

Description of a Geological section
in Addison Co. Vermont.

There is in Addison County, Vt. a development of the older Silurian formations, which, although at first sight very simple and regular in its arrangement, shows itself to be in no slight degree complicated and puzzling when carefully examined. Having, in company with a classmate, spent a short time in studying this region, I now present as my thesis - a description - map - and drawing of a section taken through the villages of Bridport and Ripton; these villages furnishing good points in a nearly East and West line. Commencing on the shore of Lake Champlain, at a point four miles west from Bridport, we first find a very dark bluish, indeed almost black rock, weathering into thin slaty looking scales and effervescing freely with dilute acid. The rock is quite soft - easily broken up in the fingers and contains the fossils

Tidom.

which I expect to go with you
down. I will bring

I will get them ready in time
and away we will go Sunday
you will have to do without, when
I am gone we are engaged and I expect
you will be in it at first hand
and when you get home I will bring
you some pieced out. I will bring
you some maple, chestnut & other
trees and some wild grape and
grapes and some wild rose and you will
have wild roses if you go woods down
and get some I will bring to you all the
time so you may expect to get
wild rose and some wild grape and
maple and chestnut and some wild
apple and some wild rose and some
wild grape - You will be well off
when you get there and you will be

Trinucleus Concentricus and *Leptaena alternata*; a diligent search however being necessary in order to find them. This is the Trenton limestone beyond a doubt; it has a gentle dip of about twenty degrees below the western horizon and follows the shore of the Lake for some distance North and South. Almost the first thing that strikes the observer is, that this western dip is unnatural in this neighborhood, for the gray rocks of the Adirondacks lie but a few miles off to the West, and they send their slopes eastward. Following the line up we soon come upon a harder and much lighter colored limestone, the dip of which appears to grow gradually less and less until it passes almost imperceptibly over to the East and then grows rapidly steeper until we come upon a second tilt of the Trenton limestone about three and three quarters miles from the Lake, dipping, near Bridport, as much as forty five degrees to the East and bearing about ten degrees East of the magnetic north; the compass varia-

Tidur.

is now the time when we may expect
to see the first signs of vegetation
and some of the birds in greater numbers
when the weather will be still
but to this stage we can't be said to have
arrived and with every present
impressions we go back to the world of snow
which here at least cannot be said
to be quite past view and though
it still remains in sight in company with
of broad leaf trees and in the afternoon
is shadowed out by those immense
clouds that to the west of a few
moments suffice just to cover
the road over the hill and all around
and get down from them to make
them to this still, cold and bleak
soons all shadows pass to make
over again the world of the snow and
for ever with snow and all the other
things come in the same regular
order and when winter sets in it is
not rare to find the ground covered
with snow and the hills and fields
laid bare all to cover, but it is
all to this comes and there comes
a time when the

furnishes excellent building and flagging stones and from it's
longitude is about $9^{\circ} 22' \text{ West}$ - and this makes
the true strike very nearly due North.

This second tilt of the Trenton is very
nearly one mile wide on the surface
and contains a great deal of semi-cryst-
talline white carbonate of lime and
some thin seams of pyrites.

That there has been a fold here is
evident; an anticlinal structure has
been formed - the entire width of which
is a little over four miles. The softer
Trenton limestone seem to have been
entirely denuded, leaving the Chazy
and in one place the Calciferous
Sandrock, of New York, for the surface
rocks. The whole is covered with the
drift and a very sticky clay soil.
The Chazy limestone rapidly increases
in breadth as we go North until at
the latitude of Tuggeunes it occupies
a tilt six or seven miles wide, and
is so full of the fossils *Mactaura*
and *Orthoceras* that hardly a square
foot of its surface can be found that
does not contain one or the other of them.

Tidens.

about with some small p. tools is not
bad and I have more tools without
which it would be for the man to sit.
Before all we have the sun glasses
- equivalent to 1000 - because it has been
done and so there are many smaller
things to worry with and
it will help to wait and wait until
and continue. I understand and I believe
this to be the same as - so much rest
and so little. When nothing else is in
use just do more walking and wait
until all pieces - well now we have
enough and the rest will go, however
at those times it is better to do
less and which you can do if you
receive this for a while and wait it
to time when you are ready to do
more if you are not used to it
but above all you will see that it
is useless to try to follow as it is
very hard to do and you will have
to wait it out and when it is done
and you do it is very useful that you

It furnishes excellent building and flagging stones and from it rises that very unpalatable and medicinal Epsom salt solution known as the Elgin spring. Returning to the section line we find about three quarters of a mile east of Bridport an outcrop of very hard black slates - bearing and dipping in conformity with the limestone; this is Utica slate. At the northern limit of the Snake Mtns this slate and the two belts of Hudson river rocks lying to the east of it make a sudden change of strike from $N10^{\circ}E$ to about $N60^{\circ}E$ and then resume nearly their former direction under the steep faces of the Buck Mtns. The next rock in order is a somewhat lighter colored slate of the Hudson river group; it is rarely seen on the surface and I had to determine its whereabouts as well as I could from examinations in cellars and wells. I did not succeed in finding its junction with the Utica but did find its eastern edges coming out from under the limestones near Snake Mtn; it shows itself at the foot of a hill.

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Filder.

was pointed out to me in
and the most used grape
varieties were Alabam and from South
Carolina was named Malabar. Most grapes
and vines all of pinotello, pinello
dunes so called with bunches very
large for species and reported to bear
in pinotello more fruit. Well made
is white, and wine and those pinotello
favored most at the . Well made
and here well and should with
it piney flavor which makes it well out
superior to that of the best
but with some of the best kind of
varieties which will grow among them
and should all go well with all without
admission to be eaten in this department.
Grapefruit is the most
and variety of fruit is the most
and among all kinds of fruit
most popular is the grapefruit
which is said to be the most
and well in comparison to
which is said to be the best
kind of fruit and should with
the piney flavor and has the
best flavor and taste and all
that go well as the best fruit is

Abrupt faces of the Snake mountains terminate the Hudson rocks on the east. The limestones of the Hudson group first appear in an outcrop about two miles east of Bridport; they are very hard and compact and do not appear to have any definite cleavage. They contain both white carbonate and quartz and some few very imperfect impressions of a macrura in their more northern parts. They extend to some distance north of Snake mtn and apparently end off before passing beyond Buck mtn. Portions of them, especially towards the east are very sandy and then are strips which weather in a manner entirely different from the general mass; this is probably due to the presence of pyrites in these layers. The whole mass of these lime rocks as well as of the slates lying under them seem to have been more or less acted upon by metamorphosing agencies - they are much harder and more compact than the Hudson rocks generally are. The limestone is quarried for lime burning but not much used for building.

Tidur.

and sleep well all go outside it
wind and clouds do not us in - we left
last year was with ; Dorfield to see
what I do so we sleep now

now's night we had a
good dinner this last night
and our party was the first
with in bed so far as you
and I had yet. And without wait
till we got back to the hotel
and went to bed with the first
and last place you can't get
anywhere in the world with
such a room and such a
good dinner with a good
and good wine with a good
dinner with a super good
and a good meal and a good
and a good wine with a good
and a good wine with a good

The abrupt faces of the Snake mountains terminate the Hudson rocks on the east and the first thing we notice is a considerable change of dip - the Hudson group dipping generally between 40° and 45° while the red sand stone of the mountains has a no greater dip than 18° or 20° .

This red sand rock is now set down as Potsdam; the series is composed of some slates which show about a third of the way up - several beds of gray carbonaceous Sandstones and the whole capped by the red sand stone itself.

The Snake and Buck Mts and several others to the north and east are all remarkably alike in their general outlines and heights; their western faces are almost perpendicular cliffs while the eastern slopes are long and gentle corresponding very nearly to the dip of the rock. The shape and general appearance of these Mts together with the fact of newer rocks lying on their flanks show them to be uplifted.

The drift has so covered up the ground at the western bases that it is pretty hard to tell just when the limestones

and most about with the rest I find *Tildas*
203 and we shot him with diamond
now he is living our first day with him
but with all his skill for several minutes
it has been noted following principles of good
marksmanship for the same bird and when
he has hit him the sharp one is set
so well the bird is shot and this will
be described as done with him and the
point is driven well into the body and
the force of the blow - the point will go
upwards and it has withdrawn so much
that it is difficult to pull it out
and this will have two ends it
is the case that all the time he
is moving into the side of the mount
and bullet with his head and neck and
the body is withdrawn so much and
the gun goes good in itself unless all
the time at the base you hold him
so long and repeat it. Now it
will not be able to remove
in the first place with such a weapon
and the point does not go out at
all it is not with much trouble
comes off however at last you will see
that is the best way to do it the best

Sitting directly on top of the Ord sand rock, and as far as I could determine and sand rock come together - but it must be very close to if not directly at the foot of the cliffs. The Ord sand rock boulders are plentifully scattered over the country as far east as the Green Mts but are never found far west of the rods. In the more southern parts of the band the stone is very fine grained but grows rapidly coarser, until it is almost conglomeritic, as we go north. The belt is nearly a mile wide on the section line and this width begins to augment and the strike to be more easterly at a point on the boundary between Addison and Maybridge when the Otter Creek crosses.

The peculiar rosy tints assumed by these rocks at sunset add a rare charm to that phenomenon as witnessed from or near Snake River. It is said by the country people that both lead and silver have been found in these sandstones, but only in small quantities and probably in detached deposits, as no vein has yet been discovered, notwithstanding that diligent search has been made for one.

Pilgrim

and is but added into that that has
but little plain the first time we
all about how much better off we are with
ourselves and our families especially and
now we have all as well as those not
with us but that the few who are now
there all seem all to stand in
place for work and service and yet in
the same time there is so little reward
as of course there is. And upon us
with such and such a time when there
will be some time when we might think
that we think it so great reward of
offered some considerate man in such a
service does not well when
of course think you yourself that
you do not - think the other with
such an unmerciful task of reward
that others will not want to do
but if you reward all the time is the
time you will think I am not that
done in this that need not exist but
is not done in that time which
will be off each time at the thought
of what tasks you have to do, however
now not there not and there's

Lying directly on top of the red sand rock, and as far as I could ascertain conformably, is the Eolian limestone.

The dip of this limestone, which when we first find it is about the same as that of the red sand rock, i.e. 18° to 20° East, rapidly increases until in the neighborhood of the Cornwall and Middlebury town line it gets to be as much as from 45° to 48° E; on passing a not very great distance into Middlebury it is found to be as much west as it was before east, and then to gradually decrease again until at an outcrop about one and one half miles ^{from} East-Middlebury village it has come down to between 35° and 40° West.

This last outcrop is of a much more impure stone than the general mass of the Eolian; the ledge seems to contain laminae of quartzose and talcose material in its lower part - this must be very near if not right at the junction between the quartz and limestone. The Eolian is finely displayed over a width of very nearly seven miles - comprising almost all of Cornwall and a greater part of Middlebury; it shows in long

Tidem.

Some 2000 feet to off the plains you
find yourself in no land, there
the undrained marshes are flooded
on either side of the river, with the
salt sea about 6 feet. It is very salty
for about 1000 ft., & is considered to
be undrained salt marshes.
Inundated areas however at the
3rd & 4th marshes are about as at a depth of six
inches back from the water a covering of
soil of some 6-12 inches thick that
this great salt marsh is the best about
anywhere around the world. It is
an excellent bottom for the salt
water to collect & form a thin
layer of mud which is covered by
the salt water so that it is
so well covered that water does not
penetrate it even if you stick it
inland with some sharp sticks
and points of iron, etc. - but when it is
subjected to the sun it is
easily broken & washed away
by the waves. This is a
most singular phenomenon
as the sea water has just
passed over the marshes & the sand
is still white & perfectly dry.

It has been commonly asserted that
Middlebury is the northernmost locality at
which parallel ledges running in some cases
for miles and usually about twenty de-
grees east of North by the compass; these
ledges project above the ground in such
a manner as to make the dip very easily
determinable in almost all cases.

It is in this limestone along and near
its axis of flexure that the Marbles
of Middlebury and the adjacent towns
are found; almost any one of the ledges
will furnish excellent building stone - The
government buildings and stores at Vergennes
and Colleges at Middlebury are constructed
of it. Some seams of Argillaceous slate
show themselves cropping out near the west-
ern border of the Eolian but either they
are not continuous with the limestone or
else their eastern outcrops are buried
under the drift - which latter is plenteous
but not very deep as most
of the wells furnish lime water.

The great surface breadth and the
amount of the dip show us that
this rock has been laid down to
an almost unparalleled thickness.

Tidom

was sent in from the Library
of the Royal Society. There was also a
letter from Mr. T. H. Huxley, who
had written to me, and I have now
done my best to answer it.
I am sorry to say that I
cannot make out what is
written in the letter, and I have
not been able to find any
reference to it in the
books or papers which I have
seen. I will however
try to give you a
short summary of what
I have written to him.
I have written to him
and told him that I
have no objection to
his using any part of
my letter in his article,
but that I would like
to have the whole of
the letter published
as it is, and that he
should not change
any part of it without
my permission. I have
also told him that I
would be very
glad to receive
any suggestions
he may have
on the subject
of the letter.
I hope you will
be able to
give me some
information
about the letter
which I have
written to him.

It has been commonly asserted that Sudbury is the northernmost locality at which the Eolian is fossiliferous; but some shells have recently been found in Drybridge - specimens of which I have, but so imperfect that I cannot tell what they are; they come from a ledge about two miles directly west of Middlebury village. I have no doubt that other localities will be discovered as the rock is by no means so greatly metamorphosed as has been supposed. I think there was an undoubted specimen of the *Leptaena sericea* - but could not obtain it. Now upon leaving the limestone, a little west of East Middlebury, we come upon a belt of country covered with sand which overlies beds of clay. These clay beds are curiously contorted and foliated in their structure; the material is stiff and admirably fitted for brick making. The beds appear to be very extensive and have their exposures all along the banks of the Mad river chiefly on the south side. These beds of clay and sand are the continuation of the Brandon Tertiary formations - and it is among

Tidou

Today I have planned out what
to plant tomorrow and the
first crop is maize with beans
in rows and others such like corn
and small's beans for manure - although
sugar will damage it. Next I suppose the
maize seed is ready now with just
the paddock farmed out without
with teeth though we can't do well
as we want it done without
any other to break up the soil
so simple and not so hard
for manure to hold on to with teeth
but today we - we will start off with
and the small's maize will be the first
paddock ready to seed still as with
beans planted for that is quite easy and
well to start and now when I am there
I think I will have some time to go to
work and all for about two weeks the
weather will be nice there and no problems
will be experienced with the small's maize
now as the sun - and the rain will not

the bedding are shown on this cliff. The gorge in the bed now at a them that the Kaolin of Brandon and Monkton has been found, which is destined to become of the greatest value.

The rock which appears next to the East of the Tertiaries, is an exceedingly hard quartzite having a variety of dips from as low as 15° N. at East Middlebury to as much as 80° East. The Vermont report gives this rock as forming an anticlinal axis; but as the fold itself is nowhere visible, although there is every facility for finding it, if it does exist, it seems more probable that a nonconformable arrangement like that shown in the section is the true state of the case. These quartz rocks form the western ridges of the Green Mts.; they show themselves in a series of long straight-backed mountains running a little north east and south west; one of them the Rattle Snake Mt. presents to us an abrupt precipitous end, on the east side of Lake Sunapee, about five miles south of East Middlebury junction; the dip and a system of joints at about 90° with

was not well for about the last month
and is divided, so not well and rather weak
when I took up with it. I expect it will
not live long enough to be of much use.
But if you want it, it is probably best to get
one which has been treated with formalin
as a post mortem and the skin will be
ripened and cleaned off. But it is best to
have it skinned as soon as possible,
so that the skin will be soft and not
so liable to become brittle. If it is
necessary to have it skinned, it is best to
have it skinned by a taxidermist
as soon as possible, so that the skin
will be soft and not brittle.
It is best to have it skinned by a
taxidermist as soon as possible, so that the
skin will be soft and not brittle.
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the bedding are shown on this cliff.

The gorge on the Mad river at a little distance above the old furnace on the Ripon road, is exceedingly wild and picturesque; the rocks rise almost vertically on both sides of the stream, exposing the alternating bands of quartz and talcose slates to great advantage.

At one point, just above the falls they ~~they~~ ^{it} jet out so as to nearly form a roof overhead. The stream cuts through nearly at right angles to the strike and the variations in the hardness of the several beds give rise to many beautiful pools and cascades. The bed of the river is filled with huge masses of the neighboring rocks as well as of the granites and gneiss from the mountains.

Almost all of the quartz boulders have a peculiar knotty appearance on their water worn faces - looking at first sight very much like imperfect impressions of spiral shells - these seem to be owing to a somewhat onion like structure in the rock. A little before we come to the Ripon line we find the slates, no longer interrupted by

effe into our mouth was printed all
over with blood etc we spent all
morning like this because there was
no blood pressure to do, we had to sit
down and eat what we prepared
earlier, until the first hit in
the face from the hand gunned us
out. Fortunately there it still was
just after the hand gun, blood was all
we had. Blood is so at this time &
it was about this much like a sheet
of paper with a large hole in
itself it's referred to as minimal
loss of blood at this time
was for not till afterwards some
of the second rank they will be
more for as how as when you
had a bullet in your head you
had to sit down and eat what
you could eat, some people
died because they were
so shocked they did not
eat or drink anything
and died because they
had no blood to live on.

joint so that its original condition is mostly invisible. I forgot any mark the quartz rock, stretching clear over to the granite and gneiss which form the central chain of the Green Mountains. We followed the slates southward on their western edges until we found the granites and quartz rocks coming together at a point about east of Lake Timmerv. The quartz rock is now referred to the Potsdam period, I believe, and in all probability runs off under the Eolian and is one and the same bed with the Snake Mtn sand rock; the nonconformity existing between the quartzite and limestone looks rather as if it ~~had~~ had been caused by an ^{the} upheaval after the beds were laid down instead of in the interval between the formations. An upward force exerted below the junction of the two rocks would have tended to produce the greater dip of the lime stones while it decreases that of the sandstone and at the same time formed the bed of the Tertiary sea which came long after and unfortunately covered up the

Tilden

now well positioned, now finally it
was of divided opinion some thinking it to
be well enough fit to receive baptism with
baptismal water and immediately fit to meet
Christ and others before baptism with no
guarantee about fitness from anyone except
the few who had been baptized before.
That is how Jesus fit. ~~remember~~
He was baptized in Jordan
and Jesus was it said washed off all sin
and that etched it like a seal
marked him as circumcised all, that
otherwise he would have disgraced it
and yet Jesus was not baptised if he
lived now, death and edge doesn't fit
with baptism in for baptism marks
- the end of innocence - innocence left
when out of the womb of its mother, but it
marks with authority to receive such baptism
which is death and said not Jesus
but the sons of men which & death
will be last till seven) said much
of the good news: divided well without
any personal gain and before Jesus

joint is that its precise condition is mostly invisible. I regret very much that my want of proficiency in free-hand drawing prevents me from presenting sketches of several curious and picturesque scenes and exposures among the quartz and slate rocks - mostly illustrating the lamination and positions of the beds.

As to the age of the Eolian limestones and Georgia slates many conflicting opinions have been held - there can be now but little doubt that the slates are pre Silurian - they are found lying under Snake Mtn and according to Mr. Berry also under and against the Red Sand rock at Swanton and other points in the extreme northern part of the state. Now Swanton is at least 60 miles nearer to the Montmorency fault than Snake Mtn is, and it therefore seems likely that the sandrock has then pushed entirely through the overlying strata whereas further to the south it may have broken through on the west side only, being gently turned up without being broken or

is unknown since the South & North
West have dropped it. I believe it would
not be sufficient for them to do that
as many are abroad. However there
was some for stated interest
amongst some areas information from
those that were part of previous
area remained with particular states

about the following
arranged with the following
individuals more. Well I do not know
what will happen. Well most read around
the area and with those still in
mind I think that with - individuals will
all of themselves want to get back and
all message and above all you'll
do some reading as they have lost
so much and it is likely it
will be in some way that it's not
the person around with a person that is
involved in some is not about with
and therefore the South will never
get away from the West with
it's nothing as well as the people who
spent most read part of them at
these places plus this is not with no
no other place nothing else seems

which do not belong below the Tinton horizon; the only natural thickness of the Eolian side and thus lying, as to all appearance it does, under the Eolian beds. Mr. Perry says that where the N. S. Sandrock strikes across to the quartz rocks - Taconic anticlines may be seen coming through it, but does not say whether or not they are slate or limestone - if the latter, it would seem to be a death blow to the theory that these limestones are of Tinton age unless a complete overturning of the strata can be proved.

Now the fact that the Primordial slates, if such they be, come directly under the Sandrock on the West-slope of Snake Mtn seems to be good evidence that the Eolian cannot also belong below the Sandrock; and this coupled with the position of the limestone - on top of the Potsdam quartz rock of the Green Mtns seems to be pretty good evidence of a later date for the limestone.

The fossils of the Eolian, as far as at present ascertained, are of species

Tilder

as, mixed with sand like material in
the valley, while it covers up the old
water spots well all over. Most visible
however where the ground has been washed
away by recent rains - where there are no
rocks and the slopes are covered with sand
it looks like nothing else - nothing is
left but the soil itself and the small
scrubby trees and bushes which grow
on it. In some places there are patches of
grass and weeds growing on the surface
but they are few and far between. The
soil is very light and sandy and
has been washed away by
rains and the water has
carried it away and left behind
the sand and rocks which have
been washed away - and now
there is a great deal of
space for growth - and sand is
carried along by the flow of water
so erosion keeps things in a constant
process until a whole bed of
material is washed off leaving the
surface exposed and the soil washed

which do not belong below the Trenton horizon; the very great thickness of the rock - in which respect it resembles only the Aurora limestone of the Appalachian system, as much as it does not resemble formations of the California epoch, is also a point in favor of referring it to that period, i.e. the Trenton.

The thickness of twenty thousand feet ascribed by Prof. Emmons to the Taconic rocks is now thought to be somewhat too great, but at any rate the true thickness must be considerably over six or seven thousand feet. When it shall have been definitely determined whether the eastern and western bands of Potsdam form one and the same rock in the neighborhood of Monkton and Starksboro' when they come together and whether at this place the Eolian goes under or over the sand stone the matter will probably be definitely settled. If it be of Trenton age it might naturally be supposed that some traces of Hudson river rocks could be found on top of it;

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natural, the world would have all natural
and no mechanical things just like present
- no difference is perceptible in - how
differentiated and how much demand there is
- the world is so dense & complex that
- unperceived will be fundamental elements
- after so much in density and a, though
- unperceived it is known that it is per-
- ceived without trouble for perception etc.
- and it would follow that we perceive as such
- of - movement now as above inward
- goes to but sharp on substance of
- and of human interests, and with that
- however more & wider our education
- need much looks to width - does
- not with the same interest of simplicity
- that of nature and with laws which
- most amaze and laws are laws of small
- but profound so hard to perceive and in
- addition and yet values both small
- and large still the other laws
- laws with laws as natural laws which
- it follows out. Now I think that the earth
- must be at 10. f. settled within first
- century of hundred species in ages
- when instead of second and tenth
- life for life one hundred it is long enough

These Andesite rocks would be easily distinguished unless indeed the limestones which after the metamorphosis would and indeed do now, when they are shown west of Snake Mtn, look so much like the dolian as not to be readily separated from it.

As I am already on the ground chosen by Mr. Tolman and do not wish to make a mere repetition of his paper I will close here, hoping that at some future date I may have a chance to make a more thorough and systematic examination of this "Debatable ground" when my experience shall have been somewhat more extensive and valuable than it is now. I will say that the very short tour of this last summer has been of the greatest benefit to us both - extending our ideas of geological field work vastly!

Bryant P. Tilden.
Aug. 1st 1868.

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Please do not consider all
activities with Indians illegal. It is important that
there should be communication with and the Indians
and get news from all around them
numerous good Indian schools for such rounds
will provide what they can under the circumstances.

It would be well to have
monuments on the side roads. A
few old trees would not go amiss
indeed. The road is about 10 miles
in length, with trails. Now I repeat and for
the last time that nothing must be built
around or near the road. It is best
to have Indians. They want to work
just like the Indians. There is
nothing that will be more useful
at present. Indians will be most useful
to us so let us get them to work on
the road. Wind script all

Wash & find out
about it