✓ **REMINDERS**

May 11: Required Economic Ex. 19 is due.

May 15: Last class lecture.

May 18: Final Exam from 11:30AM-1:30 PM includes a take-home question due on May 18th

Optional for grading and extra credit exercises are due no later than May 18.

Until May 17: Course Evaluation Period open. See your Hunter email for instructions from the College.

1

25
The Nature of Mining in NYS

Prof. Anthony Grande
Geography Dept
Hunter College – CUNY

Spring 2018

2

NYS is a Mining State

- NYS ranks in or near the **top third** of all states in the **total value** of its mineral production including oil, natural gas and geothermal.
- Ranked #15 in non-fuel mineral production (2015)
  - Mineral resources make a substantial contribution to the state's total economy (c. $1.5 billion).
  - Mining occurs in every county except those of NYC, with St. Lawrence (96), Oswego (90) and Steuben (73) counties having the most mining sites.

✓ **Read Chapter 15 in "*Geology of New York State*"**
✓ **Read the *Mining and Mineral*s handouts on course home page.**
✓ **Look over the DEC *Mining and Mine Reclamation* homepage:** http://www.dec.ny.gov/lands/5020.html

3

Mining Exercise

Optional Exercise 20:

Mining and Land Reclamation

is available on the course homepage.

>> It is due no later than the time of the final exam.

4

NYS is a Mining State

Almost 90% of mining in NYS involves the excavation of:

sand
gravel
limestone

These minerals are used in construction projects.

NYS has important national reserves of

salt garnet
emery gypsum
talc zinc
wollastonite

These minerals are used to produce sandpaper, wall-board, paint pigment, brick, ceramics, plastics, glass and industrial abrasives.

5

NYS National Ranking of Mineral Commodity Production

- New York is the **only state** in the U.S. that produces **wollastonite**. (NYS is #3 in world production after China and India)
  - ✓New York ranks **second** in the nation in the output of **garnet** and **zinc**.
  - ✓Ranks **third** in **salt** production
  - ✓Ranks **seventh** in the production of **construction sand** and **gravel**.

See the Mined Product Fact Sheet:
http://www.dec.ny.gov/docs/materials_minerals_pdf/minfactsht.pdf

https://www.dec.ny.gov/docs/materials_minerals_pdf/minecommodities.pdf
Mine Commodity Production by county

https://www.youtube.com/watch?v=IXdwDI59Xfl **Talc mining in 1990s Gouverneur, NY.**

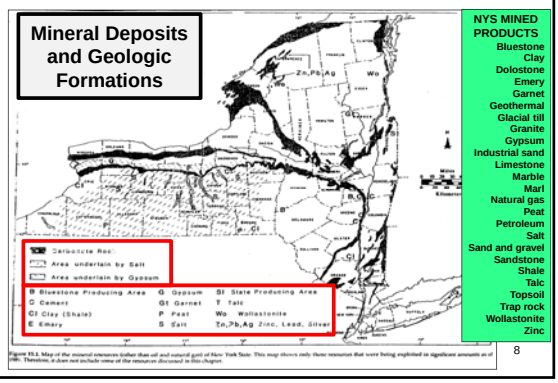
6

Current Leading Mineral Commodities Produced in NYS
(based on value)

1st Crushed stone
2nd Limestone
3rd Salt
4th Construction sand and gravel
5th Zinc

7

Location of Minerals



8

Location of Metallic Minerals

Metallic minerals are found in metamorphic rock deposits.

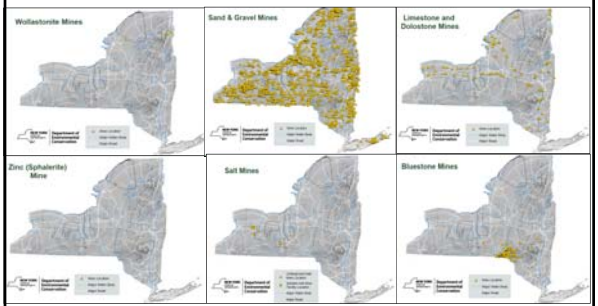
Entrance to St. Lawrence Zinc Co. mine near Sylvia Lake.

9

Mine Locations in NYS

10

Location of Mines by Commodity



11

Mining Slabs of Bluestone

Bluestone Quarry cut into a sedimentary rock formation.

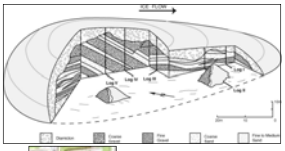
Bluestone is a dense, hard, fine-grained, quartz/feldspar sandstone of Devonian Age, which is easily split along bedding planes.

The term is applied to all varieties, no matter the color. Bluestone has been used for sidewalks, curbing, countertops, patios, fireplaces and many other structural and decorative uses.

12

Sand and Gravel Quarry

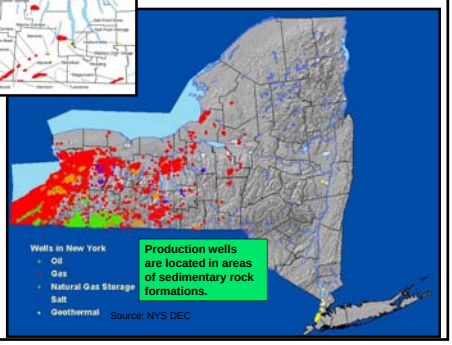
Sand and gravel is mined throughout NYS. Many quarries are operated by towns, counties and the NYS DOT. The main use is road and highway maintenance.



Quarry in a drumlin

13

Wells in NYS



Production wells are located in areas of sedimentary rock formations.

History of Mining

Mining began with the **Native Americans.**

- They used:
  - **chert** for arrowheads
  - **clay** for pottery
  - **stones** for jewelry and tools
  - **iron minerals** for pigment
- They knew the location of **salt springs**.
- They were aware of **petroleum** and **natural gas** escaping from the ground.

European colonists brought **iron making technology** with them.

- They refined the **low grade iron ore** of the Hudson Highlands and Taconic Mts. (esp. in Orange and Columbia co.) into ironware products.
- They found and used **lead, copper, silver**.

15

History of Mining

- By the **mid-1800s** various metals and non-metals were discovered in the Adirondack Mts.
- NYS accounted for **25%** of the **US iron** production.
- The peak of the mining era in NY was from 1880-1920.
- There was a renewal during World War II (1940s) but declined after the war ended.

❖ **Sand and gravel** was considered a nuisance until the late 1800s when cities began to grow.
  - ➢ Now there was a need for construction materials!!

❖ The **proximity** of sand and gravel and natural cement (limestone and clay) **to the NYS cities** aided their growth in the early 1900s.

16

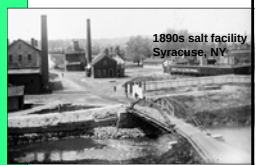
Salt Mining

❖ **Syracuse once provided salt for the entire US.** (During the War of 1812 salt from aboard was embargoed.)

- Salt spring "mining" started in the early 1800s.
- Salt water (brine) was boiled to remove the water. Salt crystals were dried and bagged for shipment.
- After the Erie Canal was opened (1825) salt was shipped east and west by canal boat. This continued into the late 1800s.

http://www.syracuse.com/business-news/index.ssf/2017/04/rare_piece_of_syracuses_long-lost_salt_industry_uncovered.html

THE SALT MUSEUM at Onondaga Lake Park



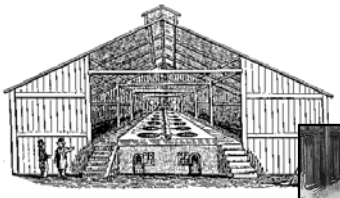
1890s salt facility Syracuse, NY

Mining Salt

Solution Mining (Brine)	Underground Mining (Rock Salt)
1. **Impurities in salt are more easily removed from brine** and allow production of high-grade salt for food-grade products, chemical, and pharmaceutical manufacturing and can be returned to their origin when reinjected with fluids for additional brine production.	1. **Per ton cost of mined rock salt is less** than salt produced by energy intensive evaporation of solution-mined brine.
2. **Brine forms the uniform and pure table salt-sized grains** when it undergoes recrystallization by evaporation and other processing.	2. **Underground rock salt mines use the room and pillar method of mining.**
3. **Brine is easily transported**.	3. **Rock salt is easily stored and handled** by highway service crews.
4. **Brine is a vital raw material for certain chemical manufacturing processes.**	4. **Rock salt is primarily used for ice and snow removal/ control from roads** and is more effective and efficient than brine.

18

19th Century Salt Works
Salina, NY



Internal view of a salt manufactory Salina
From Barber's Historical Collections of the State of New York, 1851

Interior of a boiling block. The men labored in intense heat (over 120° F). Note baskets of wet salt.
(From the collection of the Onondaga County Parks Office of Museums).

19

Nature of Mining

Underground **salt mining** in western NYS was started in the 1860s.

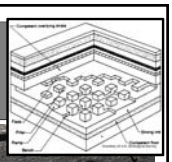
Half mile deep US Salt Company brine well at Watkins Glen, Schuyler Co.' was first opened in 1882.

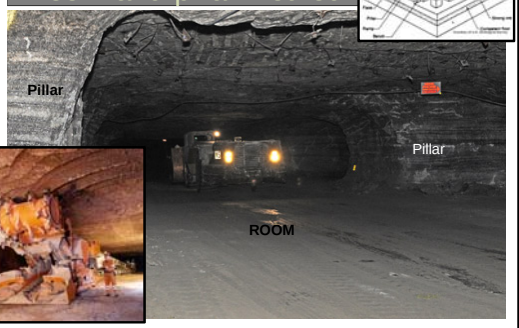
By the 1880s a new technique called **solution mining** was developed.

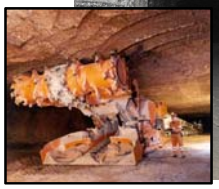
Reopened mines in the 1990s have gone back to using **room and pillar** techniques.

20

Underground Salt Mine
(called halite or rock salt)
Room-and-pillar Method







American Rock Salt Co. Mine

Mt. Morris, Livingston Co.

http://www.economicdevelopmentho.com/blog/american-rock-salt-mine-mount-morris-new-york/

22

Nature of Mining: Petroleum

- **NYS is at the northern edge of the Pennsylvania oil fields.**
  - **Petroleum** (oil) was discovered in SW NYS by Native American Indians who used it as a medicine and for waterproofing.
  - In 1627 they showed the "seep" sites to French missionaries.

23

Nature of Mining

- The petroleum industry **began in 1859** with the first explora-tory wells and **peaked in 1882.**
- It declined rapidly in the 1890s until new technologies were invented in the1930s. Over **75,000** wells have been drilled.
- **Natural gas** was burned off as a "useless and dangerous by-product" in the 1800s.

24

Oil Well Drilling, W NYS

25

Nature of Mining: Marcellus Shale

- In 1980s during first energy crisis, there was a resurgence of drilling for natural gas.
- New technologies developed in the 1990s has made the recovery of gas profitable.
- Until 2009, the **Marcellus Shale** formation was the major source of natural gas in NYS.
- But, the methodology used **(hydraulic fracturing, aka fracking)** created controversy across the Southern Tier counties.

➢ **The practice was banned by NYS in 2014.**

Supplemental Generic Environmental Impact Statement, retrieving natural gas from shale formations:
https://www.dec.ny.gov/docs/materials_minerals_pdf/fsgeis2015ch4.pdf

26

Mined Land Reclamation Act

❖**In 1975 Mined Land Reclamation Act was enacted.**

- Its purpose is to put mined lands back to public use as parks, farms, wildlife habitats and residential developments.

➢**This is a NYS success story!**

27

Mined Land Reclamation Goals

1. **Prevent improper disposal of mining waste.**
2. **Require erosion and sediment control.**
3. **Prevent the contamination of surface and ground water supplies.**
4. **Require dust and noise abatement.**
5. **Guard against aesthetic degradation (protect scenery).**
6. **Protect property value (local tax base).**

https://www.dec.ny.gov/cfmx/extapps/MinedLand/standard/ml_summaries/ :
Project summaries by DEC region and NYS county.

28

Restoring a Mine

DEC Mined Land Reclamation presentation:
http://www.dec.ny.gov/lands/33251.html

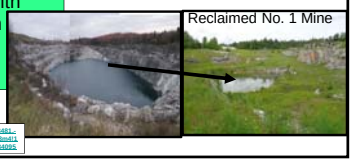
DEC checklist after mining ends:
http://www.dec.ny.gov/cfmx/extapps/MinedLand/help/index.cfm?topic=reclamation_inspections

29

Talc Mine in Fowler, NY Receives National Reclamation Award

- Vanderbilt Minerals stopped talc production in 2008 at its No. 1 and 2 mines in the **Balmat area in St. Lawrence Co**
- Quarry pumps were shut down and reclamation of the lands began.
- The company worked with DEC on the reclamation of 185 acres of affected lands.

- Major revegetation work was completed in 2012; vegetation is now thriving.
- In June 2017, the mine was deemed 100% reclaimed.
- Award was given in Nov, 2017.



https://www.google.com/maps/place/Vanderbilt+Minerals+LLC/@44.2658481,-75.4507621,2294m/data=!3m1!1e3!4m8!1m2!2m1!1sbalmat+no.+1+mine!3m4!1s0x4cccc4effb1ee8ab:0xf93855f27c65d584!8m2!3d44.2578046!4d-75.3984095

30

Galster Sand and Gravel Pit
Onondaga County

Before reclamation

After reclamation

Approximately 36 acres, 20 feet deep, were excavated for gravel above and below the water table at the pit. Kinsella instituted procedures to protect the environment surrounding the pit, stockpiled topsoil to allow for revegetation of all disturbed areas, and created a lake from the exposed aquifer.

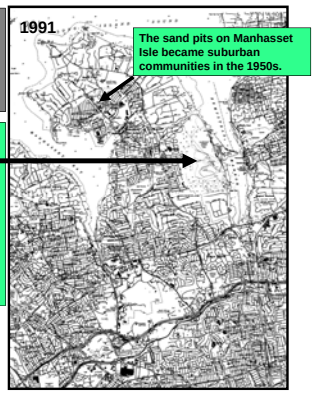
31

Manhasset Neck
Nassau Co.

East shore commercial sand mining operations stopped in the 1980s.

Quarry was closed and then rehabilitated under NYS law (1975). The area is now a county park.

https://www.google.com/maps/place/Manhasset+Neck/@40.8282172,-73.6813414,3786m/data=!3m1!1e3!4m5!3m4!1s0x89c28f3071f0b429:0xf820dd913e7859a!8m2!3d40.840378!4d-73.6870742



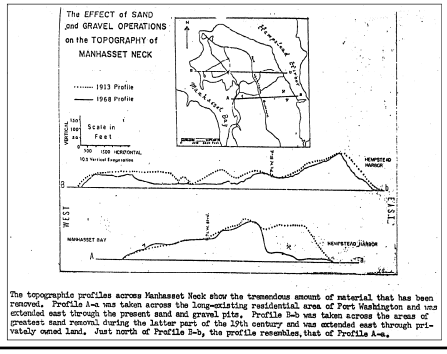
32

Oyster Bay Map

Sea Cliff Map

34

Topographic Profiles
1913 vs. 1968



The topographic profiles across Manhasset Neck show the tremendous amount of material that has been removed. Profile A-a was taken across the long-existing residential area of Port Washington and was extended east through the present sand and gravel pits. Profile B-b was taken across the areas of greatest sand removal during the latter part of the 19th century and was extended east through privately owned land. Just north of Profile B-b, the profile resembles, that of Profile A-a.

35