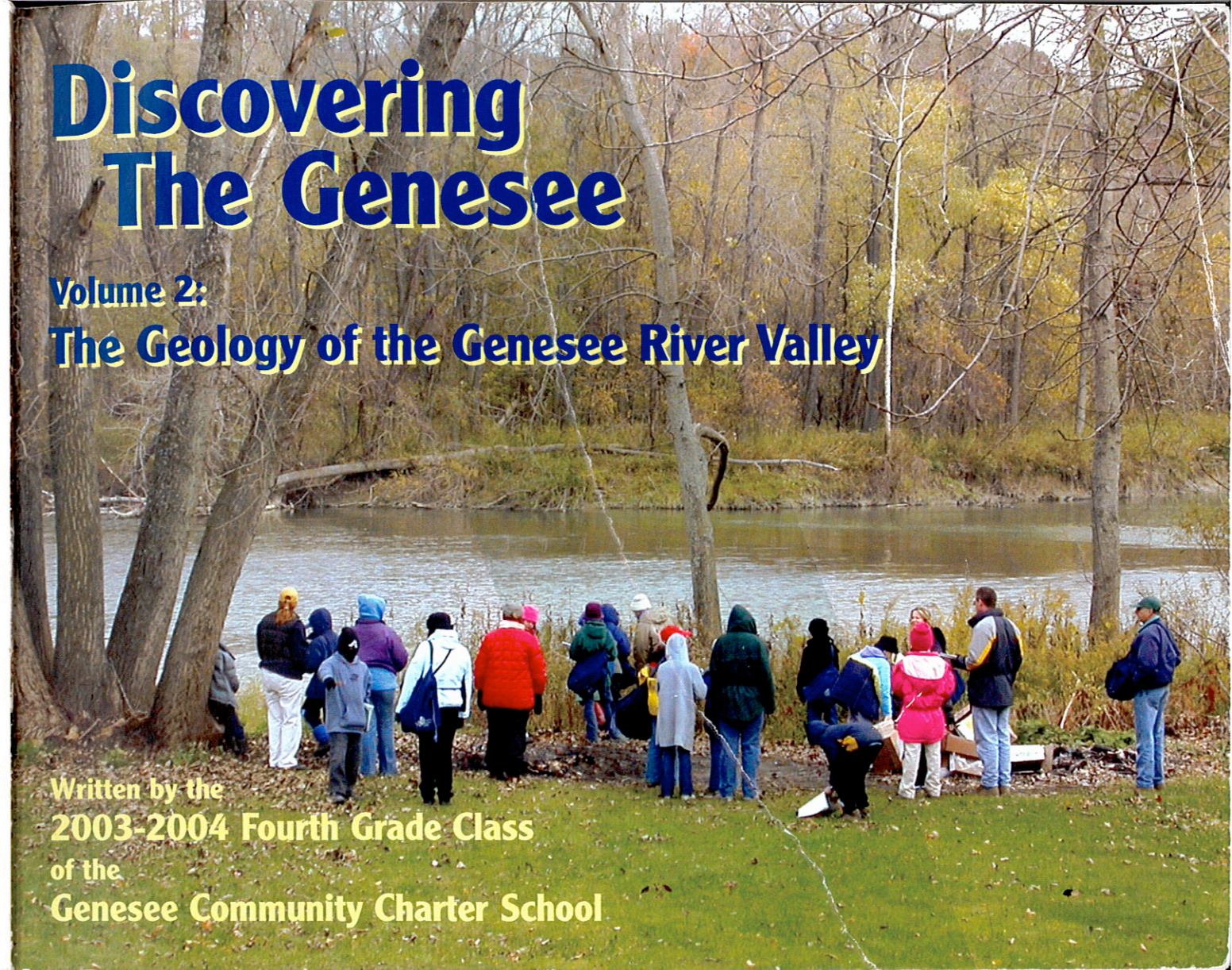


# Discovering The Genesee

Volume 2:  
The Geology of the Genesee River Valley

Written by the  
2003-2004 Fourth Grade Class  
of the  
Genesee Community Charter School

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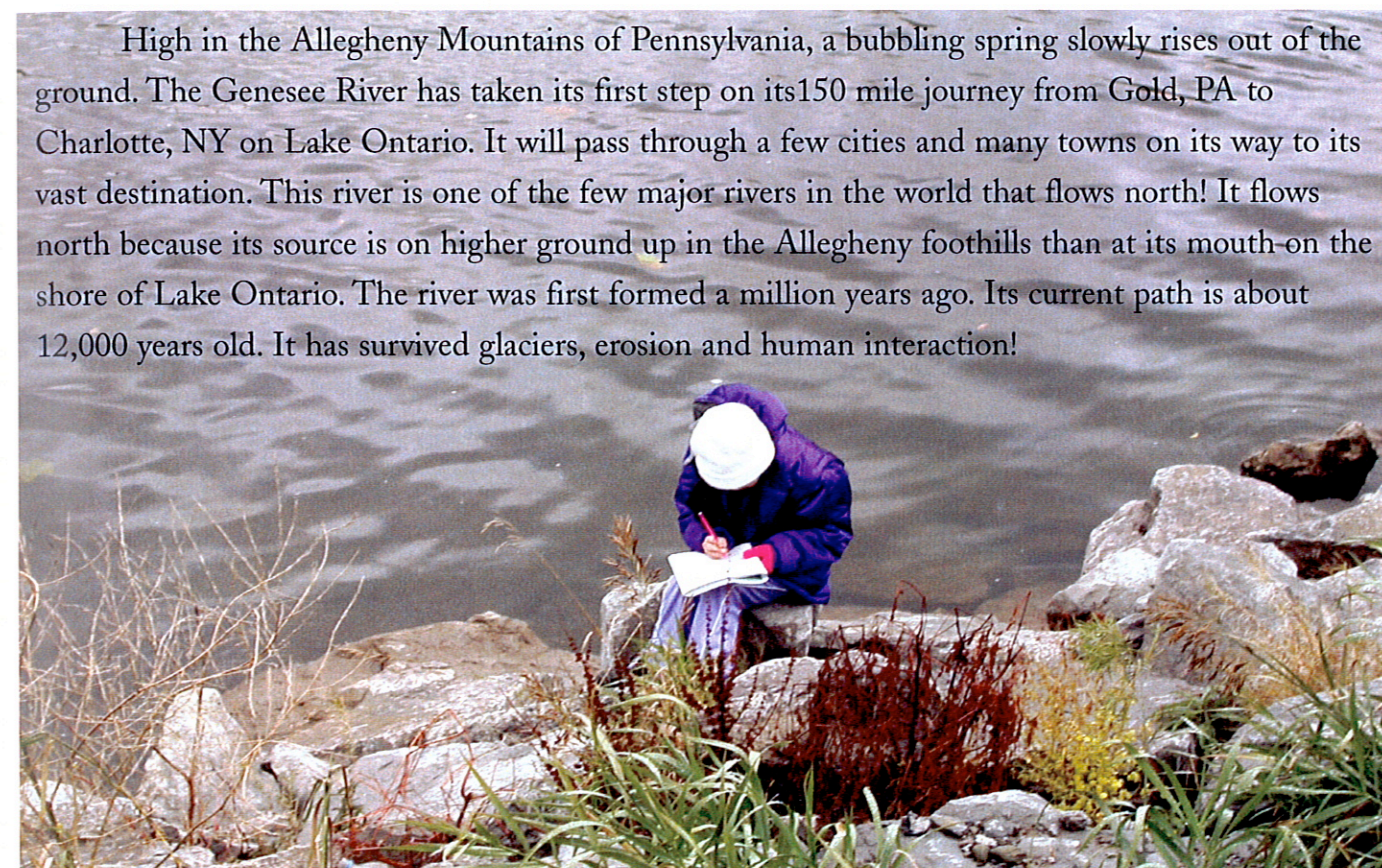
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## Introduction

High in the Allegheny Mountains of Pennsylvania, a bubbling spring slowly rises out of the ground. The Genesee River has taken its first step on its 150 mile journey from Gold, PA to Charlotte, NY on Lake Ontario. It will pass through a few cities and many towns on its way to its vast destination. This river is one of the few major rivers in the world that flows north! It flows north because its source is on higher ground up in the Allegheny foothills than at its mouth on the shore of Lake Ontario. The river was first formed a million years ago. Its current path is about 12,000 years old. It has survived glaciers, erosion and human interaction!





## Gold, PA



Nestled in the Allegheny Mountains in northwest Pennsylvania, a northward journey begins. In the small town of Gold, PA crystal clear water appears out of the ground like magic. This tiny stream is the start of the courageous Genesee River.

Twelve thousand years ago during the Miocene and Pleistocene time periods the fourth, and last, glacier began to melt allowing the ice to scrape the earth leaving valleys and river beds behind. In this process the frozen water may have carved the path of the miraculous Genesee River. The Genesee River is one of the few rivers in the world that flows north. The land elevation is higher in northwest Pennsylvania than it is in western New York. This allows the water to flow north.

It all begins underground about a half mile from the property owned by Mr. David Slaybaugh. Underground, water flows until it surfaces in four spots on Mr. Slaybaugh's property. These springs

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are the beginning of the Genesee River. Springs may occur when rain or melted snow seeps into the earth. The water may flow. If permeable rock is met, the water passes through and remains groundwater. If the groundwater flows and meets impermeable rock, it surfaces forming a spring. Each trickling stream makes its way through grassy fields merging into one waterway. This tiny creek meanders through the river valley widening as it makes its way north.

Humans have used the water from these springs. When the land was a farm, the farmer built a small reservoir that he used to pump water to the barn. The stone walls still stand at the source. Small box-like wells were built around two of the four springs to help the water flow into the reservoir. If the wells were not there, the water would spread all over making the ground soggy and it probably would not flow into the reservoir.



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## Wellsville, NY

Wellsville is a town located in southern New York near Pennsylvania. The river in Wellsville splits and curves around an island. On the island is a town park. There is a small man-made waterfall on the northwest side of the island. The waterfall is about 18 inches high.

The water is gray and looks bluish green. The water was clear enough to see big rocks located near the surface. We estimated the width of the river to be 95 feet. We measured half way, which was 42-1/2 feet, then we doubled it and got 95 feet. The depth of the river before the waterfall is 20 inches.

The motion of the river is different on each side of the waterfall. Before the waterfall, the water is smooth-moving and calm. After the waterfall, the river has a few rapids. Rapids are caused when rocks are sticking up under water and the water is moving swiftly.

Wellsville is not protected by the Mt. Morris dam. People have done many things to prevent erosion and floods in Wellsville. People constructed cement walls on the side of the river. They hauled giant boulders to place on the side of the river. They created a waterfall to slow the water down. There are no visible rock layers next to the river in Wellsville.

• • •

It was hard to write this book. We had to go to the Genesee River to find out what it looked

like, the width and depth, and the motion and clarity. It was awesome to write a book about the Genesee River because the river is so interesting.





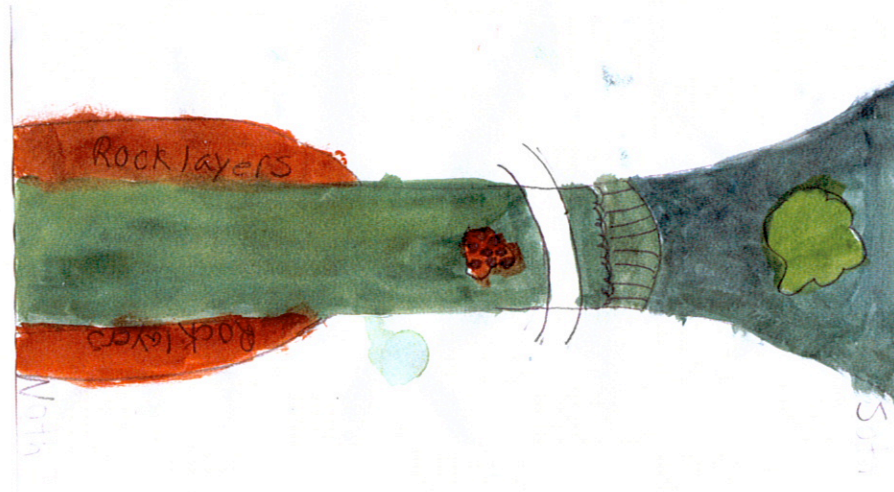
## Belmont, NY

Belmont, New York is located in between the towns of Wellsville and Oramel. Route 19 runs through Belmont. Belmont is in Allegheny County.

South of Belmont, the river was wide. The land was flat and grassy. There was a grassy island that the river flowed around. As soon as the river hit Belmont, it poured over a man-made dam and created a smooth-flowing waterfall.

The dam was constructed in a horseshoe shape. The dam was made out of planks at one time, but now it is made out of concrete. Did you know way back in the 1800's and 1900's people used the area behind the dam as a pool? In the winter the waterfall freezes. People used to use the ice from the waterfall in their iceboxes to store food.

After the waterfall there is white foam. There is a little island out in the water with pebbles on it. When the river



rises, the island disappears under the water.

What's special about Belmont is that riverbank starts to look like a gorge north of the waterfall. Upstream red, orange and brown rock layers start appearing alongside the river. The rock layers on each side of the gorge used to be connected together, but the river acted like a knife and eroded the rock layers underneath it. Now, the rock layers in Belmont are cut into two sides with the river running down the middle.

The river gets narrower as it flows north. The water travels faster and gets rapidy. The faster water is still eroding the riverbanks.

In Belmont people interact with the river. They use flood gauges to measure how high the river gets. People in Belmont have put down big boulders to stop erosion from happening in their town.

• • •

What I think is compelling is the way the white and blue rushing waterfall runs into the Genesee River. While I was in Belmont I noticed really great detailed rock layers and the way the water flowed was awesome.





## Oramel, NY

Oramel is a small town about 5 miles north of a town named Belfast, about a third of the way along the Genesee River. Oramel is located alongside a large meander in the river. The river depth in Oramel was 48 1/2 inches deep, the river width was 118 feet.

At Oramel, rocks are made from small ocean sediments that have hardened at Oramel. There are rocks that are round, rocks that are gray, rocks that are jagged, uncommon cube rocks and rocks with fossils in them. The rock layer at Oramel is Canadaway Shale.

Forces of nature have taken their toll on the riverbank in Oramel. There was a serious erosion problem for the townspeople of Oramel. The western bank shows evidence of this problem because it has a very steep and high side. The bank has a road on the top, this road would cave in if the erosion had not been stopped. The shape of the river – the meander – has contributed to the erosion problem. Water on the outside of a curve flows faster than on the inside. This faster-moving water causes more erosion.

The townspeople of Oramel had to take drastic action. They built gabions to slow down the river and stop erosion. The gabions are like fingers protruding from the riverbank; they are peninsulas of wire mesh stuffed with rocks.

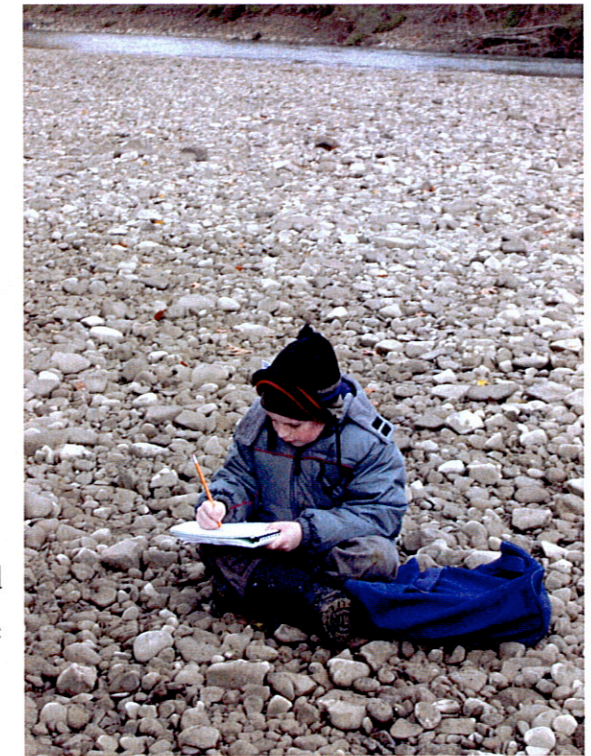
Gabions help by slowing down the water that erodes away at the riverbank. Their other

purpose is to build back up the riverbank. The river current carries sediments. When the river slows down, sediments no longer remain in the current. They drop off, therefore building up the riverbank.

The first gabion ever made was built 7,000 years ago in the Nile River to protect a pyramid being built there, but they were unlike modern gabions, because instead of filling it with rock they filled it with many plants. Gabions can last over 75 years and are actually better 50 years after when they were first made because the river sediments get lodged in the gabions, making them more stable. The first rock-filled gabions appeared in Great Britain in the 1900's. From then on they have filled them with rock but they still sometimes also use plants. Some gabions have a coating of cement that enables the gabions to flex with the motion of the earth and the river.

• • •

We have gone through a long painstaking experience in the creation of our chapter. We both offered help when it was needed and supported each other. If one of us was having a hard time, the other would contribute a sentence or a start to get us going.





## Fillmore, NY

Also lying on the Genesee River, Fillmore is located between Oramel and Portageville. The murky water rushes over the rocky bottom. Along the sides of the muddy river, rocks lay strongly making sure the banks of the river don't erode away, destroying the town. The edges of the river are shallow and the water is as clear as a crystal. However, the deeper middle and far side of the river looked like a murky greenish brown. The mud on the bottom of the river makes the river water dark because of all the sediment that is pulled up by the swift moving water.

Downstream a tributary meets the murky waters of the Genesee. Small streams such as this one flow into bigger bodies of water adding more water to roll swiftly onward. Tributaries along the Genesee include Black Creek, Oatka Creek, Honeoye Creek, Conesus Creek, Wolf Creek, and Van Campen Creek. There are many many more tributaries flowing into the river.

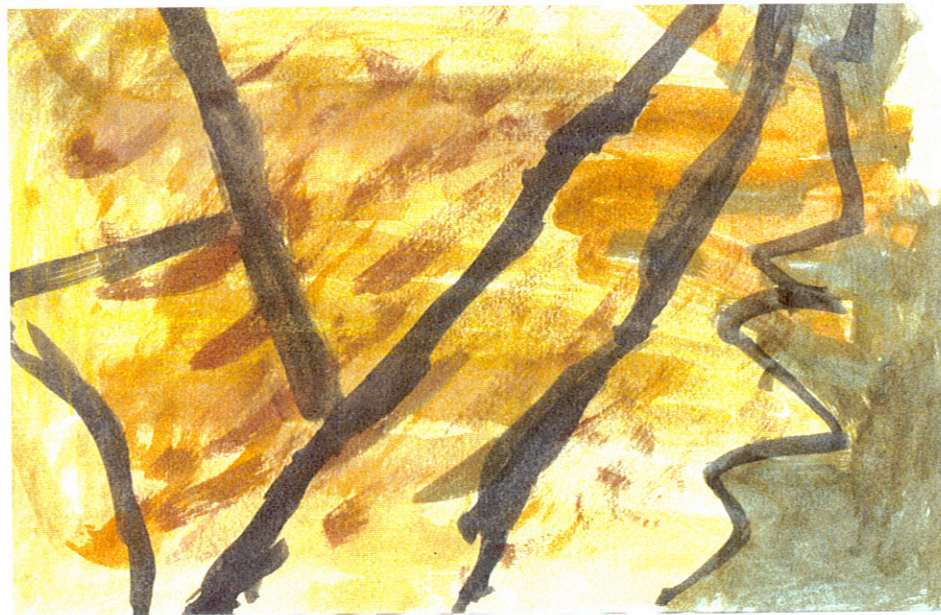
In Fillmore, erosion has dug up land. This has been a problem for the town. As far back as 1889 floods have taken away the land and lives of many people. The flood of 1889 killed 2,206 people. It destroyed many houses and buildings. Today people put rocks along the edge of the river to help stop erosion.





## Portageville, NY

Portageville is located north of Fillmore at the south end of Letchworth State Park. The river in Portageville has flat slippery slabs of bedrock on the bottom. Each looks like it was carefully placed in the water like a jigsaw puzzle. Erosion caused the cracks between each piece. In the center of the river the cracks are much wider and deeper than along the sides. The steep drop-offs seem like missing pieces of the puzzle. Some of the rocks stand out of the clear water as if they are waiting to play leap-frog with the swift moving water. When the water hops over these rocks, rapids are formed. Near the land, the water is as clear as glass, but towards the middle it is as brown as sewer water. The sediments that erode from places downstream



» 16 «

cause the brownish green color in the middle.

Twelve thousand years ago, when the fourth glacier swept through Portageville like a raging bull, the path of the river was changed. The huge block of ice carried an enormous amount of sediment. When the ice melted, the sediment was left behind filling parts of the river and changing its course.

There have been many floods in Portageville. The most recent one happened in 1972. Like a pouncing tiger, the water rushed over the banks of the river. The town filled with swirling water. The Genesee Falls Inn, located next to the river, withstood the flood and is still standing now. If you go there, you can see a line on the wall that shows how high the water reached. It is about 5 feet from the floor of the restaurant!

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## Upper Falls in Letchworth State Park, NY

Just north of Portageville, you will find Letchworth State Park. Also known as the “Grand Canyon of the East”, this park is located along the Genesee River gorge between Portageville and Mount Morris.

The rock layers that form this gorge begin in the town of Portageville and run all the way through Letchworth State Park. Listen carefully, you may hear the roar of the amazing Upper Falls. Three waterfalls can be observed in the park. Upper Falls has a height of 71 feet! For millions of years, the rocks sat upon the earth waiting to be carved by the waters of the Genesee River. For the last 12,000 years, water has eroded away at the Nunda sandstone to form the waterfalls and river gorge. The sandstone that makes up the gorge is 409-363 millions years old! Nunda sandstone is made up of soft and hard rock. The soft rock erodes faster than the hard rock. The soft parts wash away leaving the hard parts behind for the water to flow over. This process formed the waterfalls.

Within the layers of rock, evidence of prehistoric life can be found. Trace and marine fossils prove that a warm sea once covered this area. Brachiopods and crinoids are some examples of fossils that can be found around Letchworth State Park.

A railroad bridge spans the river at the Upper Falls. A hiking trail runs along the river to the top of the falls.





## Lower Falls in Letchworth, NY

Letchworth State Park is located north of Portageville on the Genesee River. Letchworth is located in the middle of the Genesee River in New York State. Letchworth is part of the new path of the Genesee River.

“The Grand Canyon of the East” is a nickname for Letchworth gorge. A gorge is a deep valley with steep sides. The walls of the gorge are made out of sedimentary rock. Most canyons or gorges have been formed by rivers or streams. Letchworth gorge is an amazing example of erosion. As the river has passed by this area for thousands of years, it has eroded the sedimentary rock, slicing the land into two separate sides. The gorge reminds you of a cut-open onion because it has many layers of rock.

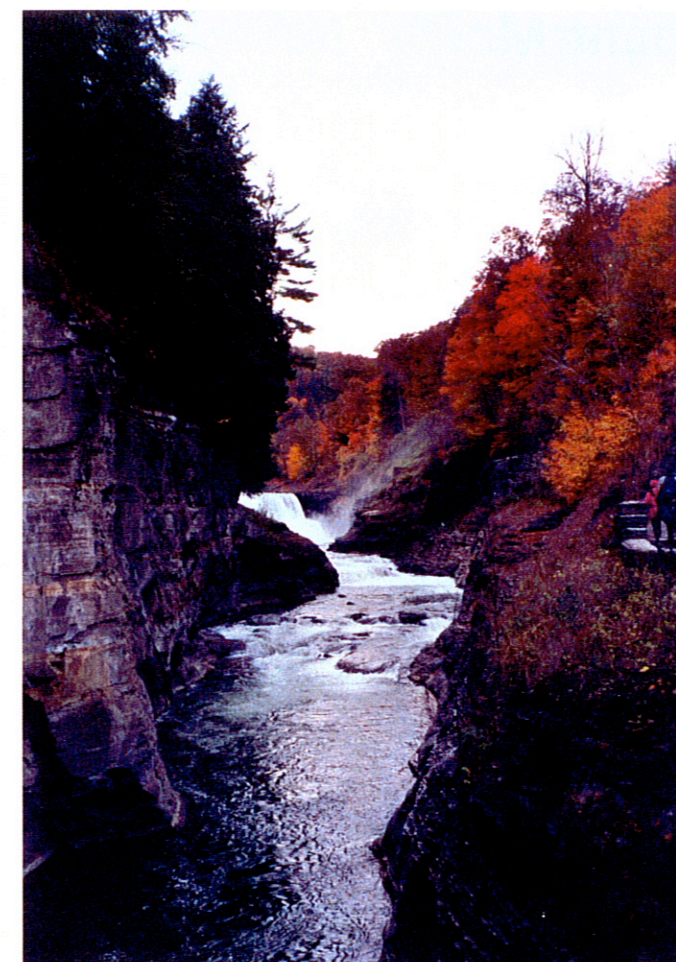
One of the layers of rock is Table Rock Sandstone. Table Rock Sandstone is the type of rock that the water flows over at the Lower Falls. The Lower Falls are 70 feet high. The river crashes down as it dives over the Table Rock Sandstone layer to the bottom of the gorge and then snakes its way north to Mount Morris.

Downstream from the falls there is an island of rock. The river splits and travels in two halves around the island. The river water we observed was dark and green. The water was not dirty, it just looked polluted because of the sediments like mud, dirt, and clay.

People have changed things in the area, but not to control the river here. People made a bridge. They made it so you can get across the river to the other side of the gorge. They also made a path that you can take to the falls.

• • •

The most compelling thing to us was the water going over and around the rocks. You should know about this place because it's an awesome place to look at the falls and the water. We liked this place because the falls look beautiful and the nature around is fun to look at. It's relaxing and calm.





## Mount Morris, NY

At the northern end of Letchworth State Park sits the town of Mount Morris. In this town there are two features, the north end of the gorge and the flat terrain. As the Genesee River meanders through the gorge it seeks lower ground.

Thousands of years ago glaciers formed and changed the course of the river. The path changed near Portageville. The region north of Portageville is known as the new path of the Genesee River.

Many layers of rocks can be seen in the gorge. The bottom layer is usually the oldest rock. The higher the layer the younger the rock. The rock layers found in the gorge are limestone, sandstone, and shale. Each layer of rock has its own color. The colors blend together like a freshly painted canvas designed in autumn. Some layers are as black as charcoal while others have a rusty tinge.

Sometimes too much water can cause floods along the path of a river. This happened many times to areas along the Genesee River. Places like Portageville and Rochester were drenched during heavy spring rains. This was a problem, but the people had a solution. Humans constructed a dam near Mount Morris to help control floods. Mount Morris was a good place to put the dam because of the high gorge. Construction began in March of 1948. This dam is a monolithic dam because the cement sits 450 feet below the river and 100 feet into each side of the gorge. There is no bedrock here to anchor the dam. The dam is built in sections which move. The height of the dam is 245 feet.

The dam can hold back 75-100 feet of water protecting towns upstream. In 1952, after 4 years of hard work, the Mount Morris dam was completed. Thanks to the hard workers of the Army Corps of Engineers, Rochester and other towns don't have to worry about floods.





## Cuylerville, NY

Cuylerville is located between Mount Morris and Geneseo. The river flows through flat farm land in this area.

The river has two big meanders in Cuylerville. One of them has a sharp turn and the other has a wider more gradual turn. The banks are steep (as in a slant). The plants along the sides of the bank prevent the soil from eroding away. The dark greenish brown water moves slowly through the meanders. The water flows faster on the outside of the curves. This causes more erosion on this side of the river.

It is difficult to see through the water because of all the sediment that is floating around. The



bottom and sides of the river are made of dirt causing all the sediment in the river. People put big boulders on the side of one of the curves to stop the banks from eroding away. Farther down the river is a bridge that also has big boulders under it to block the bridge from eroding away.

• • •

I think Cuylerville is important because of the huge curves, the land, and the erosion. I think people should know about Cuylerville. because it is an interesting place to me.





## Geneseo, NY

After our stop in Cuylerville we visited Geneseo. Geneseo is in Livingston County in New York State. The Genesee River runs north through Geneseo heading towards Avon. Geneseo is about 40 miles south of Rochester.

On the curvy bank of the Genesee River in Geneseo there are some small smooth pebbles and lots of soil. There were many skinny trees scattered along the river bank. The land in Geneseo is pretty flat, but it slopes down about six feet to the river. The river bank was mostly mud and rocks. The rocks in Geneseo are part of the Hamilton Group and Onondaga Group. They were formed during the Middle Devonian time period, which was about 370 million years ago. The kind of rocks you will find here are shale and limestone. You may find trilobites and other coral reef fossils in this area. Fish may have been present in the Middle Devonian time period, but it is rare to find a fish fossil in Geneseo.

This part of the Genesee River we observed was slow, wavy, and ripply. The color of the water was blue, silvery and greenish-brown. The soil and algae made the water that color. The rate of flow of the river in Geneseo was 0.8 feet per second that day.

In Geneseo there's a big green bridge made of concrete, built so people could get across the river to the other side of town. There's also a stone wall, most likely to help stop erosion in Geneseo.

In the spot we stopped at in Geneseo there weren't any signs of people trying to monitor flooding.

• • •

The most compelling thing in Geneseo was the rapids in the water. We think Geneseo is a pretty place. Geneseo was beautiful because the water was slow and the pebbles on the bank seemed to shimmer in the light. You could almost see all the colors and the dappled gray spots. The water looked cool and refreshing, but don't drink it because it's green. We'll always remember our trip there.





## Avon, NY

Avon is located in between Geneseo and Rochester. In Avon the land is very flat. The land around the river has a lot of thin skinny stands of trees. The river has steep muddy banks that are about ten feet high.

The river in Avon is very wide, almost the same as in Geneseo. We estimated that the width was 90 feet. The water looked too deep for us to measure.

We noticed the water was a murky, mucky green, almost like a swamp. The river was flowing fast, but the surface was calm that day. There was some bubbly foam in the water, maybe because it was fast flowing, or maybe because of pollution.

In Avon the rocks were formed in the Devonian time period. That was 409-363 million years ago. If you find fossils in Avon they will most likely be insects and fish because they were alive during the Devonian time period. The rocks in Avon are mostly shale. The banks in Avon are muddy because when shale mixes with water, it turns to mud.

In Avon there is some evidence of erosion. On the banks, trees stand very close to the edge and roots stick out. This probably happened when the river washed away the soil that covered the roots. Another sign of erosion is how high the banks are and how low the water is. Our theory is that a long time ago the water and the banks were at the same level. When the water started to take

away and loosen the soil and dirt, the river started to dig into the ground.

On one of the riverbanks in Avon, there were concrete blocks which were human made. The concrete blocks were scattered all over the bank. They might have been placed there to help prevent erosion.

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The thing that was most compelling to me in Avon was how fast the water was flowing, and how the trees just matched the color of the water. To me Avon was one of the most peaceful places I've ever been. So any time you need to calm down go to Avon! Writing this book was a great experience. We were learning new things, and I found out things I never knew before. I also got to go to places I have never been before.





## Rochester, NY

Rochester is a city in western New York at the end of the Genesee River. It has three falls – High Falls, Middle Falls and Lower Falls.

The river in Rochester looks a bit murkier than one would imagine, changing color in different areas. It is murky because of eroded sediment that falls into the river and creates a greenish, brownish color. At the Lower Falls the Genesee River is 276 feet wide but at the Upper Falls it is 200 feet wide. The motion of the water through Rochester is calm and smooth because the river here is wide.

Rochester has one big gorge that starts just north of downtown at High Falls and ends near the mouth of the river very close to Charlotte. Did you know that without erosion, we would have no gorge; without the gorge, we would have no waterfalls; without waterfalls, there would be no Rochester; and without Rochester, this book wouldn't exist! The waterfalls were important in early Rochester because they provided power, and led to jobs in this area. The gorge has a lot of visible strata. Strata is a fancy word for rock layers. Some of the layers are Queenston Shale, Grimsby Sandstone, Kodak Sandstone, and Reynales Limestone.

Queenston Shale was formed in the late Ordovician time around 500 million years ago. Shale is one of the most common rocks along the Genesee. It is made up of a muddy-clay like material. It

is very soft and you can break it with your hand. It has sort of a dull gray color and looks crumbly. The Queenston Shale layer is 1,000 feet tall, but only 50-55 feet are visible in Rochester. Unfortunately this layer does not have fossils.

Grimsby Sandstone was formed in the early Silurian period about 438 million years ago. It is only 50-55 feet thick. The color is usually dull gray but sometimes is red. A common mineral to find in Grimsby Sandstone is hematite. You can recognize it by its dull red color. The Grimsby layer has many fossils of worm burrows and trails. Did you know that Grimsby was used in the first Erie Canal aqueduct over the Genesee River and sometimes in the foundations of old buildings?

Yet another layer is Kodak Sandstone. It was formed in the middle Silurian age about 413 million years ago. It has a dull





gray color or may be sort of a tan-white color. The Kodak layer caps the Lower Falls.

One of the last layers is Reynales Limestone. The layer is approximately 21 feet thick. Within it, there is a small layer with fossils such as coral and brachiopods. It was formed in the middle Silurian time around 408 million years ago.

Rochester has three waterfalls. High Falls is capped by Lockport-Dolomite rock. High Falls is 96 feet tall. Lower Falls is 67 feet tall. At Lower Falls small fossils such as worms, ferns, small fish and insects are common to find plastered or loose among the gorge rock wall.

Over time waterfalls migrate upstream. This is caused by erosion. The water carves the softer layers of rock that are underneath the capstone. The capstone loses its support and breaks off. This causes the waterfall to move back several feet. This process repeats over and over.

Along the Genesee River, people have constructed bridges, locks and other things that made the Genesee River usable for transportation. Boats and barges have been made to carry things like passengers, trash, spare metal, and cement.

The Genesee River has almost completed its long northward journey through Pennsylvania and New York.

• • •

The writing of this chapter took a lot of teamwork and self discovery. We learned that we can do a huge amount of work if we set our minds to it. The research of our chapter's material was a painstaking experience that taught us the true meaning of the importance of rivers.





## Charlotte, NY

Charlotte, a neighborhood in Rochester, is located at the north end of the Genesee River. After a long journey flowing north, the river finally comes to an end here in Charlotte. This is where the river empties into Lake Ontario. It is the mouth of the river.

This section of the Genesee River started to form 12,000 years ago during the Pleistocene time period. However, the rocks that are found along the river near Charlotte are between 439 and 409 million years old. They were formed during the Silurian time period. The rocks are much older than the river itself.

The river is brownish green at this location. It's difficult to see through the water. You cannot see the bottom at the mouth. The water is so cloudy because of all the sediment - like dirt that is floating and swirling around. There are two long piers on each side of the river. They stick out into the lake. There are big boulders on the sides of the piers. People built the piers and placed the boulders on the sides to stop erosion.

There is a lot of history in Charlotte. It is one of the first settlements in Rochester. There is a lighthouse and a swing bridge.





## Glossary

Compelling – something that catches your eye or really interests you

Erosion - water wearing away land

Gorge – narrow path cut through land usually by erosion

Meander – a big curve in the path of the water

New path – the way the rivers flow now

Old Path – the way the river used to flow before the last glacier came through

A sampling of the Geologic Time Periods related to the Genesee River's history:

Cenozoic Era	Holocene	10,000 years ago to Today
	Pleistocene	1.8 million years ago to 10,000 years ago
- - - -		
Paleozoic Era	Devonian	417 to 354 million years ago
	Silurian	443 to 417 million years ago
	Ordovician	490 to 443 million years ago





## About the Authors

This book was written by the 2003-2004 4th grade class of the Genesee Community Charter School while studying geology, physical fitness and artistic composition. We spent three days traveling to Pennsylvania, the source of the Genesee River, and visiting spots along the river as we followed it north to Charlotte where the river empties into Lake Ontario. All photos and graphics in this book are original creations by members of our class.

We each paired up with another classmate to write a chapter:

- Gold, PA - Khari and Danny
- Wellsville, NY - Shane and Ben
- Belmont - Tatiana and Nicole
- Oramel - Jamie and Zac
- Fillmore - Shanell and Emma D.
- Portageville and Upper Falls in Letchworth State Park - Corey and Ryan
- Lower Falls in Letchworth State Park - Brennan and Mark
- Mount Morris - Eden and Emma M.
- Cuylerville - Julia and Alexis
- Geneseo - Addie and Jennifer
- Avon - Camille and Maggie
- Rochester - Bolan, Eric and Paul
- Charlotte - Whitney and Kennethea

*Thank you to...*

*Our families and friends and everyone who helped us along the way!*





