J. W. DAWSON.
PICTOU, N. S.

Pictou Literary and Scientific Society.

"With the starting of the Grammar School in Pictou, and the foundation of the Academy, the nineteenth century saw the beginning of the Pictou County renaissance; .... and we find in 1834 the foundation of the Pictou and Literary Society. .... The program included a weekly lecture by a member. J. D. B. Fraser and John W. Dawson, in the early years, contributed most valuable scientific papers.

The Society continued to prosper for many years. It did incalculable good in Pictou and Pictou County. It gave Sir J. W. Dawson his early opportunity to speak of his reading and early geological discoveries."

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Essays
on

Geology.

Read before the Picton Literary Society
March 1836

Those parts of the Earth beneath its surface, to which mankind have been able to penetrate, have in all ages been objects to which their attention has been particularly directed, both from a curiosity of knowing the structure of the globe, and from the utility of the minerals which they contained. It was not, however, till the 14 century, that any attempt was made to reduce the knowledge of these to scientific principles. At that period the attention of the learned in Europe, was directed to this subject, by the discovery of shells and bones imbedded in ~~the~~ rocks at the foot of the

the Asperines; and many curious opinions were entertained respecting their origin. One class of disputants maintained that these shells and bones never had belonged to animals, but were formed spontaneously in the rock in which they were found, by what they called "plastic force"; or a tendency in stones and clays to arrange themselves in certain definite forms. Others asserted that all those rocks which contain animal or vegetable remains, such as limestone, sandstone, and coal, were the residuum of the deluge. And others that they were all formed by the action of fire. These, and many other opinions just as remote from truth, were discussed for more than a century; and then, after much opposition, the principles which form the basis

of

of modern systems of geology were established. These are that the nature and arrangement of the crust of the earth, and the nature and relations, the order and relative ages of the various strata which constitute the crust, cannot be ascertained, not by comprehensive and profound speculation, but by a careful and patient investigation of the facts, which alone can be such as that which the essay I have to offer only aspires to be, a general outline of the first results of the geologic research.

These principles however are seen to be extremely obscure, and perhaps even in a short century such as that which we are about to offer, the masses of rocks, clay, sand, and other heterogeneous materials, heaped together without order or regularity. When however we examine the crust of the globe, in those places where it has been laid open by mines and other excavations, we

we discover that it is composed of a great number of layers of rock varying in thickness from a few inches to many hundred feet and each of which is by some peculiarity distinguished from those immediately adjoining it. These have been termed the Strata of the earth. Imbedded in the rocks belonging to these strata there ex an immense variety of remains of animals and vegetables which have existed in former ages of the world and belonging to species the far greater part of which have now no living representatives. They thus afford in characters which can never be obliterated a record of the animals and vegetables which have existed upon earth to a period far antecedent to the era of history. These fossils are called Organic Remains. And it is the investigation of the origin nature and ar-

rangement of the strata and the organic remains contained in them which is the province of Geology.

This science has often been confounded with mineralogy it will therefore be necessary to state the distinction between them. Mineralogy refers to the chemical composition and more minute peculiarities of rocks and earths and Geology to the general structure of the earth and to the positions in it occupied by the strata. This subject may therefore be ~~considered~~ divided into two parts 1st Those features which belong to all the strata of which the earth is composed and 2dly the order in which they occur ~~to~~ in the crust of the globe and the peculiarities which distinguish them from each other

If we dig into the earth after passing through the vegetable soil

we find sand and clay containing loose blocks of stone; and below these hard rocks in layers parrallel to each other. These are composed of very few materials the principal of which are Quartz or Flint Clay and Limestone but these are mingled in such a manner as to produce a considerable variety of combinations. They are also arranged in a certain determinate order which is never in any degree inverted. Thus if we suppose the strata to be represented by the letters of the Alphabet A being that nearest the surface and Z the lowest; rocks of the same kind as A are never found below Z or any of the intervening letters. The knowledge of this principle is of great advantage in mining thus if a person searching for coal discover upon the surface any

rock

rock known to be below it in the series he is certain that no coal exists there. The reverse of this however is no sure guide of information as it often happens that in particular places many steps in the series are wanting this is caused by the circumstances in which all the strata were originally formed, that is ~~that~~ the materials of which they are composed were washed by water from the land which existed at the period of their formation and deposited at the bottom of seas oceans and lakes It would thus happen that those parts which were nearest the land would consist of much coarser materials than that which had been in the ~~vicinity~~ centre. That all the stratified rocks were deposited by the action of water is one of the fundamental principles of Geology. and it is corroborated another cause is the different elevations and depressions to which the strata have been subject

by the appearances of the strata themselves as for example their containing pebbles having the appearance of having been long tossed about in the sea, immense quantities of shells corals which from their perfect state and the positions in which they are found ~~been~~ must have lived in the same places in which they are discovered and ~~from~~ logs of wood and blocks of stone with marine shell fish adhering to them

From this it is evident that they must have been deposited upon a foundation which was level or nearly so But at present they are found not level or in the bottom of the sea but upon dry land and inclined at different angles twisted and contorted and sometimes even in a vertical position and

it

it is to this disarrangement that we owe the greater part of the hills mountains and valleys with which the surface of the earth is diversified. The question thus arises how were these rocks elevated from the bottom of the ocean and from the level state to the position which they now occupy? and Geologists from a careful examination of the strata themselves and of the effects at present produced by volcanic agency have referred it to this cause. The correctness of this conclusion is proved by the existance of what are called

Unstratified Rocks.

These are not placed in layers like the others but are generally found in masses in columns or in upright walls called dikes. They contain no pebbles or organic remains, are very hard and many of them in their mineralogical structure

bear a striking resemblance to the lavas of modern volcanoes. The most common of these are granite whinstone and basalt. They are always found below the stratified except where they have protruded through them from beneath. Their positions and some of the disturbances to which strata are subject will be seen by a diagram. In No 1 (see page) A B & C represent unstratified rocks which have forced themselves through ~~the~~ strata lying above them A & B have sent out shoots or veins into the stratified rock and A & C after reaching the top have flowed over No 2 represents strata which have been thrusted by force from below while in a soft state. In No 3 the strata marked G have been driven through that marked H while that marked I has been formed after the distur-

bance took place. Though the diagram is imaginary cases nearly resembling it are often found in nature as will be seen from a section of part of the Coast of England In N° I the unstratified rocks marked A have placed the strata B in a ~~horizontal~~ vertical position. and in No II the stratum C and unstratified rock d have forced the coal bed E in to a curve and G are the remains of strata which have been formed after the disturbance took place but have been subsequently washed away.

From such facts as these it is evident that the unstratified rocks were forcibly ejected from the earth in a melted state. This is rendered still more certain by the effects which they have produced in the strata through which they have passed Thus where they have passed

sed through coal they have converted it into a substance resembling coke and where they have passed through chalk it has become as hard as marble
Since therefore these unstratified rocks have been thus ejected and in almost every case where elevation of strata has been observable it has been produced by them we may fairly conclude that all the strata were elevated by the same cause. It is however proved by the appearance of the strata themselves that they were elevated from the seat in small portions and at far distant periods This accounts for some of the oldest strata appearing on the surface ~~while~~ at one place while at another not far distant ~~far~~ ~~more~~ much recent strata may occur. As for example

some

of slate belonging to the oldest strata being found at the head of the East and Middle Rivers while at the Albion mines the coal which is far more recent occurs. Having thus given a short sketch of the general features of the strata the next point is the Order in which they occur in the crust of the Earth and the peculiarities by which they are distinguished In classing the strata Geologists found that the lowest or most ancient division of rocks with which they were acquainted contained no pebbles or organic remains This therefore they called the Primary Strata Above this was another class which did contain organic remains but these belonged to species of animals which are now extinct This they called the Secondary strata. Another class

yet

more recent was also discovered containing some remains of animals and plants of the same species which now exist. This they called the Tertiary strata. And the accumulation of sand clay and loose stone immediately below the vegetable soil was called Deluvium Each of these divisions I shall therefore consider in their order beginning with the

Primary Strata.

These rocks contain no organic remains or pebbles. This however does not prove that these never existed in them as as many of the rocks composing them appear to have been melted and all of them have been subjected to immense pressure They consist principally of limestone flint slate granite and other hard rocks ~~and~~ they contain all the metals except mercury and many of

the finest beds of Statuary Marble The granite rocks on the southern coast of Nova Scotia belong to this class. The next general division is

The Secondary Strata

These contains a great variety of rocks formed from those parts of the more ancient strata which at the period of their formation were elevated above the level of the sea and exposed to the action of the elements. They have been subdivided into a number of groups each of which contains many beds of rock.

The first and lowest of these is the Graywacke Group.— In this occur the first signs of animal life in the shape of a small species of shell-fish called Trilobites and a few corals. No remains of any terrestrial animals have been found in this and some of the strata above it and from this circumstance many geologists have concluded that at the pe-

riod when they were formed the whole earth was covered with water. This however is unfounded as we know that at present notwithstanding the numbers of animals in existence the bones of very few are deposited in the body of the ocean and as all the strata were formed in the bottom of the sea the same will apply to them

To this group the clay slate upon which the town of Halifax is built and which extends along the head of the East and Middle rivers and occurs in Antigonish is supposed to belong and in it are the beds of iron ore on the east river. Above this is the Old Red Sandstone. This is principally composed of the course red sandstone from which it derives its name and which derives its colour from the oxide of Iron. It contains many beds of water-worn pebbles but few organic remains

next above this is the Mountain Limestone.— This rock is very plentiful it contains veins of spar and in many places is wholly composed of shells and corals. Joplin contains valuable mines of lead It underlies the Pictou coal-field. The next group is the Coal Measures.— This is one of the most important of the strata. it does not consist entirely of coal but is interstratified with many beds of sandstone and shale often containing iron. The coal itself is entirely composed of vegetable matter which does not however as has sometimes been supposed grow in the ground but is the remains of forests which have grown upon the earth in former ages but from the pressure to which it has been subjected it has been reduced to an undistinguishable mass in which however traces of leaves and other remains

yet exist

and which when chemically analysed is found to consist of the same materials as wood. Coal beds are at present forming in many places particularly at the mouths of great rivers where the vegetable matter washed down at one time and the sand and mud at another may produce the same alternations which are observed in the ancient coal measures.

One of the most curious facts with respect to the coal strata is that at the period of their formation the climates of Europe and America even in their most northern latitudes were as warm as those of tropical countries are at present This is proved by the palm trees, tree ferns and other productions of warm latitudes which are found in them and which from their perfect state could

not

have been carried from any great distance. The coal also bears evidence of having been formed in straits between small islands and thus when ~~they~~ it was formed the greater part of the continents of Europe and America consisted of archipelagos similar to those of the Pacific ocean.

In coal beds are often found "faults or breaks in the strata ~~called~~ in which it often happens that one part ~~of the~~ ~~the~~ has been elevated above or depressed below the other. These faults frequently occur in the Pictou coal-field. The next is the

Red Marl group.– This is often of great thickness It is composed of beds of different kinds of sandstone limestone and muddy sediment and sometimes contains rock salt The red sandstone of river John belongs to this group and the salt springs at the head of the West River are

also supposed to belong to it. It is therefore probable that extensive beds of rock salt may exist at the salt springs. Among the organic remains found in this group are those of two gigantic species of marine animals called the

Ichthyosaurus and Plesiosaurus

The former of these is about 32 feet in length with a long snout and 60 teeth in each jaw and 4 fins resembling those of a whale. Like this animal it seems to have been formed for living in the waters of the ocean and to have been able to swim with great velocity. The latter is remarkable for the length of its neck which exceeds that of any other known animal having no less than 41 joints. It seems to have been adapted for living in shallow water

such

as the margins of rivers and lakes Both the Ichthiosaurus and plesiosaurus from the undigested bones found within their skeletons seem to have preyed upon fish and occasionally to have devoured the young of their own species. (d'ge'n)

Above the Red Marl is the Oolite Group.— This contains a great variety of sandstones and clay stones and a kind of limestone in oval blocks resembling eggs from which the group derives its name. There has been much disputing as to what could provide the material for this limestone; some have referred it to shells and corals and others to mineral springs. In this group are found the Ichthiosaurus and Plesiosaurus and ~~and~~ remains of a great number of curious reptiles, a few vegetables of kinds very

dif-

ferent from those now existing and great numbers of shellfish Of these latter one kind called the Ammonite of Cornu Ammonis is so abundant that beds of considerable thickness are formed of the shells of this species alone Above this is the

Chalk Group. – The greater part of this group consists of the well-known mineral from which it derives its name although in its lower parts there are extensive deposits of sandstone sand and clay. In its upper parts the chalk is mixed with flints and in its lower parts these are wanting The chalk belonging to the group has therefore been divided into Chalk with flints and chalk without flints This group appears to be entirely wanting in Nova Scotia. It

con-

contains many organic remains The vegetables ~~[illegible]~~ are principally marine but some terrestrial reptiles are also found. Having thus shortly noticed the groups which compose the secondary strata we must next consider the third great division or the

Tertiary Strata.

The existance of these strata was discovered by Cuvier who found that the city of Paris was built upon a kind of basin surrounded by chalk hills which had been gradually filled up with thick beds of sandstone clay and limestone more recent than the secondary strata and containing a few bones of animals belonging to species the same as now exist He therefore divided them into a separate group. Cuvier's discovery having directed the attention of other Geologists to these strata it was afterwards

found

that the valley of the Thames was a basin similar to that of Paris and subsequently that tertiary strata were found in different parts of Europe These strata are not like the secondary deposited continuously deposited over large tracts of country but are found in basins of comparatively small extent which seem at some period to have formed the beds of small lakes and inland seas (in which the tertiary strata were formed seas) Though this is the most recent of those rocks which may properly be termed stratified there is a group above it which as it contains an immense quantity of animal remains some of which do not differ in many respects from those now inhabiting the earth is worthy of notice. This is the accumulation of sand clay gravel and pebbles which lies immediately below the vegetable soil

It

It appears to consist of fragments which have been conveyed to their present position by water and from this many geologists have concluded that it is the residuum of the deluge. The organic remains which it contains are principally those of terrestrial animals; of these the principal is the Mammoth which seems to have been a large species of Elephant distinguished from those which at present exist by the superior curvature of its tusks and by its being covered with hair. A perfect specimen of this animal was found enclosed in an iceberg (where it had probably remained since the deluge) at the mouth of the river Lena in Siberia. Its flesh was so well preserved that dogs and wolves collected from all quarters to feed upon it. Another gigantic animal.

which is found in this formation is the Megatherium an animal about 17 feet long and 7 in height It appears to have nearly resembled the ant-eater or sloth and to have been a burrowing animal. Along with the bones of this animal was found parts of a large shell ~~which~~ resembling that of the armadillo and which seems to have belonged to the megatherium Many conjectures have been made as to what advantage an animal so large could have derived from a shell. Some have supposed that its use was to prevent the masses of earth which in burrowing must occasionally fall upon him from injuring his back; and others that it served as a protection from wild beasts.** In this group the principal deposits of such bones are in caverns

one of

of the principal of these is the Kirkdale cave in Yorkshire. In the bottom of which were found imbedded in hard mud the bones of the Elephant Rhinoceros. Hippopotamus, Hyaena, Tiger, Bear, Horse, Wolf, Fox, Weasel, Ox, Deer, Hare, Rabbit, Water-rat, Mouse, Raven, Pigeon, Lark, and Thrush. All these bones were gnawed and broken and from this it is supposed that the cave was in antedeluvian ages a den of hyaenas and that the other animals were dragged in to it as food. It thus appears that ~~it~~ Great Britain was at one time inhabited by animals which are now found only in intertropical regions. There are besides the Cave of Kirkdale many other caverns in Europe containing bones in yet greater abundance. From one in Italy a ship's load was carried to France to be employed in refining sugar for which purpose however they were found to be useless. and in one of

the valleys at the foot of the Alps the leg bones and ribs of Elephants were found in such abundance that the peasants used to employ them for building fences ~~This~~

I Have thus given a very brief account of the strata in their order beginning with the oldest before leaving them it must be remarked that the whole series never occurs in one place and that the very oldest are often seen on the surface of high mountains ~~thus~~ the Highlands of Scotland are almost wholly composed of the Primary Strata

From what has been said respecting the structure of the Earth it will be seen that no bones either of Monkeys or of Men have been found in the strata. And from this it is evident that these animals either did not exist in the most ancient periods of the Globe or

were confined to small limits. From this circumstance also and from the fact that in the more ancient strata only shell fish and other animals supposed to be of simple structure are discovered and as we reach the more modern groups we gradually find animals more complex in their structure. La Marck deduced the theory that at the creation only a few simple animals were formed and that these gradually improved themselves until a shellfish after passing through many gradations at length became a monkey an orran-outang and finally a man. An amusing refutation of this theory is given by Lyell also notices the custom of some of the natives of Sumatra who train monkeys to climb cocoa nut trees and throw down the nuts. and then asks how

these

these Indians after attempting in vain to climb the trees upon the original shape and not acquire the long arms and feet ~~with fingers and thumbs~~ like the monkeys instead of being obliged to tame the meheyile animals. It is also proved by the appearance of the strata that at the period of their formation the Northern parts of Europe ~~and~~ America enjoyed a climate as warm as that of tropical countries at the present day, and that this heat gradually decreased. To account for this many theories have been advanced as for example that the poles of the Earth had changed their position and that the Earth was created red hot and had been gradually cooling. These however are utterly at variance with the common course of nature and therefore extremely improbable. There is one opinion however first brought forward

ward by Mr Lyell which is very probable and generally believed That the warmth of the Earth ~~every~~ at the time when the strata were formed may be accounted for by the different positions of the Great Continents of the Globe. That this is capable of producing these effects may be seen from the comparative heat of Europe and America The former in corresponding latitudes is the warmest and this because it is separated from the arctic icy cold water while America stretches to the very pole. If then the great continents of the world were situated nearer the Equator than they are at present they themselves would be warmer than they are at present and also the warmth of the whole globe would be increased Another proof of this is that the coal-

coal-measures and others of the secondary strata of Europe and North America seem to have been formed among small Islands and therefore if there were then any great continents they must have been in different positions from those occupied by those now existing

Another and more interesting part of Geology is the consideration of the question whether the causes at present acting upon earth are capable of producing the stratified rocks which exist in the crust of the globe and what strata are at present forming All stratified rocks must be formed from substances existing previous to their formation. Those causes therefore which produce strata must be such as either abstract matter from the interior of

the

earth and deposit it on its surface or ~~[illegible]~~ wash earth and other substances from the land into the sea. These may be included under the heads of Springs, rivers, coral formations, tides and currents earthquakes and volcanoes.

1. Springs.— The causes of springs were fully explained in the lecture on Hydrostatics lately delivered before the society It will therefore be necessary only to consider their effects in forming strata. It is a very rare occurrence to find a spring not in some degree impregnated with mineral matter which it is continually transferring from the crust of the earth to its surface some however contain it in very small quantities while others such as the West river salt springs contain very great proportion

All of these however insignificant though their action may appear carry an immense quantity of matter to the sea & deposit it upon land. (92.000 tons)

2. Rivers.— In dry weather rivers do not carry to the sea any very considerable deposits but in the spring and fall when the rivers are flooded and the ground at the same time rendered soft and brittle by the frost very great quantities of sand mud gravel and vegetable matter are conveyed to their mouths. These substances when deposited in water which is not frequently agitated generally accumulate in deposits called Deltas immediately at the mouths of rivers. Of the formation of these the Nile is a very good example It has not only deposited at its mouth a large

delta but has within the period of history elevated the part of Egypt which it overflows to the height of more than six feet

3 Coral reefs and Islands. The animals which form these though themselves very diminutive have continued on the earth longer than any other animals as their corals which are their workmanship are found in the very lowest of the secondary strata a great part of the limestones contained in which are to be attributed to their industry and they are yet found in great abundance and still continue to form ~~great~~ ~~numbers~~ of Islands and rocks. To these belong a great part of the Islands in the Pacific ocean Coral Islands generally appear above water in the form of a ring containing a small pool or lake of

water

and having one or more openings
This circumstance together with
the fact that coral insects ne-
ver begin to build at any great
er depth than from forty to a
hundred feet which proves that
the coral islands must be built
upon some foundation elevated
above the bed of the surrounding
sea Induced Mr Lyell to conclude
that the circular form of coral
islands was owing to their be-
ing built upon the margin
of the craters of extinct submari-
ine volcanoes As coral in-
sects never build above the level
of the sea their islands never attain
any great elevation unless raised by
volcanic force As soon however as
they reach the level of the sea they
become covered with a dense gro-
wth of vegetables and soon be-

come habitable. Some coral formations are of great extent; one upon the coast of N Holland stretches to the length of 1000 miles

4 Tides and Currents.— It is a general principle in Geology that all land which is above the level of the sea is gradually wearing away and upon no part of its surface is this more apparent than upon its sea coasts. In such situations the decrease is caused by the waters of the sea which are continually lessening the amount of dry land and depositing matter in in their own bed. ~~As this~~ Of this the East coast of Britain is an example. Its shores are worn by the tides of the German ocean which have in the era of history very much changed the appearance of the coast. The sites of towns and villages have been

obliged to be moved further inland
Thereby valuable tracts of country
have been Destroyed.

5. Volcanoes and Earthquakes.— Although
there are very few of what are com-
monly called Volcanoes Volcanic force
exerts far more power in the formation
and arrangement of strata than may
be supposed as it is often exerted with
out breaking out into eruptions
A an instance of this the Chain
of the Andes and Rocky Mountains
and indeed nearly all the great
mountains of the world are of
volcanic origin The whole num-
ber of Volcanoes upon earth is
estimated at 200 of these America
contains 116, Asia 66, and Eu-
rope 13. None having yet been dis-
covered in Africa. Very many
of these are called extinct because
no eruptions from them are known
to have taken place in the period

of history from this however it does not follow that these volcanoes are incapable of causing eruptions for the periods of these in particular volcanoes are generally far distant and many which have been long considered extinct have given evidence of the existence of volcanic power in them. The mode in which volcanoes act is by streams of water and mud by lava or by showers of ashes and hot stones. The first of these which is rarest of all accompanies the eruptions of particular volcanoes as of Cotopaxi in the Andes while in those of others it is entirely wanting. It is supposed to originate partly from water emitted from the earth and partly from the melting of snow on the summit of the mountains In one ~~example~~ of the kind in Italy water was poured

from a rent in the side of a mountain, containing numbers of small fish. The other substances ejected from volcanoes ~~are~~ lava and ashes are most frequent and destructive of man and his works and it is these which have given rise to the erroneous idea that volcanoes emit flame and smoke the former being the red gleam of the melted lava and hot stones and cinders and the latter clouds of steam or ashes

~~The cones~~ almost all volcanic mountains are formed of lava and ashes regularly stratified and intersected by lava dykes

Volcanic action has been assigned to various causes. Some have asserted that the interior of the earth was a mass of fire or of melted rocks and Hclove adduced as a proof the fact that

as we descend into a mine the air becomes warmer But it has been found that by allowing this heat to increase in the same proportion at a few miles below the surface we should find a temperature equal to the melting point of Iron and consequently should then come at the surface of the melted part of the earth which would thus bear a greater proportion to the solid crust than the yolk of an egg to its shell and it is evident that such a crust could retain its solid state for a moment. It is therefore impossible that this can be the cause of volcanoes and besides it has never been explained how such heat could be produced.

That explanation which is generally believed is that volcan-

oes are produced by chemical action, and from the circumstance that volcanoes are always found near the sea or in situations where they have access to water that is concluded that the combustion is produced by this agent. This is corroborated by the fact that there are many minerals and are purely by the which take fire by exposure to water

Earthquakes are produced by the same causes as volcanoes and act upon the crust of the earth by heaving up particular points and depressing others (clefts or faults)

It thus appears that the causes which have been mentioned are now forming strata similar to those which ~~the~~ present compose the crust of the

the earth containing remains of Man and of his works which may in future ages of the world be viewed with the same curiosity as that with which we view the bones of the Mastodon or the Mammoth

The following pages are merely a Catalogue, describing specimens collected by Sir J. William Dawson in his youth. The essay at the beginning of this book was read in 1836 when he was only 15 (his birthday being in the autumn); and this collection was probably begun about that time, as each set of specimens begins with number 1.

William B. Dawson
(son of Sir J. W. D.)

May, 1934.

The following pages are evidently a Catalogue, describing specimens collected by Sir J. William Dawson in his youth.

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Multivalves

Genus 1 Chiton – Valves placed in transverse plaits down the back. Shell in the form of a boat inverted and high at the stern.

2. Lepas – Barnacle – Conical formed of triangular valves broad at the base and tapering at the top where they are united by horizontal plates.

3. Pholas. Stone Piercer. Shell bivalve, obliquely striated, with several small accessory valves at the hinge, an incurved tooth inside beneath the hinge.

Bivalves

1 Mya – Gaper – Generally gaping at one end. Hinge with broad strong teeth seldom more than one & not inverted in the opposite valve.

horn coat

2 Tellina. Sloping on one side in the fore part of one valve there is a convex in the other a concave fold – 3 teeth lateral ones smooth in one valve.

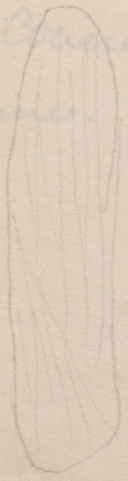
Shells often delicate and beautifully coloured

3. Cardium, Cockle. Equilateral Equivalve, convex, ribbed striated or grooved longitudinally. toothed margin, two teeth near the beak and a larger one at each side. Shell thick often spherical

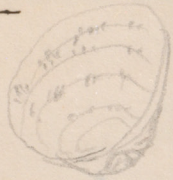
4 Mactra - Unequal sided equivalve Middle both with a hollow in each side lateral ones remote Shells usually thin & delicate

5. Donax. Wedge — bluntly toothed margin — blunt or broad margin 2 teeth / marginal one a little behind sometimes smooth at others striped & filed.

6 Solen. Razor fish — open at both ends, often covered with a thin cuticle



7 Verrus. frontal margin flattened 3 teeth, lateral ones divergent at the tip interior often colored Wampum –



8. Spondylus. Thorny oyster – hard solid with unequal valves one of the valves ~~[illegible]~~ the other nearly flat 2 teeth separated by a small hollow. Covered with longitudinal rows of spines.

9. Chama. Clam. Shell coarse hinge with a hard gibbosity. often not equilateral.

10. Arca. Equivalve. hinge with numerous sharp teeth inserted between each other shell thick sometimes covered with a cuticle sometimes crenulated sometimes grooved

11 Ostrea — generally with unequal valves hinge without teeth but an ovate hollow transverse groove divided into Scallops and oysters

12 Anomia — not equivalve beak curved over the hinge one of the valves flattish the other gibbous. Shells thin sometimes striped at others smooth.

13 Mytilus – Muscle – hinge usually without teeth, some species have grooves some are smooth others striated.

14 Pinna. – Very brittle, large tubular ribs – no teeth – resembles a wing or fin.

Univalves

1. Shells having a spire

1 Argonauta. - Shell extremely thin, with only one compartment resembling a scroll with a large aperture.

2. Nautilus. Some spiral others tooth shaped.

3 Conus — cone shaped smooth without teeth. slit at the lip

4. Cypraea — Cowry. toothed.

5. Bulla – without teeth
A perture large at the base oblong

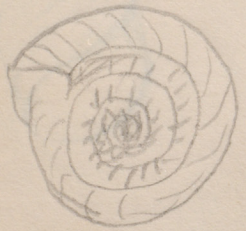
6 Voluta Shell are called.
teeth or plaits on the pillar
side of the lip.

7 Buccinum – gibbous Aperture
ovate terminating in a short canal
leading to the right with a beak
or projection pillar lip extended

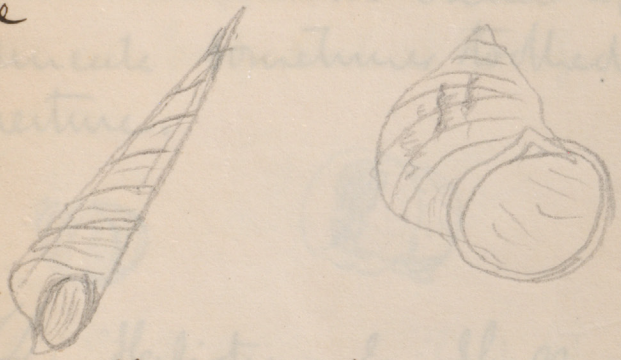
8. Strombus – Aperture much
dilated the lip expanding and
produced into a groove.

9 Murex, – Trumpet shell rough, membraneous, aperture oval with a straight or slightly ascending canal.

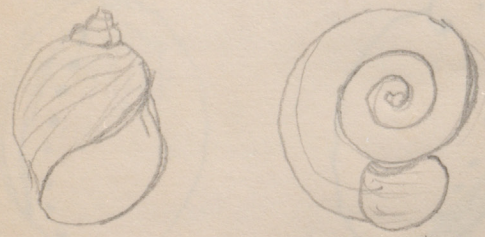
10. Trochus. Conical, aperture angular or rounded upper side contracted



11. Turbo. Wreath. Spiral long
Aperture contracted orbicular en-
tire



12. Helix. or Spiral — Delicate
little Aperture contracted — semi-
nar, or round-ish



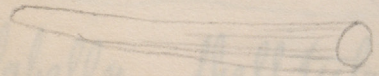
13. Nerita or Hoof-Shell
Gibbous flattish at bottom aperture semilunar pillar lip truncate sometimes toothed aperture.

14. Haliotis or Ear Shell —
Ear shaped with a row of orifices along the surface shine nearly concealed.

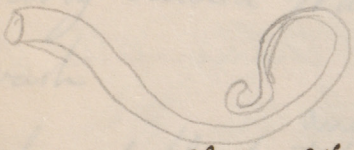
Without a Shine

15. Patella or Limpet. Cone basin shaped some have a petition and appear like a slipper some are perforated at the apex

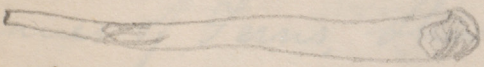
16. Dentalium or Tooth Shell Tubular straight or slightly curved with an undivided cavity open at both ends.



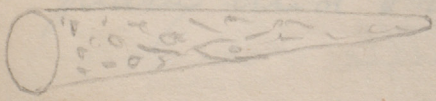
17. Serpulæ or worm shell. Tubular, adhering to other substances separated by external divisions sometimes spiral.



18 Teredo or Ship Worm.—
Shell tapering flexuous with two Hemisphercal ~~and~~ two Cunneiform valves before



19. Sabella— Shell tubular composed of sand broken shells, vegetable substances &c glued together



1 Smooth Bivalves – Limestone from Cape Breton

2 Bivalves – Striated longitudinally probably cardia White Carb – Lime Pugwash

3 Bivalves deeply striated – cardia and Productus – Black Carb Lime Pictou Island

4 Leaves & Stems of two species of Encrinites Do Do

5 Leaves of Ferns, Shale – New-road

6 Stems of Calamites Cannaeformis from Patterson's Mills, Mc Kenzies quarry and 6 mile brook

7 Stems of Smooth Succulent vegetables Shale & Sandstone New Road &c

8 Long Lanceolate Leaves probably of Calamites Pattersons Mills, Picton, &c

9 Small Plant Shaped Leaves Pattersons Mills

10 Smooth Lignite Spotted like Beech wood, Sandstone, Locality unknown.

11 Three forked leaf like that of Oxalis Acetosella *wood sorel or Sheck grass. but a little smaller Pell.

*Class Pentagynia, Herb. Ness, Geraniaceae

12 Globules consisting of carbonaceous matter containing oxide of iron but still sometimes sand or clay

13. Leaves of Grapes. P. M.

14 Parts of the impression of a large plant 8 inches broad at the battery stone in a coarse sandstone. The impression was nearly a foot long and in that distance there was no perceptible narrowing.

15 Pieces of a plant converted into sulphuret and ochreous oxide of iron

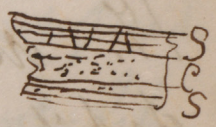
found at Kitchens farm in a peice of shelly sandstone. It extended at right angles to the planes of stratification had a crooked root-like appearance, and no punctuate markings; the wood itself had a stringy asphaltic case.

16. A small Ammonite apparently smooth about 1¼ inch in whole diameter and a little more than ⅛th of an inch in the diameter of the whorls, found in a black shaly piece of Pic-

ton Island Limestone - one other in the same piece - both destroyed

17. Irregular oblong pieces of white lime or gypsum, about 2 inches long, and little more than ½ in. broad, ⅛ thick found in P J lime, nature unknown.

18. A large specimen of a rough barked tree about 2 inches thick petrified into some kind of calcareous spar at the sides and by iron in the centre petrified the same as 15. found in

a hard ~~blue sandstone~~ grey conglomerate, at
mortimers shore near Howlets
to the east of the same
place were strata 

of sandstone containing
Calamites & smooth stems
with a stratum of hard grey
argillaceous conglomerate
like the same rocks at Pt M

19. At Howlets shore in
the sandstone before men
tioned two smaller specimens
of No 14. In the grey con
glomerate of same place
one calamite and small
pieces of coal or lignite, in

the sandstone smooth reeds like a specimen found at R. D's garden. No 7. also, stem 1 inch diameter striped transversely. ligneous impression In a hard blue sandstone a specimen of a large cactus beautifully marked nearly 2 inches diameter, surrounded by carbonaceous matter. X

26 At Kitchens farm. leaves of a species of fern broad indented leaves.

X This appeared to be a ligneous impression, the cortical one was smooth

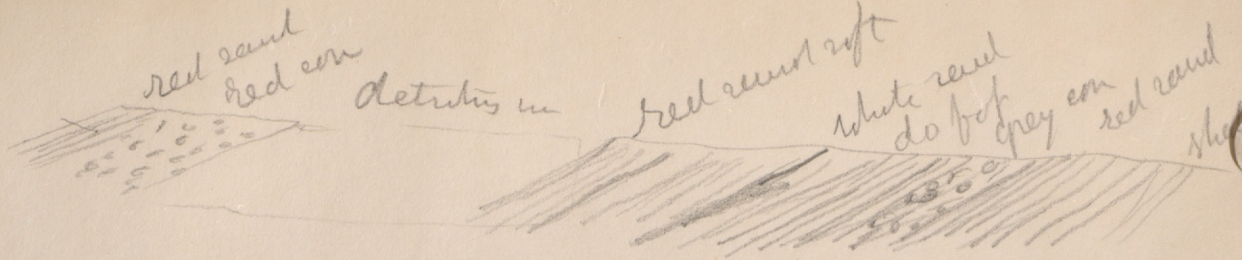
21 At Flowlets a stem 1 inch in diameter cortical impression roughly striated bark a line thick, lignous impression nearly smooth. also a smaller specimen of 19. in Sandstone, blue

22 a stem striped transversely 1 inch diameter no marks of leaves or branches

23. Two specimens of a horn shaped plant striped like calamites 2 inches thick much flattened blue sandstone

at Flowlets and detritus at Battery.

Small round bodies resembling leden bulbs ~~t~~ with carry P. M.


red sand
red con
detritus in
red sand soft
white sand
do bof
grey con
red sand
shale

105

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