustrated by the flats along the Bay of Fundy.

The formation of all fossils can be accounted for in some of the four ways described. We now proceed to observe what may be inferred from a fossil.

INFERENCES FROM FOSSILS—AGE.

1. The age of the deposit:—Each age, system, group or formation has fossils which are peculiar to it. If these characteristic fossils are known we can at once infer the age. A good illustration is afforded in the quarry under consideration. The fossils found in it are peculiar to the Silurian system. The trilobites are found in no strata higher than the subcarboniferous, consequently the discovery of one of these interesting relics enables us at once to infer that the rocks in which it has been found are below the carboniferous, and that true coal cannot be found in a region whore such rocks occur near the surface. It is on this account that the trilobite is an important fossil in identifying the relative position of certain beds to coal-bearing strata which are always above formations in which these fossils are found. certain fossils found in the Northwest are common to the cretaceous rocks elsewhere, hence we at once conclude that the deposits west of us, where these are found, belong to the cretaceous system although we find no chalk as in England where that substance is common among these deposits.

Early geologists were inclined to name systems from their mineral characters rather than the fossils which they contained. But fossils are now considered

as the most important factors in determing the age of rocks.

NATURE.

2. Nature of the deposit. All animals have a particular habit, a place adapted to their habits of life. It may be in the sea, river, lake, deep or shallow water, consequently if we know the mode of life led by the animals we can form a conclusion regarding the nature of the deposit. The fossils we find at Selkirk are the remains of animals which are now represented by such as are found only in salt water, comparatively shallow and of warm temperature. Knowing this, as we examine the different species of coral found in the quarry, our minds revert to a time when a great sea must have covered this region, the waters of which had a temperature the same as those in which corals flourish now. Some of our northwest fossils indicate that they flourish in brackish water something like what is found in the Gulf of St. Lawrence and other places where fresh and salt water mix. Thus you can perceive how readily the nature of the deposits can be made out by knowing the habits of the creatures which have been entombed within them.

CLIMATE

Climate can be fairly inferred from fossils. The presence of coral furnishes an excellent example of this. These animals can exist only in water with a mean temperature of 66°. To maintain such the climate of a country must be tropical, at least semi-tropical, such as where corals are found at the present time.

Their presence in Selkirk becomes of great interest reminding us of the pleasant climate once common to the Northwest, when balmy breezes swept over the country and blizzards were unknown.

Further, the plants of the carboniferous period recall a time when gigantic club mosses, immense ferns, and other forms of flowerless plants flourished in a warm climate and moist atmosphere supplying the conditions necessary for such luxuriant growth as seems to have been common in the days when the carboniferous flora was in existence. On account of the immense coal fields in America, some have thought the American continent of those days had a more moist climate than Europe, and some have even thought the atmosphere of carboniferous times was highly charged with carbonic acid, a compound very important to plant life. You can, without further illustration, perceive that much can be inferred regarding the past climate of a country the rocks of which contain the remains of the organisms which flourished at that time.

SELKIRK FOSSILS.

We shall now proceed to consider some of the fossils found in Selkirk quarry.

1. A few are readily recognized as the remains of shells some of which show considerable resemblance to the common whelk of our present seas. I have here an excellent specimen of this kind, it is fully three inches long and shows four distinct whorls. Others are more symmetrical in appearance and though the shell had two valves still they are quite different from the bivalve shells of modern seas. They are members of a great family (Brachiopoda) which thronged the Silurian seas but are now represented by comparatively few forms. A chief characteristic of these animals was a pair of long fleshy "arms" covered with delicate cilia. By far the most interesting fossils among the remains of shells is an immense one about 9 inches in diameter with three well defined whorls, one side is perfectly flat the other convex four inches through the thickest part. The nature of the creature which occupied this large shell is not well understood. The family having passed out of existence long before our modern seas were formed. I have found another of this group, but it is not so large. Several distinguished scientists have seen this large form and pronounce it the largest they have ever examined. Further examination of Selkirk rock may furnish us with still more complete specimens, from which something may be gathered that will give more light regarding the nature of this peculiar type.

2. Another comparatively large fossil obtained last summer appears to be made up of a series of thin layers, each about twice the thickness of note paper. These are arranged in a wave-like manner. At the summit of each crest there seems to have been an opening around which the layers are arranged in concentric rings. This specimen is five inches in length, four in width and two in thickness. It is not complete but it shows the structure very distinctly.

Several fragments of the same nature were found. This peculiar fossil is the remains of an animal which is of doubtful nature. By some it has been considered a sponge, by others as allied to animals (Foraminefera) which have assisted largely in the formation of chalk.

3. There is an exceedingly common fossil in the Selkirk limestone which bears such a resemblance to the disc of a sunflower that it is not a matter of surprise that quarrymen should have called them "petrified sunflowers." Many excellent specimens of these can be seen in the stone brought to the city for building purposes. Some of them are ten inches in diameter and about one inch thick, perfectly round with a slight depression in the centre on one side, and slightly convex on the other. The whole surface presents a checked appearance, like the seeds in a sunflower. When a vertical section is examined it appears composed of innumerable rods about the thickness of ordinary wire. This peculiar fossil also occupies a very doubtful position in the scale of life. It has been referred to the sponges, corals and even plants.

Owing to it being found in the vicinity of some lead bearing rocks, it has been called "lead coral."

CORALS.

4. By far the most common fossils in this locality are representatives of the coral family, embracing several species. One very beautiful form is the "chain coral.' It appears like a mass of small chains thrown together. Some very fine specimens of this kind have been found which show very distinctly the structure of a vertical section. One specimen weighed over twenty pounds. Another common coral presents a star-like appearance on the surface, and in some respects resembles the "honeycomb coral" of other formations.

This species occurs in comparatively large masses, and in some cases interferes with the successful "dressing" of the stone. Another variety of coral, not so common as the preceding, bears some resemblance to a horn, varying from two to six inches in length, two inches thick, and tapering to a point, and having a slight curve. These are the "petrified horns" of the quarry. Together with the preceding some two or three other forms of coral life are found in Selkirk quarry, a place where there seems to have been a sort of coral reef at one time on which these tiny organisms toiled in the waters of a warm sea, forming rock to be quarried by man when the genial climate was replaced by the cold northern blizzards which now sweep over the same place with a temperature forty to fifty degrees below zero.

CUTTLE-FISH.

5. Almost as common as the corals are the innumerable fossil remains of representatives of the cuttle-fish family. Several species are found, some of which are large—three to four feet in length. Most of these are readily recognized by a series of rings. These are the fossil segments of the animals' body. In some the rings are not more than one quarter inch in thickness, in others much thicker. The animals lived in shells consisting of many chambers, the last being occupied by the animal. They likely sported in the water near the shore, and thus became embedded in the coral reef. On examination of one of these fossils you will frequently find a rod-like structure passing through the centre of the segments. This is often the only remains you find of the animal, and must not be considered as the whole. Some of these structures are two inches in diameter, with a more or less beaded appearance, bearing a close resemblance to a piece of turned wood.

ANIMALS ALLIED TO CRABS.

6. As yet only the fragments of trilobites have been found in this quarry. But there is no doubt further investigation will be rewarded by more complete forms. The trilobite is one of the most complete fossils found. Some look very much like the "king-crab," exceedingly common in the vicinity of Portland, Maine. The shell-like covering is usually trilobed, hence the name applied to the class. The eyes were compound, like those of insects, and are most excellently preserved in one of the specimens found at Selkirk. The body of the trilobite is composed of a series of separate rings or segments varying in number in different genera. Sometimes these fossils are found in a rolled up condition, a form which the animal was able to assume, likely to enable it to sink with greater rapidity into deeper water during moments of danger. The well developed nature of the eyes in these crab-like creatures indicates that at this early period in the earth's history there was light. Some fossils of this class have been found which measured a foot in length. The largest I have found in Selkirk rock seems to have been the fragment of one five inches in length.

Besides these fossils grouped in the six divisions above, there have been found a few others of a more or less doubtful form, chiefly fragments which I am not in a position to describe but which after a more thorough examination of these

rocks than I had an opportunity of doing last summer, I hope to obtain much additional data that will assist largely in determining the position of the Selkirk exposure in the geological series of rocks.

I have no doubt but many interesting fossils will be obtained and complete forms secured, of which I have as yet been able to find only fragments.

All these peculiar remains to which reference has been made are traces of primeval life that occupied the waters of an ocean which once covered this part of the world.

These animals were among the leadin tvpes then in existence, for at that period in creation none of the higher animals (those with a backbone) had as yet made their appearance. Life was confined to the sea, and was of a rudimentary nature. It was a time of great stillness, for the land was not yet fitted for terrestrial life. No sound was heard but the lashing of the waves along the lonely shores, or the winds sweeping, unimpeded in their course across the bleak and solitary rocks. The continent, like its species, was submarine. It was outlined, but not until long periods had passed, during which great physical disturbances took place, was the present form brought into existence. Taking the data collected from this somewhat obscure quarry and reflecting upon the changes which must have taken place since these animals existed, and how these changes have likely been brought about, the fragmentary records of the quarry become a source of intense interest and constant food to a contemplative mind.

CHARACTERISTICS OF SILURIAN ROCKS IN GENERAL.

As already observed, the stratified nature of the rock, its comparatively soft condition in contrast with crystalline rocks and sedimentary origin, for no doubt it was formed beneath water as sediments are accumulating in our modern seas, place the limestones of this quarry under the division Aqueous rocks. The presence of innumerable fossils characteristic of Silurian rocks indicates the rock as belonging to the Silurian system.

This name was given by geologists because the rocks of this class abounded in the western part of England, once occupied by the Silures, a tribe of Britons. The name, like many in geology, is misleading, for there are many places now known both in the United States and in Canada where these rocks are very common.

An examination of the Silurian rocks wherever they have been found, shows that the life of the period was limited in species but exceedingly prolific in individuals. The trilobites already referred to seem to have thronged the seas in some parts. Their remains are very numerous, and we know that a great number of bodies are never preserved in a fossil state, for the conditions necessary to their formation are absent. Besides corals, cuttlefish and shells, there were peculiar organisms not yet found at Selkirk in these early seas, allied to the starfish family. They are sometimes called sea lilies. Placed on a stalk and attached to the sea bottom they presented a flower-like appearance. We seldom find the top or animal proper, but the stems are very common, varying from an eighth to one inch in diameter, and over a foot in length. Another fossil found elsewhere in these rocks is something like the appearance of a tiny saw. In Europe fish have been found at the summit of the Silurian rocks. The deposits were evidently laid down in comparatively shallow seas, with rocks rising here and there above the water, but yet unfitted for animal life.

Besides the interest which a consideration of the stone in Selkirk quarry gives us regarding its nature and formation, it becomes instructive when we view the quarry with regard to the bearing of its fossils upon the theory of evolution.

THEORY OF EVOLUTION.

This theory has commanded, and is now attracting, a great deal of attention, and has its conclusions defended by some master minds. The data in its favor has been arranged with great skill, and the arguments so cleverly presented that many are inclined to accept it before it has passed beyond the region of an hypothesis. Some of our citizens had an opportunity last summer of hearing one of the ablest teachers of the day take the platform in defence of what he himself styled a glorious guess at hidden truth. In the course of his remarks he laid great stress upon what is revealed to us when we consult the geological records regarding the development of life upon the globe.

As a fitting conclusion to my remarks upon Selkirk quarry, I shall present to you some of the information we gather from these rocks, as it bears upon this question. The advocates of this theory tell us that it is not between man and the monkey we must seek a connecting link, for they are the descendants

of some common form which we cannot expect to find in the life as it exists upon the globe, but we must turn to the imperfect records in the rocks, and that as they have been but little explored, we need not be surprised if that primordial form has not yet been disentombed.

As already remarked, the Silurian rocks occupy a comparatively low place in the geological scale, viz.:—the 4th, the first of the series, has no fossils. There has been found something in them which by some is considered a fossil, but it is questioned by others, so that we may say that these rocks have none, or but imperfect traces of past life. The second is also without fossils. In the third there is only a comparatively small number, but in the fourth, the Silurian, a great outburst of life breaks in upon us, there being as many as 9,000 species discovered. Now what I wish to impress on your minds is the development of animal life at this early stage in the world's history. In order that you may understand it clearly it is necessary to remind you that animal life is divided into six sub-kingdoms:

1. Embracing minute forms of life chiefly microscopic and very rudimentary in their structure.

2. Corals and allied types more highly developed than the preceding but without a heart, and many without a nervous system.

3. Starfish, sea urchins, etc. A distinct nervous system, a circulatory system but not segmentation of the body.

4. Crabs, insects, spiders, etc. Among these the body has definite segments, well defined limbs in many, and good nervous system.

5. Mollusks (snails, oysters and cuttlefishes) generally a shell covers the soft bodies, distinct heart and breathing organ, and a highly developed digestive system.

6. Animals with a backbone and the most highly organized.

We shall examine some of our fossil forms with reference to their position in the scale of life.

EVIDENCE AGAINST THE THEORY.

1. Among our fossils we find the trilobite, a member of a very unique family found in the 4th sub kingdom, and allied to the crabs. It appears to have had a well developed eye, and yet we find it at the beginning of the records, even in rocks formed long before the Silurian.

These creatures do not seem to have developed much, if any, higher than in the Selkirk rocks, for they pass out of existence at the commencement of the 5th system. It is somewhat surprising to find a family of creatures comparatively well organized, appear in such great numbers almost suddenly and almost as quickly end their career.

2. Another fossil of interest in the Selkirk limestone in connection with the theory of evolution, is the cuttlefish. These creatures were very numerous on the Silurian seas, already several species have been found in our rocks, some several feet in length. I wish you to bear in mind how low we are in the line of stratified rocks and at the same time to remember that the cuttlefish not only occupies the highest position in the scale of life, as represented in the 5th sub-kingdom, but also that in some cases they are very near the 6th division.

The cuttlefish has a brain enclosed in cranium; further it has special ganglia, nerve structures set apart for the purpose of giving origin to the nerves of sight, just as we see in the higher animals. Does this not seem surprising that at such an early period in rock formation, life should attain such development? The Silurian rocks do not seem to teach us that the progressive march of life is indicated by a series of connecting links.

3. At Selkirk we have not found traces of plant life, but elsewhere some comparatively few have been obtained allied to the seaweed. But in the next system of rocks (Devonian) there is a marvellous outburst of plant life, huge plants allied to the Equisetum (horse tails) of our own day, gigantic clubmosses, some attaining almost one hundred feet in length, are found in these rocks. Besides these innumerable ferns embracing a great many species.

This wonderful flora breaks suddenly upon us, and side by side with it coniferous plants allied to our pines and firs are found. Here no transitional types appear to be present. The flora of the 5th system seems to be unheralded by primitive types. When we consider the comparatively well developed condition of animal life as represented in the Silurian rocks, occupying a low place in the geological series of rocks with an almost total absence of plant life, followed by a wonderful flora in the Devonian system, it does seem to afford a barrier for a time at least to the adoption of a view which would lead us to believe

that the development of life as read from the rocks is demonstrated to have been regular and onward, that the progress of life has been slow but upward, and that where transitional forms are wanting it is owing to our ignorance of the geological records.

Another instructive thing we gather from a consideration of the rocks of Selkirk is observed when we compare the life represented in them and that of the succeeding age. The Silurian system occupies a place in the second age (the rocks are grouped into five ages).

In the first where the rocks contain very few if any traces of life they are 30,000 feet thick. The second in which the Silurian rocks are found contains 53,000. The third age has only some 10,000 feet of solid rock and yet in this age the least in thickness, the most marvellous forms of life that ever appeared upon the globe are found. Here is where the wonderful reptiles flourished, the gigantic saurians of past time—animals the size of which surpasses anything we have in existence belonging to the same families. Flying reptiles, whose wings expanded twenty feet. Reptiles, whose steps, as found in the rocks, indicate a stride of five feet, as they wandered over the muddy flats of tidal shores. The Ichthyosaurus and plesiosaurus fought their battles in the seas of this age. Gigantic saurians nearly 100 feet in length, sported on the banks of nameless rivers It was in very truth the "Age of Reptiles." Eight hundred species of cuttle-fish thronged the seas of this age. The sea, air and earth had each its species. Life was common and represented by huge forms. This flashes upon us in the smallest of the records in striking contrast to the comparatively limited representation in the largest. Unwearying research will require to be undergone through long periods of time before the great hiatus is filled up between the life of these two ages.

SCIENCE ATTRACTIVE.

In conclusion, I think enough has been said to show that a quarry is a place of more than ordinary interest when we endeavor to glean something from its stony layers which lie like so many leaves above each other, each, if properly read, revealing some history regarding the early condition of our globe. The knowledge requisite for such intelligent examination is within the grasp of all. Reading, with some degree of thoughtful study, will attain it, and once secured, such knowledge will prove a lasting source of pleasure.

It was from amongst the rocks immediately overlying those which have been occupying our attention to-night that one of the brightest intellects of Scotland fought his way up from wielding a stonemason's hammer to become the author of some of the most eloquent descriptive books ever written. Thought and study did this for Hugh Miller, it will do the same for the members of this association. You are surrounded by a most inviting field for original research in the great Northwest, with its deep ravines cut hundreds of feet through deposits of the very systems which contain the remains of the gigantic reptiles already referred to. Very little is known of the prolific fields that surround us. Selkirk quarry is but one of innumerable outcrops along the Red River. I know of no more pleasant pastime that could be enjoyed by members of this association than that derived from a knowledge of some branch in the department of science. My object to-night in addressing you has been to show that much interest can be obtained from places where it might reasonably be thought there was none. If I have succeeded in interesting you with my remarks upon that quiet place on the banks of the Red River near Selkirk, and have in any way stirred up your minds to some activity so that you may snatch a few hours for contemplation and study from the many you are inclined to squander in an unhealthy atmosphere of mistaken pleasure, for I fear there are too many young men of to-day who scarcely know what reading is unless it be the time spent in a hasty perusal of a newspaper, or the reading of some idle tale poorly told. If, I repeat, I have placed a barrier to this wholesale useless expenditure of time by influencing your minds in the direction of study and research along the entrancing path of scientific study, I have been amply repaid for the time spent in the preparation of what I have said.