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Bulletin 101

PALEONTOLOGY 16

GEOLOGY OF THE PENN YAN-HAMMONDSPORT QUADRANGLES

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BY

D. D. LUTHER

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New York State Education Department
Science Division, November 25, 1905

Hon. Andrew S. Draper
Commissioner of Education

DEAR SIR: I beg to communicate for publication as a bulletin of the State Museum the accompanying manuscript, entitled, *The Geology of the Penn Yan-Hammondsport Quadrangles*, with geologic maps of these areas on the topographic map scale.

Very respectfully yours
JOHN M. CLARKE
Director

Approved for publication November 28, 1905

A. S. Draper

Commissioner of Education

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New York State Education Department

New York State Museum

John M. Clarke Director

Bulletin 101

PALEONTOLOGY 16

GEOLOGY OF THE PENN YAN-HAMMONDSPORT QUADRANGLES

BY

D. D. LUTHER

All the formations represented on the area here considered belong to the Devonic system and except for a very minor part to the upper or Neodevonic division.

The following formations are present:

Neodevonic	Chautauquan	Chemung sandstone and shale
		Prattsburg shale
	Senecan	High Point (Portage) sandstone
		West Hill flags and shale
		Grimes sandstone
		Hatch shale and flags
		Rhinestreet black shale
		Cashaqua shale (including the Parrish limestone)
		Middlesex black shale
		Standish shale
		West River black shale
		Genundewa limestone
		Genesee black shale
		Tully limestone
Mesodevonic	Erian	Moscow shale

These are considered in order from bottom to top.

The old group terms commonly employed in combining the units represented in the above table have now entirely lost their value and hence do not appear here. In this and a previous paper the precise value of the geologic term *Chemung* is demonstrated and it now becomes a unit term in accordance with its original usage. Hence there is no place in the nomenclature for the expression *Chemung group*, and its use involves an objectionable duplication of terms. On previous occasions also it has been shown that the High Point sandstones of the area next west are continuous with the original Portage sandstones of the Genesee valley; hence we can not wisely employ the term *Portage group*. Likewise the Genesee shales have been restricted to the lower measures of the group passing under this name and in accordance with the original intention the term becomes a unit name. Study of the typical sections of the Hamilton shale in Madison county makes it equally clear that the name *Hamilton* will not be advisedly employed except as a unit and not as a group term.

Under the former grouping, the units here embraced under the term *Senecan* would be divided as follows from above down.

	High Point sandstones	contain Chemung fossils in Ontario county
	West Hill flags	
	Grimes sandstone	
Portage	Hatch shale	
	Rhinestreet shale	
	Cashaqua shale	
	Middlesex shale	
	Standish shale	
Genesee	West River shale	
	Genundewa limestone	
	Genesee shale	
Tully	Tully limestone	

MESODEVONIC

Moscow shale

The lowest formation exposed within the limits of these quadrangles is the Moscow shale, of which there are a few small outcrops of its upper beds along the Keuka lake outlet between the Seneca paper mills and the east line of the quadrangle, half a mile below.

In Bruce's gully, a mile farther east, 40 to 50 feet of the upper part, capped by the Tully limestone, at the top of the falls, are finely exposed in the sides and bottom of the ravine.

A vertical section of this entire formation is well shown in the gorge of Kershong creek at Bellona near the northeast corner of this quadrangle.

It is composed of a mass of mostly soft, light bluish, gray calcareous shales becoming darker toward the upper part. Thin layers of limestone usually extending but a few rods and irregular calcareous lenses, consisting principally of fossils, are of frequent occurrence.

Normally the Moscow shale rests upon a stratum of limestone formerly called the Encrinal limestone but now known as the Tichenor limestone from its favorable exposure at and near Tichenor point, Canandaigua lake. In Ontario county the shale formation has a

total thickness of 150 to 165 feet and the Menteth limestone, a stratum somewhat similar in character to the Tichenor and which has been sometimes mistaken for it, is interstratified 75 feet above the base. There are numerous exposures of the Moscow shale in central and western New York, among the most favorable of which eastward from this quadrangle are: along the east shore of Cayuga lake for 10 miles north of Ludlowville; in ravines and cliffs at the south end of Skaneateles lake and Otisco lake; in the Fellows Falls ravine 2 miles west of Tully, and at Tinker's falls near Fabius; and toward the west, in several ravines along both sides of Canandaigua lake between Tichenor point and Black point; along Little Beard's creek at Moscow; along Murder creek and Ellicot creek near Darien; along Smoke creek at Windom, Erie co., and on Eighteen Mile creek and the Idlewild and South Shore cliffs on Lake Erie at North Evans.

The characteristic fossils of the Moscow shale are listed in New York State Museum bulletin 63 to which the reader is referred.

NEODEVONIC

Tully limestone

The Tully limestone is a bed of hard, dark bluish limestone that on exposure is inclined to separate into small angular blocks. It overlies the Moscow shale from Gorham, Ontario co. on the west to Smyrna, Chenango co. on the east and is exposed on the Penn Yan quadrangle at Seneca Mills on the Keuka lake outlet at 600 A. T., where it produces a cascade 14 feet high.

Here it occurs in several heavy layers that aggregate 12 feet in thickness. Some are compact and durable, but a large portion of the limestone, throughout the entire line of outcrop, has a sharp, brittle texture and, after exposure, breaks easily into small angular fragments. The extreme western outcrop of the formation is on Gage's creek, 5 miles southwest of Gorham, Ontario co., and about 1 mile from Canandaigua lake. It is here 31 inches thick. It increases toward the east slowly to 28 feet at Tully, Onondaga co., and is not known east of Smyrna, Chenango co., where it consists of several thin layers separated by shales. It is abundantly exposed along both sides of Cayuga lake in the vicinity of Ludlowville and northward to King's Ferry and also on the east side of Seneca lake from Lodi Landing to Ovid.

It appears in two small undulations on the west side of Seneca lake and finally emerges from the water on the north side of Plum point. It is well exposed on the Keuka outlet, a mile below

the outcrop at the Seneca mill, previously mentioned, and it forms the crest of the fall at Bellona. Fossils are usually found abundantly in one or more layers at nearly all outcrops but the fossiliferous layers are not the same at all localities, and a large portion of the rock is almost barren.

At Bellona the two upper layers are to a large extent made up of corals, many of them of great size.

The characteristic fossils of the horizon are: Hypothyris cuboides Sowerby and Schizophoria tulliensis Hall, with many species from the lower beds [*see* Mus. bul. 63].

Genesee black shale

Lying next above the Tully limestone is a mass of densely black bituminous shale that on exposure becomes very fissile and splits into thin flat plates.

Owing to their rigidity these shales are traversed by parallel series of joints from an inch to 3 feet apart intersecting each other at different angles and producing in cliff exposures striking effects like buttresses and bastions, and on surface exposures tessellations, triangles, rhomboids, diamonds and kindred forms.

Rows of spheric concretions and thin calcareous layers occur, specially in the lower beds, and nodular masses of iron pyrites are common throughout the formation. Thin flags of sandstone appear in the upper part at some localities but they are not continuous.

The Genesee shale is abundantly exposed in the cliffs along the Keuka outlet between Keuka Mills and Seneca Mills and along the south branch of Kershong creek in the northeast corner of the Penn Yan quadrangle.

On these quadrangles this formation is about 100 feet thick. It diminishes gradually toward the east and disappears near Smyrna, Chenango co., and also toward the west, running out entirely in the town of East Hamburg, Erie co. It however reappears and is 12 inches thick on the shore of Lake Erie, 13 miles farther southwest at the mouth of Pike creek.

The entire formation is exposed in numerous ravines and cliffs along the shores of Canandaigua, Seneca and Cayuga lakes and in the Genesee valley in Fall Creek ravine and in the ravine of Little Beard's creek at Moscow, but not directly upon the banks of the Genesee river.

Fossils are rare and poorly preserved in this shale. Lignites and conodont teeth occur very sparingly in the densely black beds

and the lighter shales carry a few specimens of Styliolina fissurella Hall; Liorhynchus quadricostatum Hall; Pterochaenia fragilis Hall; Probeloceras lutheri Clarke; Lingula spatulata Vanuxem; Bactrites aciculum Hall; Orbiculoidea lodensis Hall; Pleurotomaria rugulata Hall.

Genundewa limestone

On the next quadrangle at the west and thence continuously to Lake Erie the Genesee black shale is overlain by a band of thin limestone composed almost entirely of the shells of a minute pteropod, Styliolina fissurella and designated the Genundewa limestone from its favorable exposure at Genundewa Point on Canandaigua lake. The horizon of this limestone is entirely covered by drift in the western part of the Penn Yan quadrangle and in the eastern part the limestones are not found although there are a few exposures of the horizon.

There is, however, a small outcrop of this rock in a small ravine on the east side of the Potter swamp, 1½ miles north of the north line of this quadrangle and another 1 mile south of Fir Tree point on the west side of Seneca lake, 6 miles north of Watkins. On the west side of Seneca lake the horizon is plainly marked by a band of light gray calcareous shale 6 to 8 feet thick in which large flat concretions are common and near Fir Tree point form a continuous layer. The representative fossils of the Genundewa limestone are abundant in the concretions and they also contain a number of additional species. The latter are in strong contrast to those of the preceding rocks and mark an invasion of an entirely new congeries of organisms into this region.

This gray band may also be traced along the east side of Seneca lake and on both sides of Cayuga lake. It is finely displayed in the west bank of Salmon creek near the forks 2 miles south of Genoa. This formation is described and its interesting fauna cited in full in Museum memoir 6.

West River black shale

The West River shale, formerly known as the Upper Genesee shale, is composed of fine bluish black or dark gray shale with a thin layer of black slaty shale at intervals of a few feet. Spheric and oblong concretions, many of which are septaria, are common throughout the beds singly or in rows and thin sandy flags occur specially in the upper part.

These shales are contrasted with the Genesee shales below by their lighter color and less bituminous character, being mostly highly fissile and breaking into thin sharp laminae.

The concretions are highly characteristic of these beds and in the region of their outcrop have been collected extensively on account of their curious shapes suggestive of turtle backs, human skulls and other rounded objects. Fossils are common but nowhere abundant. Fine specimens are occasionally found in the concretions.

The following species occur in the beds:

Bactrites aciculum *Hall*
Gephyroceras *sp.*
Pleurotomaria rugulata *Hall*
Buchiola retrostriata *v. Buch.*
Panenka *sp.*
Pterochaenia fragilis *Hall*
Lunulicardium curtum *Hall*
Lingula spatulata *Vanuxem*
Orbiculoidea lodensis *Vanuxem*

The West River shale is exposed on the Penn Yan quadrangle at the mouth of the Sartwell ravine 1 mile south of Penn Yan; also in a small ravine on the north side of the Keuka outlet 1 mile east of Penn Yan and on the east side of the Potter swamp along the road leading eastward to Voak.

Other good exposures may be found in the ravine of Plum creek below Himrods; along the shore of Seneca lake at Smith's point in the town of Starkey, and at Faucetts point 1 mile farther north on the east side; in the Goodrich and other ravines in West River valley in the town of Middlesex; in several larger ravines on the sides of Canandaigua lake from Seneca point southward; in ravines along the sides of Conesus lake; in the cliffs at the mouth of the Genesee River gorge at Mt Morris; in the ravine at Griswold 6 miles west of Attica and on the shores of Lake Erie near the mouth of Pike creek in the town of Evans, Erie co.

On the western border of this quadrangle the West River shale has a thickness of 110 feet and is overlain by a lighter colored and somewhat arenaceous band known as the Standish shales and flags, which are succeeded by a heavy bed of black shales called the Middlesex shales.

By a gradual change in the character of the sedimentation the identity of these formations is lost before reaching the exposures of their horizons in the northeastern part of this quadrangle, the Standish flags being eliminated from the rock section and the Middlesex black shale appearing, if at all, only as a few feet of darker and more bituminous shale at the top of the West River shales not separate from the latter formation, and the upper limit of the West River shale is not well defined.

On the map a thickness of 100 feet is assigned to this formation. It is 65 feet thick on the Genesee river and 11 feet on Lake Erie.

In the cliffs on the eastern shore of Cayuga lake, 4 miles north of Ithaca, the beds of this horizon are dark to black barren shales, next below the heavy sandstone that is in that locality the lowest member of the Portage group and about 35 feet thick.

The Standish flags and shales, 15 feet thick, at the base of the Portage beds along Canandaigua lake and in the Middlesex valley are not accessible on this quadrangle. The formation is described in Museum bulletin 63.

Middlesex black shale

This is a well defined band of bituminous black shale overlying the West River shale and exposed in many outcrops in the Middlesex valley 2 to 5 miles west of this quadrangle, and farther west to Lake Erie. It is 35 feet thick in the Middlesex valley and diminishes to 6 feet on Lake Erie in the town of Evans, Erie co.

There are no favorable exposures of this formation on this quadrangle. It can be recognized in a few small outcrops on the east side of the Potter swamp in the vicinity of Voak, and at the mouth of the Belknap gully at Guyanoga.

The formation is fully described in Museum bulletin 63.

Cashaqua shale

The Cashaqua shale is a heavy mass of light bluish gray or olive shales and sandstone appearing as the surface rock over a large area in the north part of the Penn Yan quadrangle and outcropping in the ravines and cliffs along the sides of both branches of Keuka lake and as far south as 1 mile north of Hammondsport on the west side and to a point opposite the village on the east side. At the base in the western part of the quadrangle there are 75 feet of laminated, rather sandy shales and thin flaggy sandstones that are succeeded by alternating beds of heavier, more compact sandstones and soft argillaceous shales containing calcareous concretions, and, toward the south, more or less continuous concretionary calcareous layers. The entire formation becomes more arenaceous and less calcareous from west to east, but the upper beds on this quadrangle retain to a large degree the character and appearance of the beds in this horizon exposed along Cashaqua creek in Livingston county, the type locality of the formation, except that the sandstones are much heavier. One of the lowest of these com-

pact layers has been quarried extensively in Cornwells gully, in the north part of Penn Yan and along the upper part of the Sartwell ravine 1 mile south of that village.

These sandstones are broad lentils, usually becoming thinner and pinching out entirely in one direction and in the opposite after extending a considerable distance of perhaps several miles losing thickness by becoming shaly in the upper or lower part.

They are the most prominent features in the stratigraphy of the formation and by their superior resistance to the eroding power of the streams as contrasted with the soft shales in the ravines have produced the numerous cascades and waterfalls that contribute so largely to the beauty of the scenery in the region about Keuka lake.

In the Cashaqua shale is the

Parrish limestone

This limestone is interstratified in the Cashaqua shales 25 feet below the top in the western part of the Penn Yan quadrangle, but the shale intervening between it and the overlying Rhinestreet shale thins out rapidly toward the south and east and disappears entirely a few miles beyond the east line of the Hammondsport quadrangle.

This peculiar formation is an impure concretionary limestone which, in the Parrish gully near Naples, is 4 inches thick and is rich in goniatites and other cephalopods. It does not extend west of the Naples valley but increases toward the east and south and reaches its greatest development, so far as exposed, about the head of Keuka lake. It is 6 inches thick in the gully at Friend, 10 inches in the Belknap gully at Guyanoga and in Wagener gully near Pulteney 1 foot, 6 inches. In the ravine at Gibson Landing at 290 feet above the lake it is in four layers aggregating 2 feet, 6 inches. It dips under the water on the west side of the lake 50 rods south of Oak point and on the east side a mile farther south and directly opposite Hammondsport. In the small ravine on the east side at Rye point it is 100 feet above the lake, in the large ravine opposite Glen Grove 165 feet and in another, opposite Urbana, it is 6 inches thick and forms the crest of a 25 foot fall 211 feet above the lake level. It doubtless extends some distance farther north and east but changes in character to a calcareous nodular shale that does not resist erosion and rarely appears in outcrops. In Hewitts glen, 5 miles south of Penn Yan, it occurs as a shaly and lumpy limestone at 1000 A. T.

It is exposed in the Big Stream gorge west of the Northern Central Railroad bridge, where it is a band of thin limestones and shales 5 feet thick overlain by the Rhinestreet black shale, the intervening light shales having thinned out and disappeared. Fossils are much less common in the Parrish limestone, on this quadrangle than in the Naples valley.

Manticoceras pattersoni Hall, Tornoceras uniangulare Conrad, Probeloceras lutheri Hall and Orthoceras pacator Hall are the more common cephalopods and Styliolina fissurella Hall is abundant.

The Cashaqua beds are 230 feet thick on the Naples quadrangle. They are increased toward the north and east by the assimilation of the upper part of the Middlesex shales and lose by the thinning out of the soft shales between the Parrish limestone and the Rhinestreet shale. The formation reaches its greatest thickness, 250 feet, in the region northwest of Penn Yan, and, decreasing gradually toward the southeast, is 207 feet thick in the vicinity of Watkins. Fossils are rare in the lower part of the Cashaqua beds, but occur in considerable numbers in a few layers, mostly in the upper part, of soft light colored shales. The fauna in this vicinity consists of species of 4 crustaceans, 16 cephalopods, 5 pteropods, 12 gastropods, 25 lamellibranchs, 4 brachiopods, 1 coral, 1 crinoid, 3 plants.

The more common of these fossils are:

Spathiocaris emersoni *Clarke*
Manticoceras pattersoni *Hall*
Probeloceras lutheri *Clarke*
Tornoceras uniangulare *Conrad*
Hyolithus neapolis *Clarke*
Phragmostoma natator *Hall*
Loxonema noe *Clarke*
Paleotrochus praecursor *Clarke*
Pterochaenia fragilis *Hall*
Buchiola retrostriata *v. Buch.*
Ontaria suborbicularis *Hall*
O. clarkei *Beushausen*
Lunulicardium acutirostrum *Hall*
L. ornatum *Hall*
L. hemicardioides *Clarke*
Honeoyea major *Clarke*
H. erinacea *Clarke*
Aulopora annectens *Clarke*

Plumalina plumaria is common in a 5 inch layer of shaly sandstone exposed in a small ravine west of the rock cut of the Northern Central Railroad 2½ miles southeast from Penn Yan. See Museum bulletin 63 for full list of fossils.

Rhinestreet shale

This formation is a bed of black shale that overlies the Cashaqua shale from the Seneca lake valley where it is but 1 foot thick to the shore of Lake Erie in the town of Evans, Erie co., where it attains a thickness of 185 feet. It is 3 feet thick on the east line of these

quadrangles and 15 feet on the western. In the exposure of this horizon in the Big Stream ravine it rests directly upon the Parrish limestone, but westward across these quadrangles a rapidly thickening bed of light shales intervenes and on the west side of Keuka lake it is 20 to 25 feet above that limestone and in the Naples valley 50 feet above it.

East of the Genesee valley this formation is composed almost entirely of densely black bituminous shales, but farther west it includes several layers of lighter shales that contain a few of the fossils of the Cashaqua shales and rows of large spheric concretions. Fossils are exceedingly rare in the black shales but beds of land plants forming thin seams of lignitic coal are seen occasionally.

The following species have been identified from the Rhinestreet shale in this vicinity.

Paleoniscus devonicus *Clarke*
Acanthodes pristis *Clarke*
Polygnathus dubius *Hinde*
Prioniodus spicatus *Hinde*
P. erraticus *Hinde*
Spathiocaris emersoni *Clarke*
Lunulicardium velatum *Clarke*
Pterochaenia fragilis *Hall*
Leptodomus multiplex *Clarke*
Lingula ligea *Hall*

The Rhinestreet shale is well exposed in the ravine at Friend; in the Belknap gully at Guyanoga; in the Wagener ravine at Pulteney; at 1000 feet A. T. in the small ravine 1 mile east of South Pulteney; in the Urbana ravine; along the lake shore south of Oak point and along the east side of the lake opposite Hammondsport, also in the Rye Point and other ravines farther north to Grove Springs.

In the region between Grove Springs and Crosby the Cashaqua shales and the lower beds of the Hatch flags and shales have an unusually large proportion of bituminous matter and the Parrish limestone does not appear. This condition together with considerable undulations of the strata makes identification of the horizon of the Rhinestreet bed somewhat uncertain, but its position is, approximately at least, as indicated on the map.

Some of the best exposures of the Rhinestreet shale west of these quadrangles are along Rhinestreet and in Parrish gully at Naples; in Buck Run ravine at Mt Morris and in the Genesee River gorge in Smoky Hollow; in the ravine at Griswold 6 miles west of Attica; in the Eighteen Mile Creek gorge at North Evans; and along Big Sister creek below Angola, Erie county.

The limits of the remaining formations shown on this map, though well defined on the Naples quadrangle, are very obscurely so on the Hammondsport and Penn Yan quadrangles.

Lithologically they all have the same general character and appearance except as to the proportion of sandy sediments to the argillaceous and this is nowhere constant even in the same horizon. Very little assistance can be obtained in the determination of horizons from the fossils of these beds, specially in the Hatch shales and flags, for this is in the region, though on its western border, where extensions of the Naples fauna from the west and the Ithaca fauna from the east succeed each other, or are intermingled in a few thin layers. Correlation is therefore more a labor of careful tracing of formations from the type localities in the Naples valley than of detailed study of vertical sections.

Undulations of the strata cause frequent changes in the dip and make accurate measurements of the thickness of formations well-nigh impossible. The figures given for these upper divisions are therefore estimates or arbitrarily assigned.

Hatch shale and flags

This formation is composed principally of shales, mostly soft and light blue or olive in color, but with frequent intercalations of layers of black shale from a fraction of an inch to 4 feet in thickness. Flags and thin sandstones are liberally though very irregularly distributed throughout the beds but appear more frequently in the middle and upper parts. These sandstones vary from an inch to 2 feet thick and are usually compact and hard on the lower surface but become shaly on the upper side. Some of them are laminated and on exposure separate into thin plates. Layers of this character occur in the Cashaqua shale and in all the formations on these quadrangles above the Rhinestreet shale.

The lower beds of the Hatch shale and flags are very much like the Cashaqua beds in appearance but in the upper part the changes from dark to light and hard to soft are more pronounced and in many old exposures the frequent flags projecting beyond the softer shales produce a coarsely stratified appearance.

The proportion of sandstones is much greater at some outcrops than at others in the same horizon. The formation is 300 feet thick on the western border of these quadrangles and increases slowly toward the southeast. It is the surface rock over a large area in the Penn Yan quadrangle but appears to be somewhat thinner and softer in the more northern exposures. It is well exposed in the upper part of the ravines at Friend; the Belknap gully at Guyanoga; the Wagener gully at Pulteney. The upper beds may be seen in the large ravine in the western part of Hammondsport and at that

half a mile south of the village, also in the side of the dugway road on the east side of the lake and in the Rye point and other ravines farther north.

It outcrops in the road ½ mile southwest of Wayne and along the Bailey Gully stream and the highway a mile farther southwest. The drift sheet is thin over the large area where this is the surface formation, and small exposures are frequent along the sides of the roads and in the numerous small gullies on the hillsides.

The Hatch shale and flags are abundantly exposed along the foot of Hatch hill at Naples, resting upon the Rhinestreet shale and capped by the Grimes sandstones, also in the Genesee River gorge from Smoky Hollow to the mouth of Wolf creek. They are softer and more calcareous in the vicinity of Lake Erie where they may be seen to good advantage in the ravine of Big Sister creek between Angola and Pontiac, and along the lake shore near Silver creek. On the Naples quadrangle the fossils occurring in the Hatch shale are all representations of the Cashaqua shale or Naples fauna, but much less in numbers. The following species may be found in the lower beds on this quadrangle:

Manticoceras pattersoni *Hall*
Probeloceras lutheri *Clarke*
Bactrites
Paleotrochus praecursor *Clarke*
Lunulicardium ornatum *Hall*
Honeoyea desmata *Clarke*
Buchiola retrostriata *v. Buch.*

On the Watkins quadrangle, adjoining on the east, a few representatives of the Ithaca fauna are found in the Hatch shale and flags. They are exceedingly rare here, though broken fragments of brachiopods too small for identification appear in some of the more calcareous sandstones.

At 1250 A. T. in the Belknap gully a 6 inch sandstone contains:

Spirifer mucronatus *Conrad var.* posterus *Hall & Clarke*
Schizophoria impressa *Hall*
Productella lachrymosa *Hall*
Crinoid stems

Grimes sandstone

This formation is lithologically distinguished from the Hatch shale and flags only by the much larger proportion of arenaceous matter and consists of light blue-gray sandstones in layers from an inch to 3 feet thick separated by thin layers of hard, blue shale. The change in the proportion of sandstone and shale is very gradual at the bottom and also at the top of the formation, consequently its limits are very obscurely defined. This condition obtains throughout the entire extension of this formation across the western part of

the State and is much emphasized east of the Naples quadrangle. The estimated thickness of the Grimes sandstones on these quadrangles is 75 feet. It is not of great importance here except as a bench mark but at Naples it is a prominent feature in the stratigraphy of the Portage rocks, producing high falls in the Grimes, Tannery and Parrish gullies, and escarpments on the hillsides. It is important there also as marking the close of the period during which sediments carrying the Naples fauna were laid down, and containing the earliest representatives of the Ithaca fauna in that locality.

On the Watkins and Elmira quadrangles those faunas are intermingled in these beds, and it is probable that the same condition obtains here.

The following species have been found in the horizon of the Grimes sandstones in the western part of the Penn Yan quadrangle or at Naples:

Protonympha devonica *Clarke*
Schizophoria impressa *Hall*
Productella spinulicosta *Hall*
P. lachrymosa *Hall*
Spirifer mesacostalis *Hall*
Atrypa spinosa *Hall*
Liorhynchus mesacostale *Hall*
L. quadricostatum *Hall*
Leptostrophia mucronata *Vanuxem*
Chonetes lepidus *Hall*
Ambocoelia umbonata *Conrad*
Dictyospongia haplea *Hall & Clarke*
Orbiculoidea *sp.*
Paropsonema cryptophyum *Clarke*

The horizon is exposed on the Watkins quadrangle along the Johnson Hollow creek, 1 mile west of Lower Pine valley and there contains: Manticoceras pattersoni Hall; Orthoceras sp.; Buchiola retrostriata von Buch; Phragmostoma natator Hall; Paleoneilo filosa Conrad; Nuculites oblongatus Conrad; Grammysia sp., together with Orthis tioga Hall; Chonetes scitulus Hall; Schizophoria impressa Hall and Productella spinulicosta Hall.

There are good exposures of the Grimes sandstones in the ravine in the western part of Hammondsport and that 1 mile south of the village; also in the upper part of the Wagener ravine.

Besides the exposures mentioned at Naples the Grimes sandstones may be seen in the cliffs at St Helena and at the mouth of Wolf creek in the Genesee River gorge and along the shore of Lake Erie between Silver Creek and Dunkirk.

West Hill flags and shales

The rock of this division consists of numerous thin, uneven flags, 2 to 4 inches thick and occasionally compact, even, blue sandstones

1 to 2 feet in thickness, separated by blue or olive shales. Layers of black shale from an inch to 2 or 3 feet thick also occur.

The proportion of sandstone decreases toward the east and south.

Fossils are common in several of the heavier layers of sandstones lying 100 to 150 feet above the Grimes sandstones. In a small ravine that crosses the road leading to North Urbana 1 mile east of Hammondsport, there is exposed 40 rods above the crossing a calcareous lens 1 foot, 6 inches thick and several rods long almost entirely composed of brachiopods and crinoid segments, and several sandstones in the same horizon in the ravine 1 mile south of Hammondsport contain the same species. The more common are:

Goniatites
Orthoceras *sp.*
Leptodesma *sp.*
Orthis tioga *Hall*
Schizophoria impressa *Hall*
Stropheodonta cayuta *Hall*
Leptostrophia perplana *Conrad var.* nervosa *Hall*
Atrypa spinosa *Hall*
Productella lachrymosa *Hall*
Ambocoelia umbonata *Conrad*
Spirifer mesacostalis *Hall*
Cyrtina hamiltonensis *Hall*
Orbiculoidea *sp.*
Crinoids

On the Hammondsport and Naples quadrangles the fossils of the West Hill flags and shales are mostly brachiopods, but in the Genesee river section and westward the fauna of the Naples beds prevails and brachiopods are absent.

The West Hill flags and shales are exposed at the upper end of the ravine ¼ mile south of Friend; the Belknap gully and the Wagener gully; and in field and roadside outcrops on the hill north of Hammondsport. The fossiliferous sandstones of this formation produce a series of low cascades in the ravine 1 mile south of Hammondsport at 1150 to 1200 A. T., and an exposure of the same horizon in the ravine near the corner of the Urbana road 1 mile east of Hammondsport includes the calcareous lens previously mentioned. There are frequent small outcrops of the West Hill flags at North Urbana and along the road to Wayne and the ravine at Bradford is in the softer beds in the middle of this division. There are extensive exposures of this formation on West hill at Naples and on East hill at Dansville. It is the upper part of the Gardeau flags in the Genesee river section and includes the strata displayed in the cliffs between the mouth of Wolf creek at St Helena and the high bridge of the Erie Railroad at the top of the Upper Portage falls.

It appears in the cliffs along the shore of Lake Erie between Dunkirk and Barcelona. It is softer here and includes some heavy beds of black shale.

High Point sandstone

In structure and appearance the formation designated the High Point sandstone is on these quadrangles a repetition of the Grimes sandstone on a slightly enlarged scale. It is an arenaceous band about 100 feet thick, in which the sandy layers are from 1 inch to 3 or 4 feet thick and the separating shales have the same range as to thickness and vary from light blue to black. The sandstones are somewhat lighter colored than those below and weather to a light gray except some calcareous layers that become rotten and rusty on exposure.

The proportion of sandstone increases toward the west to the Genesee river where the formation is 185 feet thick and the proportion of shale is very slight. In the Genesee river section and westward to Lake Erie where it has gradually diminished to a few feet in thickness it is almost barren of fossils and no brachiopods have been found in it.

At Naples, the typical exposure, the sandstones project from near the top of the formidable cliff at High Point and include a large calcareous lens composed of Chemung brachiopods and crinoids. The formation has been traced from Naples eastward and across these quadrangles to the vicinity of Elmira where lenses of similar character and appearance to the one at High Point are of frequent occurrence in it. The fossil contents of these lenses are exceedingly variable, no two of them being composed of the same species.

The High Point sandstones are exposed in a small ravine $1\frac{1}{4}$ miles northeast of Italy Hill and a calcareous lens outcrops three quarters of a mile north of that village. Small outcrops and a thin lens occur near the east and west road over the hill 2 miles north of Hammondsport. The sandstones outcrop at North Urbana and at Wayne Four Corners, also in a ravine and along the roadside 2 miles north of Sonora; near the mouth of the ravine 1 mile east of Savona and along a small stream that flows into Mead creek 1 mile north of Monterey.

They are exposed in the quarries on East hill at Elmira and show an extensive calcareous lens.

West of the Genesee river they outcrop near Rock Glen in the Oatka valley and in Chautauqua county at Forestville, Laona and Brocton. The horizon, with the sandstones almost entirely eliminated, dips under the water of Lake Erie 3 miles north of the State line. Fossils are not very abundant on these quadrangles except in the calcareous masses.

The following are the more common species:

Lyriopecten tricostatus *Vanuxem*
Grammysia *sp.*
Spirifer mesastrialis *Hall*
Sp. mesacostalis *Hall*
Atrypa reticularis *Linné*
Productella lachrymosa *Hall*
P. speciosa *Hall*
P. boydi *Hall*
Orthis tioga *Hall*
O. carinata *Hall*
Schizophoria impressa *Hall*
Stropheodonta cayuta *Hall*
Leptostrophia perplana *Conrad var.* nervosa *Hall*
Orthothetes chemungensis *Conrad*
Tropidoleptus carinatus *Conrad*
Liorhynchus mesacostale *Hall*
Chonetes scitulus *Hall*
Lingula *cf.* melie

Prattsburg shales and flags

Above the High Point sandstones there is a partial return to argillaceous conditions and for about 250 feet the beds are mostly shales or thin, uneven, blocky or shaly sandstones. A few of the sandy layers are compact and hard and others are schistose or straticulate.

In the Genesee river section at Wiscoy and vicinity these beds are soft, shaly and somewhat calcareous and contain only Portage fossils but eastward from that point they are harder and in the town of Prattsburg and on these quadrangles they contain many Chemung and very few Portage fossils. Toward the southeast they become softer again and at Elmira there is an approach to the conditions at Wiscoy.

Although this formation is the surface rock over large areas on these quadrangles, outcrops that show more than a very few feet of the strata are rare owing to its elevation above the more deeply excavated parts of the ravines, except near the southern border where the drift mantle is quite heavy.

It is partly exposed in the ravine 1 mile east of Savona and in another 2½ miles south of that village, also in a ravine and along the roadside 2 miles north of Sonora.

The more common fossils of the Prattsburg shales and sandstones are:

Paleoneilo filosa (*Conrad*) *Hall*
P. constricta (*Conrad*) *Hall*
Lyriopecten tricostatus *Vanuxem*
Pterinopecten imbecilis *Hall*
Macrodon chemungensis *Hall*
Mytilarca carinata *Hall*
Grammysia circularis *Hall*
Leptodesma potens *Hall*
L. maclurii *Hall*
L. spinigerum *Conrad*
L. robustum *Hall*
L. interplicatum
Spirifer mesastrialis *Hall*
S. mesacostalis *Hall*
Productella lachrymosa *Conrad*
P. hirsuta *Hall*
P. speciosa *Hall*
Liorhynchus mesacostale *Hall*

L. multicosta *Hall*
Atrypa reticularis *Linné*
A. hystrix *Hall*
Schizophoria impressa *Hall*
Orthis tioga *Hall*
O. carinata *Hall*
Stropheodonta cayuta *Hall*
Leptostrophia perplana *Conrad var.* nervosa *Hall*
Stropheodonta demissa *Conrad*
Orthothetes chemungensis *Conrad*
Camarotoechia eximia *Hall*
Ambocoelia umbonata *Conrad*
Lingula spatulata *Hall*

Chemung sandstones

The Chemung sandstones and shales as defined in Museum bulletin 81 are the surface rocks over the high lands in the southern part of the Hammondsport quadrangle, attaining in the extreme southeast corner in the town of Hornby a thickness of 560 feet.

They are almost entirely covered by a thin mantle of drift or disintegrated shale and sandstone, the few exposures being mostly the results of grading the highways. They are, however, uncovered sufficiently to show that, structurally, the formation is an aggregation of light and dark shales and blue gray sandstones, much like the West Hill flags and shales, except that many of the sandstones are laminated or schistose and light gray or almost white in color. Calcareous lenses like those previously mentioned are more frequent and usually more extensive than those below.

Fossils are abundant at all horizons and in nearly all outcrops of these beds, the more common species in this region being:

Leptodesma longispinum *Hall*
L. billingsi *Hall*
L. shumardi *Hall*
L. spiniger (*Conrad*) *Hall*
L. disparile *Hall*
L. matheri *Hall*
Paleoneilo filosa (*Conrad*) *Hall*
P. constricta (*Conrad*) *Hall*
P. emarginata (*Conrad*) *Hall*
Lyriopecten tricostatus *Vanuxem*
Microdon *sp.*
Liopteria chemungensis *Vanuxem*
Mytilarca simplex *Hall*
Grammysia *sp.*
Pterinea chemungensis (*Conrad*) *Hall*
Spirifer mesacostalis *Hall*
S. marcyi *Hall*
S. disjunctus *Sowerby*
S. mucronatus *var.* posterus *Clarke*
Productella lachrymosa *Hall*
P. onusta
P. hystricula
Liorhynchus mesacostale *Hall*
L. globuliforme *Vanuxem*
Atrypa reticularis *Linné*
A. spinosa *Hall*
Orthis tioga *Hall*
O. carinata *Hall*
Schizophoria impressa *Hall*
Stropheodonta cayuta *Hall*
Leptostrophia perplana *Conrad var.* nervosa *Hall*
Leptostrophia mucronata *Vanuxem*
Athyris polita *Hall*
Orthothetes chemungensis *Conrad*
Camarotoechia eximia *Hall*
C. contracta *Hall*
Ambocoelia umbonata *Conrad*

UNDULATIONS OF THE STRATA

The aggregate thickness of the geologic formations and parts of formations represented on the map of the Penn Yan and Hammondsport quadrangles is approximately 2187 feet, of which 1535 feet are surface rocks by reason of the difference in elevation between the point where the east line of the Penn Yan quadrangle crosses Keuka outlet 525 feet A. T. and the extreme southeast corner of the Hammondsport quadrangle which is 2065 feet A. T. The total amount of the southward dip in the 34 miles across the two quadrangles from north to south is about 652 feet, an average of a fraction less than 20 feet a mile.

The inclination of the strata is not constant in any direction except for short distances, and there are evidences of more or less disturbance throughout the whole of the area covered by the map.

The sandstones of the beds that cover the southern part of the Hammondsport quadrangle are not reliable as bases for accurate determination of the size, shape and direction of the folds and undulations except in a general way. In the rock cut along the Northern Central Railroad 2½ miles southeast of Penn Yan a compact sandstone 2 feet thick is exposed that is probably synchronous but not continuous with a stratum of similar character that appears at the mouth of Watkins Glen and the one assumed as the base of the Portage beds at Ithaca.

In this cut the sandstone shows a strong dip toward the west, but at the west end it is 840 feet A. T. and in the Sartwell gully 2 miles farther west it appears at 880 feet A. T., 40 feet higher. It descends between this point and the quarry in the Cornwall ravine, 1½ miles northwest, 35 feet and in the quarry dips northwestward at the rate of 52 feet a mile.

The Tully limestone, from its outcrop at Seneca Mills, dips southeastward to Plum point on Seneca lake at the average rate of 26 feet a mile and rises toward the north to Bellona at the rate of 16 feet a mile. Estimates based on other outcrops of the Tully 1 mile east of that at Seneca Mills, where there is evidence of a considerable fault or very sharp fold, would give altogether different results.

The strata show more disturbance in the region about Penn Yan than elsewhere on these quadrangles, and small anticlines or downthrusts may be seen in nearly every ravine or outcrop in the vicinity.

In a ravine on the west side of the lake 3 miles southwest from Penn Yan at about 100 feet above the lake, a 4 foot sandstone that crosses the ravine is much broken and shows a diagonal fault or

downthrow toward the southeast of 9 feet. In the ravine at Crosby the sandstones dip toward the southwest at the rate of 100 feet a mile.

The western side of the high ridge that separates Keuka lake and Seneca lake shows at all exposures a strong dip toward the west, that reaches in the north part of the quadrangles as far as the Naples valley. The dip is reversed in part at least on the Seneca lake side of the ridge as may be seen in the lower part of the Plum Creek ravine below Himrods where the strata dip toward the east for nearly a mile at the rate of 100 to 200 feet a mile. The Parrish limestone is exposed in a series of outcrops on the west side of the Keuka lake valley between Friend and Hammondsport, a distance of 13 miles on a nearly north and south line. In the ravine at Friend the limestone outcrops at 1095 feet A. T. and descends southward 45 feet or 18 feet a mile to the Belknap gully where it is 1050 feet A. T. This latter exposure is 11 miles directly east of the one in the Lincoln gully at Naples and 300 feet higher, an average descent toward the west of 27 feet a mile.

From Belknap gully to the road leading west from Gibson Landing, which it crosses at 1005 feet A. T., the limestone descends 45 feet in 9 miles, a southward dip of 5 feet a mile, and from this outcrop south and a little west to Oak point, where it disappears under the lake, it descends 296 feet in 6 miles, an average of 49 feet a mile. Owing to the western dip it is above the water about $1\frac{1}{4}$ miles farther south on the east side than on the west.

From the place of its emergence on the east side of the lake to its outcrop in the ravine on the east side opposite Urbana, the distance is 4 miles and the direction northeast. Between these points the limestone rises 165 feet or 41 feet a mile. The place where the limestone dips under the water opposite Hammondsport is $10\frac{1}{2}$ miles east and 14 miles south of the place where it is at the same elevation, 709 feet A. T. at Naples.

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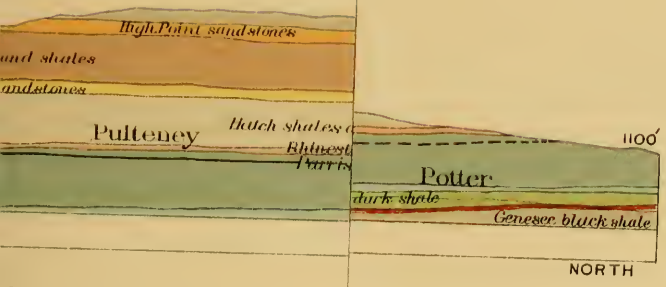

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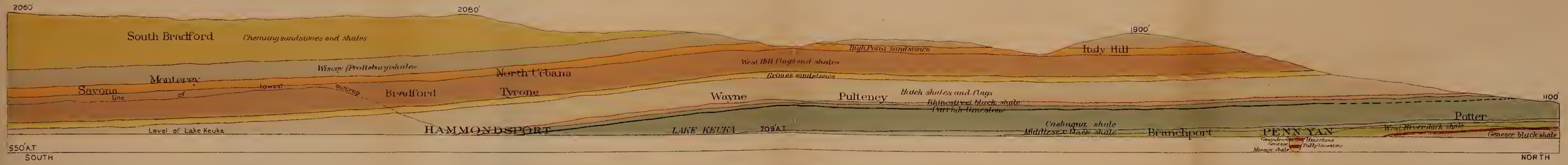


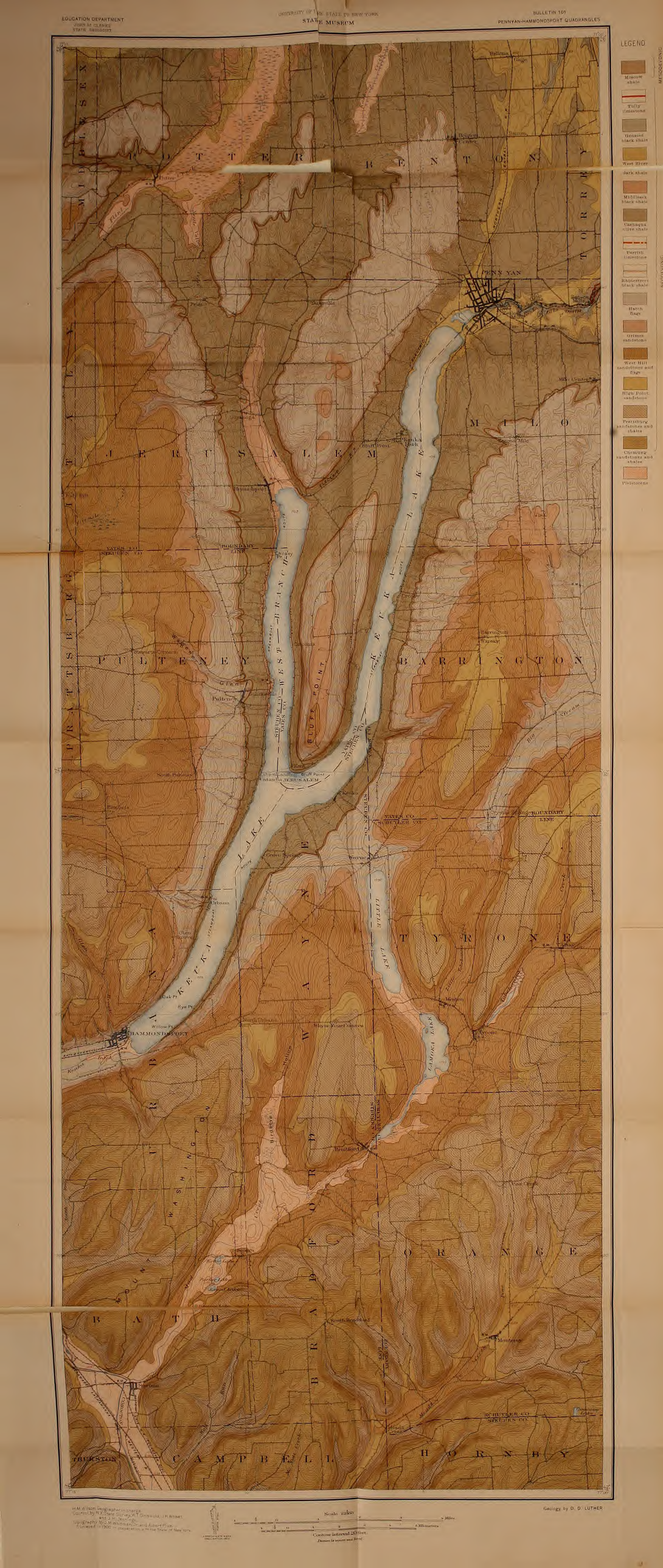
PENN YAN-HAMMONDSPORT QUADRANGLES

North and south section

EDUCATION DEPARTMENT
JOHN M. CLARKE
STATE GEOLOGIST

UNIVERSITY OF THE STATE OF NEW YORK
STATE MUSEUM

BULLETIN 101
PENNYAN-HAMMONDSPORT QUADRANGLES



H.M. Wilson Geographer in charge
Control by N.Y. State Survey, W.F. Reynolds, J.H. Wheat and J.H. Hastings
Topography by C.M. Wilmarth, Richard Abbe and Staff
Surveyed in 1900, in cooperation with the State of New York

Scale 1:62500

Contour interval 20 feet
Datum is mean sea level

Geology by D. D. LUTHER

New York State Museum

JOHN M. CLARKE, Director

PUBLICATIONS

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Museum annual reports 1847–date. *All in print to 1892, 50c a volume, 75c in cloth; 1892–date, 75c, cloth.*

These reports are made up of the reports of the Director, Geologist, Paleontologist, Botanist and Entomologist, and museum bulletins and memoirs, issued as advance sections of the reports.

Director's annual reports 1904–date.

These reports cover the reports of the State Geologist and of the State Paleontologist. Bound also with the museum reports of which they form a part.

Report for 1904. 138p. *20c.* Report for 1905. 102p. 23pl. *30c.*

Geologist's annual reports 1881–date. Rep'ts 1, 3–13, 17–date, O; 2, 14–16, Q.

In 1898 the paleontologic work of the State was made distinct from the geologic and was reported separately from 1899–1903. The two departments were reunited in 1904, and are now reported in the Director's report.

The annual reports of the original Natural History Survey, 1837–41, are out of print.

Reports 1–4, 1881–84, were published only in separate form. Of the 5th report 4 pages were reprinted in the 39th museum report, and a supplement to the 6th report was included in the 40th museum report. The 7th and subsequent reports are included in the 41st and following museum reports, except that certain lithographic plates in the 11th report (1891) and 13th (1893) are omitted from the 45th and 47th museum reports.

Separate volumes of the following only are available.

Report	*Price*	*Report*	*Price*	*Report*	*Price*
12 (1892)	$.50	17	$.75	21	$.40
14	.75	18	.75	22	.40
15, 2v.	2	19	.40	23	.45
16	1	20	.50	[*See* Director's annual reports]	

Paleontologist's annual reports 1899–date.

See first note under Geologist's annual reports.

Bound also with museum reports of which they form a part. Reports for 1899 and 1900 may be had for 20c each. Those for 1901–3 were issued as bulletins. In 1904 combined with the Director's report.

Entomologist's annual reports on the injurious and other insects of the State of New York 1882–date.

Reports 3–20 bound also with museum reports 40–46, 48–58 of which they form a part. Since 1898 these reports have been issued as bulletins. Reports 3–4, 17 are out of print, other reports with prices are:

Report	*Price*	*Report*	*Price*	*Report*	*Price*
1	$.50	9	$.25	15 (En 9)	$.15
2	.30	10	.35	16 (" 10)	.25
5	.25	11	.25	17 (" 14)	.30
6	.15	12	.25	18 (" 17)	.20
7	.20	13	.10	19 (" 21)	.15
8	.25	14 (En 5)	.20	20 (" 24)	.40
				21 *In press*	

Reports 2, 8–12 may also be obtained bound separately in cloth at 25c in addition to the price given above.

Botanist's annual reports 1867–date.

Bound also with museum reports 21–date of which they form a part; the first Botanist's report appeared in the 21st museum report and is numbered 21. Reports 21–24, 29, 31–41 were not published separately.

Separate reports for 1871–74, 1876, 1888–96 and 1898 (Botany 3) are out of print. Report for 1897 may be had for 40c; 1899 for 20c; 1900 for 50c. Since 1901 these reports have been issued as bulletins [*see* Bo 5–8].

Descriptions and illustrations of edible, poisonous and unwholesome fungi of New York have also been published in volumes 1 and 3 of the 48th (1894) museum report and in volume 1 of the 49th (1895), 51st (1897), 52d (1898), 54th (1900), 55th (1901), 56th (1902), 57th (1903) and 58th (1904) reports. The descriptions and illustrations of edible and unwholesome species contained in the 49th, 51st and 52d reports have been revised and rearranged, and, combined with others more recently prepared, constitute Museum memoir 4.

Museum bulletins 1887–date. O. *To advance subscribers, $2 a year or $1 a year for division* (1) *geology, economic geology, paleontology, mineralogy; 50c each for divisions* (2) *general zoology, archeology and miscellaneous,* (3) *botany,* (4) *entomology.*

Bulletins are also found with the annual reports of the museum as follows:

Bulletin	*Report*	*Bulletin*	*Report*	*Bulletin*	*Report*	*Bulletin*	*Report*
G 1	48, v.1	Pa' 2, 3	54, v.3	En 11	54, v.3	Ar 3	52, v.1
2	51, v.1	4	" v.4	12, 13	" v.4	4	54, v.1
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5	56, v.1	10	57, v.1	19	57, v.1, pt 2	7	56, v.4
6	57, v.1	Z 3	53, v.1	20	" v.1 "	8	57, v.2
Eg 5, 6	48, v.1	4	54, v.1	21	" v.1 "	9	" v.2
7	50, v.1	5–7	" v.3	22	" v.1 "	Ms 1, 2	56, v.4
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9	54, v.2	9	56, v.3	4	53, v.1	*Memoir*	
10	" v.3	10	57, v.1	5	55, v.1	2	49, v.3
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3	57, v.1	7–9	53, v.1	Ar 1	50, v.1	7	" v.4
Pa 1	54, v.1	10	54, v.2	2	51, v.1		

The figures in parenthesis in the following list indicate the bulletin's number as a New York State Museum bulletin.

Geology. G1 (14) Kemp, J. F. Geology of Moriah and Westport Townships, Essex Co. N. Y., with notes on the iron mines. 38p. 7pl. 2 maps. Sep. 1895. *10c.*

G2 (19) Merrill, F. J. H. Guide to the Study of the Geological Collections of the New York State Museum. 162p. 119pl. map. Nov. 1898. [*50c*]

G3 (21) Kemp, J. F. Geology of the Lake Placid Region. 24p. 1pl. map. Sep. 1898. *5c.*

G4 (48) Woodworth, J. B. Pleistocene Geology of Nassau County and Borough of Queens. 58p. il. 9pl. map. Dec. 1901. *25c.*

G5 (56) Merrill, F. J. H. Description of the State Geologic Map of 1901. 42p. 2 maps, tab. Oct. 1902. *10c.*

G6 (77) Cushing, H. P. Geology of the Vicinity of Little Falls, Herkimer Co. 98p. il. 15pl. 2 maps. Jan. 1905. *30c.*

G7 (83) Woodworth, J. B. Pleistocene Geology of the Mooers Quadrangle. 62p. 25pl. map. June 1905. *25c.*

G8 (84) —— Ancient Water Levels of the Champlain and Hudson Valleys. 206p. 11pl. 18 maps. July 1905. *45c.*

G9 (95) Cushing, H. P. Geology of the Northern Adirondack Region. 188p. 15pl. 3 maps. Sep. 1905. *30c.*

G10 (96) Ogilvie, I. H. Geology of the Paradox Lake Quadrangle. 54p. il 17pl. map. Dec. 1905. *30c.*

Woodworth, J. B. & Hartnagel, C. A. Miscellaneous Papers. *Prepared.*

Contents: Woodworth, J. B. Postglacial Faults of Eastern New York.
Hartnagel, C. A. Stratigraphic Relations of the Oneida Conglomerate.
——The Siluric and Lower Devonic Formations of the Skunnemunk Mountain Region.

Fairchild, H. L. Glacial Waters in the Erie Basin. *In press.*

—— Drumlins of New York. *In preparation.*

Cushing, H. P. Geology of the Theresa Quadrangle. *In preparation.*

—— Geology of the Long Lake Quadrangle. *In preparation.*

Berkey, C. P. Geology of the Highlands of the Hudson. *In preparation.*

Economic geology. Eg1 (3) Smock, J. C. Building Stone in the State of New York. 152p. Mar. 1888. *Out of print.*

Eg2 (7) —— First Report on the Iron Mines and Iron Ore Districts in the State of New York. 6+70p. map. June 1889. *Out of print.*

Eg3 (10) —— Building Stone in New York. 210p. map, tab. Sep. 1890. *40c.*

Eg4 (11) Merrill, F. J. H. Salt and Gypsum Industries of New York. 92p. 12pl. 2 maps, 11 tab. Ap. 1893. [*50c*]

Eg5 (12) Ries, Heinrich. Clay Industries of New York. 174p. 2pl. map. Mar. 1895. *30c.*

Eg6 (15) Merrill, F. J. H. Mineral Resources of New York. 224p. 2 maps. Sep. 1895. [*50c*]

Eg7 (17) —— Road Materials and Road Building in New York. 52p. 14pl. 2 maps 34x45, 68x92 cm. Oct. 1897. *15c.*

Eg8 (30) Orton, Edward. Petroleum and Natural Gas in New York. 136p il. 3 maps. Nov. 1899. *15c.*

Eg9 (35) Ries, Heinrich. Clays of New York; their Properties and Uses. 456p. 140pl. map. June 1900. *$1, cloth.*

Eg10 (44) —— Lime and Cement Industries of New York; Eckel, E. C. Chapters on the Cement Industry. 332p. 101pl. 2 maps. Dec. 1901. *85c, cloth.*

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Eg15 (102) Newland, D. H. Mining and Quarry Industry of New York. 2d Report. 162p. June 1906. *25c.*

Newland, D. H. & Hartnagel, C. A. The Sandstones of New York. *In preparation.*

Mineralogy. M1 (4) Nason, F. L. Some New York Minerals and their Localities. 20p. 1pl. Aug. 1888. [*10c*]

M2 (58) Whitlock, H. P. Guide to the Mineralogic Collections of the New York State Museum. 150p. il. 39pl. 11 models. Sep. 1902. *40c.*

M3 (70) —— New York Mineral Localities. 110p. Sep. 1903. *20c.*

M4 (98) ——Contributions from the Mineralogic Laboratory. 38p. 7pl. Dec. 1905. *15c.*

Paleontology. Pa1 (34) Cumings, E. R. Lower Silurian System of Eastern Montgomery County; Prosser, C. S. Notes on the Stratigraphy of Mohawk Valley and Saratoga County, N. Y. 74p. 10pl. map. May 1900. *15c.*

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New York State Museum

The New York State Museum as at present organized is the outgrowth of the Natural History Survey of the State commenced in 1836. This was established at the expressed wish of the people to have some definite and positive knowledge of the mineral resources and of the vegetable and animal forms of the State. This wish was stated in memorials presented to the Legislature in 1834 by the Albany Institute and in 1835 by the American Institute of New York city and as a result of these and other influences the Legislature of 1835 passed a resolution requesting the Secretary of State to report to that body a plan for "a complete geological survey of the State, which shall furnish a scientific and perfect account of its rocks, soils and materials and of their localities; a list of its mineralogical, botanical and zoological productions and provide for procuring and preserving specimens of the same; etc."

Pursuant to this request, Hon. John A. Dix, then Secretary of State, presented to the Legislature of 1836 a report proposing a plan for a complete geologic, botanical and zoological survey of the State. This report was adopted by the Legislature then in session and the Governor was authorized to employ competent persons to carry out the plan which was at once put into effect.

The scientific staff of the Natural History Survey of 1836 consisted of John Torrey, Botanist; James E. DeKay, Zoologist; Lewis C. Beck, Mineralogist; W. W. Mather, Ebenezer Emmons, Lardner Vanuxem and Timothy A. Conrad, Geologists. In 1837 Professor Conrad was made Paleontologist and James Hall, who had been an assistant to Professor Emmons, was appointed Geologist to succeed Professor Vanuxem, who took Professor Conrad's place.

The heads of the several departments reported annually to the Governor the results of their investigations, and these constituted the annual octavo reports which were published from 1837 to 1841. The final reports were published in quarto form, beginning at the close of the field work in 1841, and 3000 sets have been distributed, comprising four volumes of geology, one of mineralogy, two of botany, five of zoology, five of agriculture, and eight of paleontology.


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