

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 Ripston; 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 blue, 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

Tilden.

Description of a geological section  
in the vicinity of the town of

There is in DeKalb County, Ga. a small  
exposure of the older Silurian formation  
which, although at first sight very  
simple and regular in its arrangement,  
shows itself to be in no slight degree  
complicated and puzzling when more  
fully examined. It is, in fact, a  
true classic example, and is well  
adapted for the purpose, I have found  
as my thesis - a description - and  
and showing of a section taken through  
the hills of DeKalb and Polk  
counties. It is a most interesting and  
in a nearly east and west line.  
The main line of the shore of Lake  
Champlain, at a point four miles west  
from Burlington, is first - a very  
dark blue, and about three miles  
westward into thin clay looking  
and effacing fairly well. The  
The rock is quite soft - easily broken up  
in the fingers and contains the fossils



*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 Ayr 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 belt 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-





tion is about  $9^{\circ} 22'$  West - and this makes the true strike very nearly due North.

This second belt of the Trenton is very nearly one mile wide on the surface and contains a great deal of semi-crystalline 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 limestones seem to have been entirely denuded, leaving the Chazy and in one place the Calceiferous 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 Vergennes it occupies a belt six or seven miles wide, and is so full of the fossils *Maclurea* and *Orthoceras* that hardly a square foot of its surface can be found that does not contain one or the other of them.

This is about 1/2 of 1/2 of 1/2 - and this makes  
 the thin white very nearly as white  
 This is about 1/2 of 1/2 of 1/2 - and this makes  
 nearly as white as the surface  
 and contains a great deal of lime  
 white carbonate of lime and  
 some thin seams of pyrites.  
 That there has been a fault here is  
 evident; an anticlinal structure has  
 been formed - the entire width of white  
 is a little over four miles. The soft  
 Tertiary limestone seems to have been  
 entirely removed, leaving the Chazy  
 and in one place the Calcareous  
 sandstone of New York, for the surface  
 rocks. The whole is covered with the  
 soft and very thin clay soil.  
 The Chazy limestone is a very  
 is a fault as we go north west  
 the contact of the granite is  
 at the top of the white marble, and  
 is a fault of the fossils limestone  
 and otherwise that nearly a square  
 feet of the surface can be found that  
 does not contain one or the other of them



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 Mtns; it shows itself at the foot of a hill.





The 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 Bridgeport; 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 *Maclurea* in their more northern parts. They extend to some distance north of Snake Mtn and apparently end off before passing beyond Duck 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.

Wm. Allen.

The lineations of the ...  
appear in an ...  
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thing ...



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  $40^{\circ}$  and  $45^{\circ}$  while the red sand stone of the Mountains has a no greater dip than  $18^{\circ}$  or  $20^{\circ}$

This red sandrock 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 calcareous sandstones and the whole capped by the red sand stone itself.

The Snake and Buck Mt's 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 Mt's together with the fact of newer rocks lying on their flanks show them to be uplifts.

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





lying directly on top of the red sand rock, and as far as I could ascertain and sand rock come together - but it must be very close to if not directly at the foot of the cliffs. The red sand rock boulders are plentifully scattered over the country as far east as the Green Mtns but are never found far west of the beds. 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 Frybridge 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 Mt.

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.

W. Alden

and last year some to gether - but it must  
 be impossible to get directly at the foot  
 of the cliffs. The old road was not  
 so beautifully situated as the country was  
 far west as the present. But an  
 found for most of the day. In the  
 southern part of the town the  
 is very fine ground but grows rapidly  
 however, until it is almost unproductive,  
 as we go North. The hills are  
 quite wide on the western side and this  
 with being so important and the hills  
 to be more easily as a point on the  
 boundary between California and Oregon  
 where the latter creek crosses.  
 The position very little assumed by  
 these rocks at dinner - about a year  
 shown to that phenomenon as well  
 passed from or near Lake Erie.  
 It is said by the country people that  
 little last night there was a  
 in the last two days, but only in  
 quantities and probably in  
 deposits, as no rain has yet  
 occurred, notwithstanding that  
 clouds have been made for some



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.  $18^{\circ}$  to  $20^{\circ}$  East, rapidly increases until in the neighborhood of the Cornwall and Middlebury town line it gets to be as much as from  $45^{\circ}$  to  $48^{\circ}$  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 <sup>from</sup> East Middlebury Village it has come down to between  $35^{\circ}$  and  $40^{\circ}$  west.

This last outcrop is of a much more pure 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

being chiefly on top of the old lower  
 rock, and on far as could be seen  
 composed of the Bohemian limestone.  
 The top of this limestone, which when we  
 first first it is about the same as that  
 of the Westchester, is 15 to 20 feet  
 thick, and is in the neighborhood  
 of the Cornwall and Westchester  
 line it gets to be much as from N. 20° E.  
 in passing a not very great distance  
 the Westchester 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 <sup>from</sup> Westchester village it has  
 come down to between 10 and 15 feet.  
 This last outcrop is of a much more  
 pure than the general mass of  
 the Bohemian, the ledge seems to contain  
 more of quartzite and other materials  
 in its lower part. This mass is composed  
 of not quite so the further distance  
 the quartz and limestone. The Bohemian  
 is finally displaced over a width of  
 ten nearly ten miles. Comparing  
 almost all of Cornwall and a great  
 part of Westchester; it shows in



parallel ledges running in some cases for miles and usually about twenty degrees 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 western border of the Eolian but either they are not coextensive with the limestone or else their eastern outcrops are buried under the Drift - which latter is plentifully distributed but not very deep as most of the wells furnish lime water.

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

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 of Middlebury and the adjacent towns  
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 will furnish excellent building stone. The  
 government buildings and those at Ferrisburgh  
 and other at Middlebury are constructed  
 of it. Some kinds of crystalline slate  
 show themselves cropping out near the base  
 and north of the series but when they  
 are not continuous with the limestone or  
 the other eastern rocks are thin  
 and the life which latter is abundant  
 by distribution but not very deep so that  
 of the shells found in the  
 the great surface fault and the  
 amount of the dip shows us that  
 this rock has been laid down in  
 an almost unbroken thickness.



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 Frybridge - 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 College. 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 exposure 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

It has been commonly asserted that  
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 which the dolomite is fossiliferous; but  
 some shells have recently been found in  
 the dolomite - specimens of which I have, but  
 so imperfect that I cannot tell what  
 they are; they come from a ledge about  
 two miles south west of Middlebury at  
 least. I have no doubt that other  
 localities will be discovered as the  
 work is by no means so greatly advanced  
 as has been supposed.  
 I think there was an undoubted presence of  
 the dolomite in the - but could not  
 obtain it. Now upon leaving the line  
 there, a little west of East Middlebury,  
 we come upon a belt of country covered  
 with sand which was his beds of clay.  
 These clay beds are composed of sandstone  
 and shales in thin - shales, the  
 material is stiff and admirably fitted  
 for brick making. The beds appear to  
 be very extensive and have their exposure  
 all along the banks of the great river  
 chiefly on the north side. The beds of  
 clay and sand are the continuation of the  
 Hamilton - Valley formations and it is very



the bedding are shown on this cliff. The gorge on the head river at as them that the Kaolin of Brandon and Monkton has been found, which is destined to become of the greatest value. The rock which appears west, to the East of the Tertiary, is an exceedingly hard quartzite having a variety of dips from as low as 15° W. at East Middlebury to as much as 80° East. The Summit 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 Mtns; 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 Mtn presents to us an abrupt precipitous end, on the east side of Lake Summit, about five miles south of East Middlebury Junction; the dip and a system of joints at about 90° with

them that the basin of London and  
 the basin of the Thames, which is the  
 most to be seen of the greatest value  
 the rock which appears next to the  
 east of the basin, is an exceedingly hard  
 quartzite having a variety of sizes from  
 in size as 1/2 ft. to 1 ft. The thickness of the  
 bank is 20 ft. The thickness of the  
 this rock is forming an excellent  
 it; but as the bed itself is not  
 all, although there is some facility for  
 finding it if it were not, it seems more  
 probable that a more favorable  
 meant like that than in the basin  
 the true state of the case. The quarry  
 takes from the western ridges of the  
 from this; they show themselves in a  
 series of long straight rock  
 this showing a little east and  
 south west; one of them the North  
 this presents to us an abrupt precipitous  
 such, on the east side of the  
 more, about five miles east of East  
 Middlebury furnace; the dip east is  
 30 feet of fossils at about 700 yds



the bedding are shown on this cliff.

The gorge on the Mad river at a little distance above the old furnace on the Ripton 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 jut 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 knobby 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 Ripton line we find the slates, no longer interrupted by

The holding on shown on this cliff.  
 The gorge on the west side is as  
 little distance above the old furnace  
 the dip has been, is exceedingly high  
 further up; the rocks are almost vertical  
 by the foot sides of the stream, & forming  
 the alternating bands of quartz and talc  
 are later to great advantage.  
 We are first, just above the falls they  
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 and cascades. The bed of the river  
 is filled with huge masses of the  
 lightening rocks as well as of the gran-  
 ite and gneiss from the mountains.  
 Almost all of the quartz has been  
 a beautiful white appearance on this  
 water. It soon forms a striking at first  
 light appearance like sulphur but in  
 places of special shells. These seem  
 to be owing to a mineral matter like  
 structure in the rock. A little later  
 we come to the dip has been we find  
 the later, no longer interrupted by



joint is that its precise condition is  
 mostly invisible. I got very much  
 the quartz rock, stretching clear over  
 to the granite and gneiss which form  
 the central chain of the Green Moun-  
 tains. 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  
 Sumner. The quartz rock is now  
 referred to the Potsdam period, I be-  
 lieve, and in all probability runs off  
 under the Eolian and is one and the  
 same bed with the Snake Mt. sand  
 rock; the nonconformity existing between  
 the quartzite and limestone looks rather  
 as if it ~~is~~ had been caused by an  
 upheaval after the beds were laid  
 down instead of in the interval between  
 the formations. An upward force ex-  
 erted below the junction of the two rocks  
 would have tended to produce the great-  
 er dip of the limestone while it de-creas-  
 ed 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

The quartz veins, stretching clear over  
 to the granite and gneiss which form  
 the central chain of the Green Moun-  
 tains. The following is the state of  
 the veins in their various stages until we found  
 the granite and quartz beds coming  
 together at a point about half of the  
 distance. The quartz rock is now  
 exposed to the western limit, the  
 line, and in all probability runs off  
 under the basin and is seen on the  
 same side with the Andes. This sand  
 rock, the metamorphism of which between  
 the quartzite and limestone beds, is  
 as if it had been covered by an  
 upheaval after the beds were laid  
 down instead of in the interval between  
 the formations. The upheaval force is  
 not clear the function of the two rocks  
 would have tended to produce the  
 dip of the line towards which it seems  
 that of the mountains and at the  
 same time formed the top of the  
 Tertiary sea which came long after  
 and undoubtedly covered up the



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. Perry 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 been 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 on

point is that the Bureau's conclusion is  
 mostly invisible. I do not say any more  
 that any want of proficiency in the  
 bank showing forwardness are from  
 presenting details of several cases  
 and particularly for some and it seems  
 among the group and that notes  
 mostly illustrating the limitation and  
 positions of the tools.  
 As to the age of the Balaun University  
 and people that many are holding  
 and have been held that can be  
 but little about that the state are  
 for Balaun - they are found going on  
 the state that are according to the  
 they also under and against the  
 but that work at Balaun and all  
 it points in the state whether have  
 of the state. The Bureau is at last  
 so will refer to the Balaun  
 than under that of and it therefore  
 seems likely that the Balaun has  
 their Balaun only through the  
 covering that when a further to  
 the more it may have been through  
 on the Balaun side only, being partly  
 turned up without being broken on



which do not belong below the Trenton horizon; the very great thickness of the its Eastern side and thus lying, as to all appearance it does, under the Eolian beds. Mr. Perry says that when the red sandrock strikes across to the quartz rocks - Taconic outcrops 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 Trenton 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 ~~old~~ 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

to Eastern side and thus giving, as  
 to all appearances it was, under the  
 Indian side. Mr. Perry says that  
 when the redoubt was built  
 to the point - Indian's entrance may  
 to seem coming through it, but also  
 not say whether or not they are  
 or distance - if the latter, it would  
 seem to be a short time to the  
 that the distance of Indian  
 you make a complete surrounding  
 of the latter can be seen at  
 from the fact that the distance  
 later, if such they be, come directly  
 under the bank on the 24th  
 slope of bank this seems to support  
 evidence that the Indian cannot  
 also being below the bank; and  
 this coupled with the position of  
 the distance - on top of the  
 from point west of the point  
 seems to be pretty good evidence of  
 a later date for the distance.  
 The fossils of the Indian, as far as  
 present evidence, are of Indian



which do not belong below the Trenton horizon; the very great thickness of the rock - in which respect it resembles only the Ansoval Limestone of the Appalachian system, as much as it does not resemble formations of the Carboniferous 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 bed in the neighborhood of Monkton and Starkboro' 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;

which do not belong to the  
 horizon; the only great thickness of the  
 rock - in which respect it resembles  
 by the general appearance of the  
 rock system, as much as it does  
 resemble formations of the California  
 epoch, is also a point in favor of  
 giving it to that horizon; as the  
 the thickness of nearly thousands  
 feet as noted by Prof. Johnson to the  
 Pacific coast is not thought to  
 be remarkable so great, but at any  
 rate the true thickness must be con-  
 siderably less than six or seven thousand  
 feet. Then it shall have been  
 definitely determined whether the  
 system and position of the  
 same formation and the same rock  
 in the neighborhood of Portland and  
 Alaska, when they are together  
 and whether or this is the  
 same formation or even the same  
 there the matter will probably be  
 definitely settled. If it is of  
 age it might naturally be supposed  
 that some traces of the same  
 rocks would be found on top of it.



These Andover 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 Butte, look so much like the solian 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. Kildan.  
Aug. 1<sup>st</sup> 1868.

These studies were made in a very  
 distinguished manner under the direction  
 which after the publication of these  
 and others do not, unless they are  
 shown that of such kind, but so much  
 like the system as not to be really  
 better from it.  
 As I am already in the possession  
 of some of Mr. Tolson's and do not  
 wish to make a man of it  
 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 "obscure ground" when any of  
 your friends shall have been some what  
 more or less and valuable than it  
 is now. I will say that the way  
 that you of the last summer  
 has been of the greatest benefit to  
 us with - it being our idea of  
 practical bills work really!

Yours truly  
 J. P. Tolson  
 July 1st 1858.