

Classroom Activity The desk top beach grades 3-6 and up (*observation, analysis, writing for information and understanding*) Do with small group or individually

Your sample from a south shore beach of Lake Ontario contains a selection of pebbles and stuff, natural, and man made “castaways” definition=cast adrift or ashore; shipwrecked. Discarded; thrown away. n. A shipwrecked person) Use your pebble guide hand out to help you learn about some of the rocks.

What do you notice right off about your pebbles? They're different!! How are they different? Why are they different? How do you suppose they all got here?? And what happens to them? Do they just sit there on the beach forever? Do they turn into sand? If so, then why isn't all the beach sand? Clearly “new” rocks have to be entering “the system” somehow. How might that work??

There are three main classes or types of rocks *igneous, sedimentary* and *metamorphic*. Your sample contains two of these types *sedimentary* and *metamorphic*. Sedimentary rocks are formed from mud or sand. Sandstone pebbles show distinct individual grains of the original sand and feel 'gritty' when you rub them. Metamorphic rocks were formed from sedimentary rocks that were buried far beneath the earth's surface. There they were heated and squeezed and transformed. They are much harder than sedimentary rocks and feel smooth.

How many different colors and types of pebbles are present in your sample?

In your sample can you distinguish the sand stone pebbles? How are they different? Do they have any common *characteristics*? Characteristics= color, shape, feel, hardness, crystal presence (*crystals are the distinctive shapes formed by pure minerals like a gem stone- often very small, can be big*).

Check your pebbles for some characteristics;

Do you notice any differences in **shape** between your pebbles?

How are the **colors** different?

Do the rocks **feel** different?

Which rocks do you think are harder? (hint the harder rocks feel smooth and polished)

How could you test them to tell for sure?

All rocks are made of minerals. Sometimes the *crystals* of minerals are visible as distinct specks or flakes or areas of color on the pebble. They may glitter or sparkle. Do any of your pebbles appear to have minerals? The mineral feldspar sometimes appears as sparkling crystals on pale white pebbles. The mineral hornblende appears as a black rectangular or long narrow shaped speck in dark metamorphic rocks called schists.

Many of the pebbles on the lake's south shore are *limestone*. (The raw material we make cement from). Limestone pebbles are often gray. Some may contain fossils, the remains of ancient plants or animals that appear as light colored specks. Sometimes the sediment that formed the limestone was compressed and crushed so the fossil animals and plants may appear broken up or distorted. Do any of your pebbles appear to contain fossils? (*Note- not all gray speckled rocks have fossils. Fossil animals will show detailed structures. Light specks and spots could also be bits of different minerals such as quartz or calcite in your rock.*)

Write a paragraph on your 'sample' of pebbles. Include information on at least 3 observed characteristics.

“Castaway” – writing for literary response and expression or writing for information and understanding

Your beach sample also contains an assortment of “castaways” (man made trash). What are most of your castaways made of? Can you identify any of the objects?

Where do you think they came from and how did they get to the beach?

What do you think will eventually happen to this stuff?(*Read about Project Kaisai on the Internet to find out)

Pick one piece of trash. This is your castaway to write a paragraph about. Describe it. Tell what it looks and feels like. Who might have used it and how? Why and how did your castaway end up in the water and then on the beach? What's the story of your castaway? Tell us about the events and activities that could have caused it to land on the beach. Does it have a future or is a new career possible beyond this desktop? Imagine that too.

Beach Combing Discovery Field Trip to the beach (optional or use with older students for independent study?)

The beach is a frontier. Here you stand between two worlds- the water world and your own land home. It is also a Political Boundary between two nations. Over there lies Canada, a sovereign country with a very different history and government from our own. This is also one of the fastest changing landscapes anywhere in the region. A good beach scholar, like a scientist or a detective, notices details is open minded and asks lots of questions and persists. If possible visit the same spot a couple of times to see how it changes over time.

Look for signs of movement and change around you.

What patterns do you notice here in the shape and forms of the beach?

Where does the energy come from that pushes things around? Name three forces at work shaping and creating and destroying your beach.

How do the stones on the beach differ from one another in shape color size etc? Can you explain why this might be so?

Do you see signs of life (or death) on the beach? If so describe.

Do you see anything on the beach that probably came from a distant place? If so can you identify it? How do you suppose it got there? Describe one or two possible ways that it might have ended up here.

If it's a rough day, watch the waves. What do you notice about how they act upon the beach? Do they do anything to the land?

Is there anything here on the beach that you have never seen before? What is it? How could you try to find out?

Write a short report of () words about the beach you visited. Give its location and tell what the land next to it was like- if it was farm land or urban, forested, open, full of houses? or paved? Describe why the beach was different or special. How has human activity impacted it? What was your beach mainly made of? Describe shapes, colors, forms of land around you. What did you like or not like about it. Ask yourself who else might have walked this beach before you.
etc

Unit 1-geography/geology/ environmental Goes With the book Twinkle Toes and the Riddle of the Lake

learning standards and performance indicators

language arts collecting data, establishing relationships writing for critical analysis and communication of geological and geographic features and events in the Great Lakes region (Castaway writing activity) correct grammar, punctuation, sentence structure use in students will identify a central idea and create a narrative

science collecting data, analysis of same, inquiry-asking questions and seeking answers , making detailed observations and documenting same,

social studies recognizing the connections between Lake Ontario human settlement, activity and physical well being regional history- recognizing key role of lake as boundary and military theater of action, and as catalyst for economic development, and past and present energy policy

language arts *performance indicators*-using correct grammar, punctuation, sentence structure in students will identify a central idea and create a narrative (Castaway writing activity)

Key concepts Riddle of the Lake page nos provide further information

Lake Ontario's physical presence continues to affect history, settlement patterns and weather, and land use including farming, energy production, tourism and transportation. pg 175 weather pg 170 military events,

Rapid and profound climate change occurred during the ice age (and may happen again!) pg 179 “Riddle”

We all live in a watershed and our actions impact others who share it with us pg 141 Sid's List

vocabulary- ice age glacier drumlin watershed bedrock megawatt Golden Horseshoe cobblestone building bulk cargo Tug Hill (also see worksheet of locations and place names to go with the virtual field trip slide show)

activities- beach in a box work sheet and writing activity (see note at end of summary)
virtual field trip vocabulary worksheet and map fill in
additional activities- see Sid's List page page 141 and list at end of summary

for the teacher Unit One Geography and Geology of Lake Ontario- supplemental background information for use with download “virtual field trip” <http://www.silverwaters.com/program1/index.html>

A Brief summary of Lake Ontario' s geography

Geography is the study of how soils, land forms, bodies of water and other features of the earth influence human history and daily life. Lake Ontario today is an International boundary between Canada and New York State, thanks to two major wars fought here in two different centuries. Had the French held Oswego's forts during the French and Indian War, things might have turned out very differently and we might be speaking French today. During the second war between the U.S. and Britain, the War of 1812, Lake Ontario was a critical border and much military action took place throughout the 2 1/2 years of conflict. That war settled Canada's independence from the U.S. and our boundary with it. (You can read a short account of a critical 1812 War battle at Sackets

Harbor in Twink's book page 171. Find out how a patriotic carpet saved the day. We might be living in Canada and have single payer health care had things gone differently then!)

The Great Lakes and Lake Ontario were (and are) key transport highways. Early fur traders and explorers used lakes and rivers to get around easily in a land without land roads. Later after America's boundaries were agreed by treaty, a flood of immigrants traveled from the coast via the Erie Canal westward. Many boarded steamers or schooners sailing from Oswego or Buffalo to Chicago. They were seeking the rich prairie lands of the Midwest for farming. (* read about the part played by Oswego in the century development of one of the greatest maritime inventions of the 19th century pg 168) Despite that invention Buffalo with its connection between Lake Erie and the east coast via the Erie Canal won the race with Oswego and became the biggest port on the lower lakes.

Once the Erie Canal was built farmers and businesses had an easy way to reach their customers with cargoes. **B**etween 1830 and 1860 Lake Ontario's shore bustled with business and much money was made. In the 1830s a young man from Pultneyville, Captain Horatio Nelson Throop, teamed up with a flour mill owner in Oswego to carry grain from the west for his mills. After just a couple seasons he had earned enough to build a fine cobble stone house overlooking the harbor. Many other fine farm houses and canal town buildings remain from that time. Around 1856 Captain Throop had a three masted schooner the "Rival" built in Alexandria Bay to bring western grain to Buffalo. She paid her entire cost in one year of cargo transport.

After the development of more efficient steam engines and the railroad system which could operate year around, the Great Lakes trade became one of lower profit bulk cargoes. To this day, ships can and do deliver cargo to and from Oswego , including grain, asphalt for road repair and building, dry powdered cement, and other heavy and bulky goods far more cheaply than truck or rail transport.

The Great Lakes provided many jobs and resources that helped make our region prosper during the age of industry from 1860 to about 1930. In those times thousands of people worked in great lakes related jobs. Some were fishermen who set nets for lake herring, white fish, pickerel and lake trout. Others worked in ports as stevedores and teamsters moving cargo. On Lake Ontario alone hundreds of men (and some women!) worked as sailors cooks and ship yard workers. Some of the earliest manufacturing of chemicals also took place in the Niagara Falls area thanks to the relatively cheap and abundant supply of electricity from the hydro power plants there. That manufacturing created much corporate wealth but also left us a legacy of polluted water and empty urban brown fields.

Lake Ontario today

Lake Ontario continues to contribute to the region's economy today. Canada's largest city is on the lake. Toronto and the cities of Hamilton and Burlington at the west end of the lake make up the so called golden horseshoe of Canada. (Golden because of all the business and money concentrated here!) About 8 million Canadians live here. This is almost a quarter of the entire country's population (33 million). * see pg in Twinkie for more on the two countries on Lake Ontario)

some Seaway Numbers and math-

Huge hydro dams at either end of the lake help light this classroom and power up your computer at home. The dams on the St Lawrence at Messina and downstream in Quebec back in 1995 produced about 1.5 billion dollars worth of electricity. They on average generate a total of 25 MW (a megawatt is a million watts. 750 watts is a little more than one horsepower). 25 MW is enough to supply 2 million homes (on web from J L Osinski Hydropower Tech working group report 2005). How many 1000 horsepower diesel engines would it take to supply this?

Some government reports suggest that the cost of control of the zebra mussel, an invasive species that entered the Great Lakes via the Sea Way now runs about 5 billion a year. It is just one of 150 or more invasive species of plants and animals now disrupting the ecology of Great Lakes. Was building the Seaway a good bargain?)

Much of the original incentive for building the Seaway system with its locks and dams for shipping back in the late 1950's was to increase hydro power production from the St Lawrence. These hydro facilities are also valuable because of the relative constancy of the power they generate. Like nuclear power plants (which do NOT like to be switched on and off) the Great Lakes flow makes for valuable "base load" generating. There are over a dozen nuclear generating stations and several coal and oil and natural gas fueled power plants on the lake. All of them need large amounts of water to re-condense the steam used in a closed loop to drive their power turbines.

More economic 'value' from the lake

The south shore of Lake Ontario has been one of the best places in North America for growing fruit for over a century. The lake moderates the extreme cold of winter and in the spring slows down and holds back the tender apple tree buds until the danger of late frost is largely past. Rochester was once a powerhouse of nursery stock and seed businesses. In the 1850's the Ellwanger & Barry nursery and seed company of Rochester was said to be the largest such business in the world. Much of their earlier profits were from shipping young fruit trees to the settlers of Ohio and the Midwest who were building up their farms after traveling to the new lands via canal or lake. At this time Rochester became known as the "Flower City" a name it still retains today.

New York is still the second largest apple producer in the country with the lake shore county of Wayne being the biggest single county producer. The largest apple grower in the state, Fowler Farms is located here and has about 2500 acres of 23 varieties of apples plus other fruits in production.

Recreational fishing and boating are both big contributors to the region's businesses. Thousands of area residents (your author among them!) enjoy sailing or cruising or using their motorboats and personal watercraft on the bays and open lake. Anglers direct spending amounts to about 98 million a year on fishing along the New York shoreline of Lake Ontario and fishermen come from New Jersey, Massachusetts, Connecticut and Pennsylvania to catch salmon and trout here. In 2007 the state estimated from surveys of anglers in the field that there were 1.3 million trips made to go fishing on Lake Ontario.

Tourism has been ranked second after agriculture as the most important business in NY State and Lake Ontario, an inland sea draws many tourists into our area. They come in part to enjoy its water and its beaches. Each winter tourists visit the Tug Hill Plateau area east of the lake where prodigious amounts of snow make for great ski trips, dog mushing, and snow mobile rides. The snow is generated by moisture from the lake and cold winter winds. (see pg 175 in Twinkie's book for more on lake effect snow). Lake Ontario's New York shore has 326 miles of shoreline for tourists and boaters to explore. That coastline and the beaches were shaped and formed by the ice of huge glaciers that moved through the area 6000 years ago.

Lake Ontario and the age of ice

These days abrupt shifts in climate are a hot research topic. The notion that catastrophic global scale climate changes could occur within decades or even a single season as dictated in that rather awful movie bomb *The Day After Tomorrow*, was once dismissed as a loony idea inspired by myth and religious fable. However, in the 1960s better techniques and improved technology in dating using ice and sediment cores, radio-isotope decay rates and other tools began to suggest that sudden shifts had occurred in earth's past and that the ice build up occurred quite rapidly. (*you can read about one such abrupt shift the Younger Dryas cooling on page of Twinkie's book and the possible role of a meteor strike which left a crater in the lake up near Cape Vincent). There is even serious discussion that global warming could, ironically set off another ice age or at least make things a lot colder in Europe with the change taking place over just a few years time possibly.

At any event just a mere 13,000 years ago a long time for humans but a very short time for the science of geology our area here was very different. A layer of ice thousands of feet thick lay over this region as the Wisconsin ice sheet ground its way south to somewhere around Ithaca. The action of the moving ice sheet formed the streamlined elongate hills we call *drumlins* today. Here in central NY we have one of the largest concentrations of these whale shaped hills, about 10,000 of them, found anywhere in the world. They are made

up of sand gravel clay and rock dumped by melting glaciers and where they meet the lake between Sodus and Mexico Bay they form bluffs which erode and feed material that forms much of the beach.

The glaciers advanced and melted and moved back and forth several times over a period of thousands of years before retreating for good about 6000 years ago. Features like Ridge Road and Irondequoit Bay (which was once the channel of the Genesee River) are the result of ice melting and water level changes. The south shore bays are also products of the ice age, of rebounding land elevation changes, and the shifting levels of prehistoric Lake Ontario which was both larger and smaller at times than it is today.

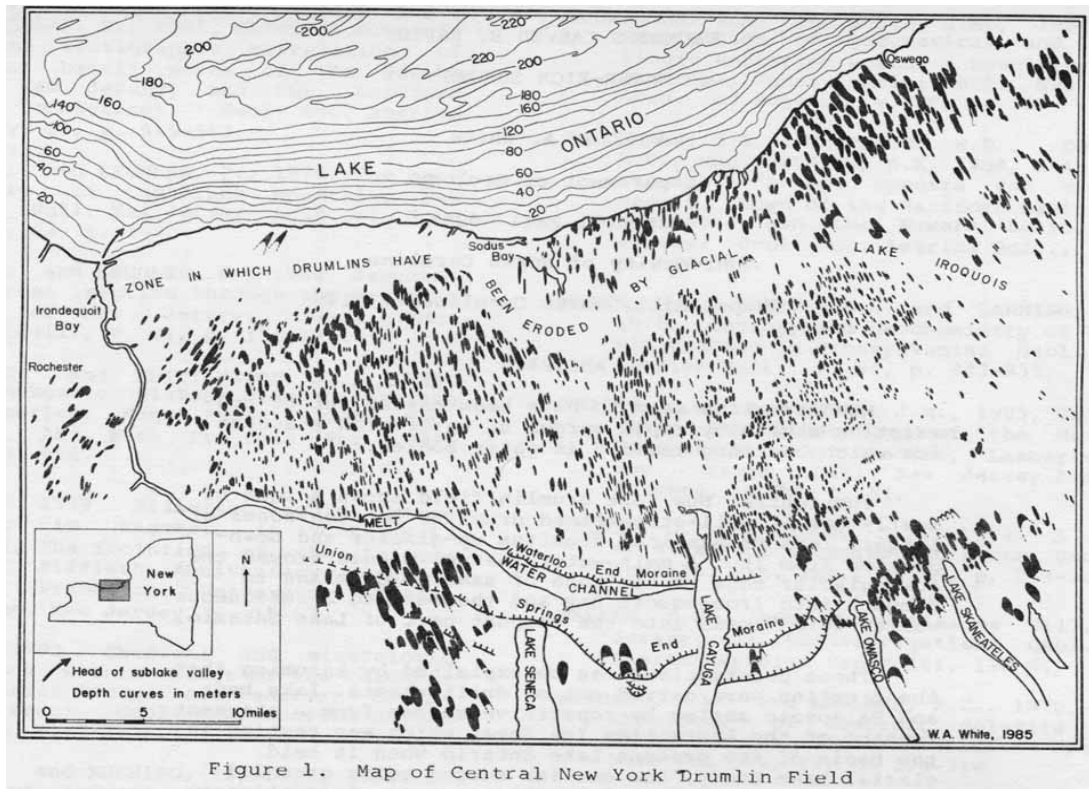


Figure 1. Map of Central New York Drumlin Field

Drumlins are represented by small black shapes in this mid 20th century figure

On the south shore of the lake our land was covered with gravel. Rock, clay and sand called glacial till after the ice melted. This mix is what makes up the drumlins and are beaches along the lake. Drumlins are distinctive ice formed hills elongate in shape and oriented somewhat north south. We have one of the largest groups of drumlins in the world here in central NY.

On the northeast side of the lake, up around Sackets and Kingston the advances and retreats of the glacier scraped rather than dumped so the bedrock is exposed here and creates very different beaches.

The Lake also has a third type of beach that of sand found at its east end, around Toronto (much of it there being man made from dredge spoil) and on the south shore of Prince Edward County.

Watersheds and embayments

Much of Lake Ontario's shoreline is quite straight and unbroken except for small streams and creeks especially along the south shore. However there are a half dozen embayments, Irondequoit, Sodus and Little Sodus being the largest. These were once important commercial ports and remain important to recreation. Their shorelines have been intensely developed for residential use except where occasional public areas have been set aside. Their warm shallow protected waters are also important nursery areas for a variety of Lake Ontario fishes

including some like the herring like alewife, that also play key roles in the open lake's environment.

The lake's northeast corner has several large islands and bays and is more complex and varied. Sackets Harbor was the only deep water harbor on the lake in the early 1800s and so became at one point during the War of 1812 among the most important naval stations in all of America. The biggest wooden battleships to ever float anywhere were launched here then.

Watersheds drainages and why watersheds matter tie in of lake and land

Water is restless stuff- it's always on the go, moving from clouds to ground to rivers and lakes or sinking deep underground. Water enters Lake Ontario from the upper lakes via Niagara Falls and from rivers and streams surrounding it. These drainage areas are made up of *watersheds*. A watershed is an area of land where all the water in it or under it drains off into the same place. Everybody whether in Arizona or Manhattan, lives in a watershed. And all living things within a watershed or linked by their common watercourse as they live upstream or downstream from one another. So your actions and behavior right here in school impact distant lakes and eventually even the ocean and those creatures who live there.

Land use affects the water. If there is bare earth in a watershed, every time it rains the soil washes into the stream. This smothers and chokes life in the stream and bay. Water runs off quickly when it hits a hard surface such as a sidewalk or a paved road. The sudden run off can cause flooding which can cause erosion and more deposits of silt and mud in the downstream waters. Tall grass brush and forests help hold water back and give it time to soak into the ground. This helps keep wells from going dry.

Resources for kids and teachers

To learn more about Lake Ontario's history and ecology check out Twinkle Toes and the Riddle of The Lake

also here are some additional sources of information for Great Lakes and Lake Ontario geology

map

<http://www.dec.ny.gov/lands/48368.html> DEC's Lake Ontario and minor tributaries of New York shoreline maps and stats for watershed information

Here is a very simple short animated feature on the lakes formation by glaciers.

<http://www.on.ec.gc.ca/greatlakeskids/GreatLakesMovie5.html>

illustrations of common lake fossils- from my Edge Walker's Guide to lake Ontario Beach Combing

illustrations of common lake pebbles see the Edge Walker's Guide to Lake Pebbles (order from www.chimneybluff.com or direct from susan@silverwaters.com)

Resources project Kaisai www.projectkaisai.org

The Kaisai is a sail training vessel, a steel hulled brigantine built in Poland for the Japanese to use to teach seamanship. Her name means Ocean Planet. A few years ago an indomitable woman named Mary Crowley who has sailed the oceans for many years acquired the little ship after Japan decided not to fund its training program any longer. About three years ago the Kaisai's crew teamed up with other concerned people to sail to the Pacific where a giant collection of plastic trash has accumulated. The little brigantine is doing research on how to collect the trash without collecting all the plankton and life that is also in the sea near the surface. The website details why this is an important problem. Many years ago when I looked at my very first plankton sample from the

Merrimac River back in 1974 I was horrified at the number of tiny Styrofoam granules it contained. I had wondered for years did the larval fish eat these things? The Kaisai project suggests maybe they do- to the detriment of all of us!

Below is a link to a short article I wrote on my blog at silverwaters.com about Kaisai last spring or Google Lake Ontario Log and find it in the index

<http://www.silverwaters.com/ed/entry.php?id=log&cnum=c1&topicno=15>

Activities and topics to explore outside the classroom for older kids

field trip on their own to a nearby beach (Writing for information and understanding middle school and up grade levels

take a 'field trip' on your own to a near by creek. If possible visit it right after a rain and see if it looks different than during a dry spell. Describe the differences.

where is your watershed- define and describe, map it, any named streams ponds etc anything special about it? How clean and healthy is it? If there is a problem or an issue could something be done to help your waters? who lives upstream and downstream from you in your watershed? What are they putting into your water- use Goggle Earth to investigate land use and activity in your water shed- How much forest land is there in your watershed? Any big farms? Are the fields covered with crops or is there bare soil? Are there businesses, factories, or housing divisions and large paved areas or roofs? How do you think these hard surfaces would impact your watershed? How might a farm impact your watershed?

For high school level

Write a report exploring energy production and Lake Ontario. What impact will wind power have on the Great Lakes? There are at least 20 generating stations using water from Lake Ontario. Why do large centralized power plants need so much water? Are there limits on the amounts of water that can be used without permanent damage to the lake's environment? What are the potential problems associated with the large number of nuclear power plants on the lake shore?

Does your drinking water get a passing grade? Use the Environmental Working Groups data base of municipal tap water test reports here

<http://projects.nytimes.com/toxic-waters/contaminants>

and do some research on the contaminants found near your own water suppliers. Use the Internet and other sources such as interviews with residents.

Find out how many towns in your area depend on lake Ontario for water and see how they rate. Is it time to buy a filter for your family's faucet?

Beach in a Box

“Desk Top beaches” suitable for 25 kids with one Pebble Guide are available for 15.00 to cover shipping and handling or make your own- go to the beach, pick up 20 to 30 pebbles include metamorphic, limestone with fossils, sedimentary, 'man made' etc. Also include a few dozen bits of junk natural and man made so they have a castaway to write about! Have kids pick a pebble and/or a castaway and work individually or have them work in small groups on the exercise depending on class size. Younger kids can 'tell ' their castaway story rather than write it.

