



Mining Jobs

NPS Keweenaw NHP Archives Koepel B.F. Childs hand drilling ca 1875



Mining Jobs

Second Grade Pre- and Post- Visit Activity Guide

Keweenaw National Historical Park
Calumet, MI 49913

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Grade: 2

Common Core Standards:

- RI.2.3
- RI.2.7
- W.2.8
- SL.2.1
- SL.2.2

Michigan State Standards:

- 2 – H2.0.2
- 2 – H2.0.3
- 2 – G2.0.2
- 2 – E1.0.4

Overview:

Pre-Activities:

1. Mining a cookie
2. Discussion of mining
3. Create a Mining Company

Post-Activities:

1. Discuss mining jobs
2. Portray job and analyze location of mines
3. Create advertisement

Introduction:

Theme:

Mining was not a one-man operation. It required a team of men to make it successful.

Focus:

Jobs at a mining company were demanding and diverse.

Background:

Prior to the 1870s, mining was mainly non-mechanized. Men used sledges, drill steels, and black powder to extract copper from deep within the earth. Rock was brought out of the mine using wheelbarrows and kibbles (wrought iron buckets) that were lifted to the surface using man- or horse-powered whims. In the 1860s, however, men began to use tramcars and skips using tracks laid out underground on more even terrain. In the 1870s and early 1880s, work methods underground began to change even more, as machinery such as the two-man and later the one-man drill were introduced. These machines increased production but lowered the number of miners needed to work. The number of trammers and other lower-paid laborers increased though, due to an increase in production.

Above ground, companies very quickly advanced from using men and animals to hoist copper rock using hemp, then wire, rope. In the 1850s and 1860s, steam engines powered the equipment that hoisted skips, pumped water, and more. The hoisting engine also hauled man-cars. To fuel steam engines in the Keweenaw, many companies first burned wood, then coal, to heat the water in their boilers. Equipment in innovative shaft-rockhouses sorted and crushed rock for further refinement. Poor rock was removed to waste piles, and copper-containing rock was sent to lakeside stamp mills by rail.

At the stamp mill, steam power was used to pound rock and break it into smaller pieces. These pieces were washed and sorted with water: heavier copper fell to the bottom of sorters, and were then taken to the smelter and melted in furnaces. The water containing the waste rock was sent by launder into the lake. The furnaces heated copper to the melting point, and any rock debris (slag) was skimmed off the surface. Men then poured pure molten copper into molds to cool into different shapes, including ingots, cakes, and other forms. Copper was then loaded onto ships and transported to different markets.

Pre-Visit Activity 1:

Duration: 20-30 min

Location: classroom or cafeteria, indoors

Key Vocabulary:

land reclamation, surface mining, underground mining

Objectives:

Students will be able to demonstrate understanding of mining operations by describing costs and labor involved.

Method:

Students will participate in a short mining activity using cookies.

Materials: (enough for each student)

- 2 different kinds of chocolate chip cookies
- 2 toothpicks
- 2 napkins
- 1 piece of paper
- pencil
- Cookie mining worksheet

Pre-Visit Activity 1: Mining a Cookie

Background:

The Keweenaw's copper mines took advantage of copper deposits on the surface (float copper) but they pioneered deep-shaft, hard rock mining techniques. Companies purchased land for mining, but not all locations were the same: some locations had richer lodes and more readily available copper than others. This impacted the cost of copper production and therefore the profits of each company. Mining was also labor-intensive. Early mining involved the use of sledges and octagonal drill steels. These steels, which had a chisel point, would be held by one man while two other men took turns hitting it with sledgehammers. After each strike, the man holding the chisel would turn it slightly and then it was hit again. Once the hole was deep enough, men loaded black powder into it and set the fuse for blasting free the rock. After awhile, companies purchased machinery such as the two-man drill and later the one-man drill, creating a more efficient method of mining copper.

Where companies purchased land also affected their productivity. Land was surveyed, and if proved to have enough copper beneath the surface, large scale operations would begin. Some companies were successful in their land purchases with sufficient amounts of copper to earn a profit while other companies were not.

Most modern mining sites, once mining operations are complete, practice land reclamation. There is no documentation, however, that ecological reclamation occurred at local mines in the Keweenaw Peninsula.



Suggested Procedures:

1. Explain that there is a finite amount of copper that was formed underground many years ago. Ask why we would want the copper and how we can get it out of the ground (underground mining and surface or open-pit mining.)
2. Show the two different cookies. These represent different land sites. Show the mining equipment (toothpicks)
3. Explain how to mine the cookie (directions are on the worksheet provided.) Emphasize that students may not use their hands to mine. They can only use the provided tools.
4. Discuss differences in the cookies. Which one was easier to mine? Which contained the most copper (chocolate chips)
5. Compare this to copper resources. Do some areas have copper that is easier to mine than others? Do some areas have more copper than others? Ask if it was easier to mine chips on the surface of the cookie or chips inside the cookie.
6. Discuss differences between surface and underground mining. Ask if the reclaimed cookies looked like the original cookies. Discuss land reclamation and why it is important.

Pre-Visit Activity 2:

Duration: 20 min

Location: classroom, indoors

Key Vocabulary:

drift, shaft, tram car, skip, poor rock, tailings, slag, ingot

Objectives:

Students will be able to describe the process of mining using at least three terms.

Method:

Students will create a diagram of the mining process.

Materials:

- Keweenaw National Historical Park brochure
- Large white paper, at least 11 x 17 or pre-designed worksheet (separate file)
- Pencils, coloring materials
- Example of completed hand-drawn diagram

Pre-Visit Activity 2: Overview of Mining Process

Background:

Copper production in the Keweenaw Peninsula required deep-shaft, underground mining. Not all operations, however, were done beneath the Earth's surface. Much of the copper production process was done above ground. Extracting copper began with the drilling and blasting of rock beneath the surface using explosions to free copper from the earth. Blasted pieces were removed and hand-loaded into tram cars, which were then pushed through the drifts towards the shafts. The rock was transferred into skips that were hoisted to the surface by a steam-powered drum with a cable attached. As one skip was hauled up, another was sent down by the same drum. Sometimes a man-car that raised and lowered men from the mine was attached.

Rock in the skip was separated and crushed within the shaft-rockhouse. Poor rock was taken out and piled up next to the mine, while copper-containing rock continued in the process and was sent to a stamp mill via railroad. The main rail split into spurs and sidings that allowed rail cars to enter buildings for loading and unloading.

Copper-containing rock was then hauled to a stamp mill, where steam-powered stamps pounded it and broke it into smaller pieces. The stamped rock was sorted by water: heavier copper pieces fell to the bottom of sorters and the lighter waste rock (tailings) was washed into the lake nearby. The copper was collected and transported to the smelter for casting.

The smelting furnaces heated up copper into a liquid. Rock debris (slag) was skimmed off the surface, and oxygen was introduced into the copper while it was melted to burn off remaining impurities. Molten copper was ladled into molds by workers and cooled off. Copper was cast into a variety of shapes, depending on the purpose it would be used for; shapes included ingots, cakes, slabs, bars, and more. Ships transported copper to market in Detroit, Chicago, and Buffalo during the summer when the Great Lakes were free from ice and open for shipping. In winter months, ingots were stock-piled in warehouses for shipping in spring.

Suggested Procedures:

1. Ask students to think about the mining process. How does it work? Where does it start and how does it end?
2. Show students the diagram of the mining process (brochure) and walk through it step by step.
3. Hand out the large white paper and explain to students that they will create their own diagram of the mining process by drawing pictures and writing a small description.
4. Show example of completed hand-drawn diagram.
5. Step by step, guide students through the creation of the diagram. (There are 10 steps)



Pre-Visit Activity 3:

Duration: 15-20 min

Location: classroom, indoors

Key Vocabulary:
company, logo

Objectives:

Students will be able to recognize that companies need a variety of workers to be successful and will demonstrate this by creating groups of individuals with different skills.

Method:

Students will sort themselves into balanced groups of "surface" and "underground" workers.

Materials:

- Small paper labels: "underground" and "surface" (enough for each student)
- White paper
- Coloring supplies
- Map of the Keweenaw Peninsula without copper vein depicted

Pre-Visit Activity 3: Create a Mining Company

Background:

Underground jobs required strong men willing to endure 10-hours underground six days a week. Men had to eat lunch underground and there were no bathrooms. They were innovative, often times using empty powder or candle boxes for toilets. Men also worked in low lighting and had to climb and descend as needed. Temperatures underground varied. The deepest mines were warm and uncomfortable with temperatures reaching around 80-84 degrees Fahrenheit.

Surface workers tended to the hoisting of men and rock, unloading skips, sorting rock, stamping rock, and smelting. They harvested timber, constructed mine buildings, and repaired equipment. There were also business and administrative aspects to be managed. There was an agent, later called a superintendent or general manager, who communicated with East coast officers and supervised personnel under him. A chief clerk made payrolls, paid bills, and ordered supplies. He also kept the books. A mining captain controlled underground operations while a surface captain controlled shops and machinery above. There were superintendents at stamp mills and railroad operations as well.

Suggested Procedures:

1. Introduce students to the types of jobs available at a mining company.
2. Explain that the students will be divided into groups to create mining companies. They will first get their assigned positions. They will then be split into 2 mining "companies" with equal amounts of each position.
3. Pass out a small paper labeled "underground" or "surface" to each student facedown. These will indicate where they will be working at the mine. There should be half underground workers and half surface workers (ex. There are 24 students, 12 are underground workers and 12 are surface workers.)
4. Divide students into 2 small groups with ½ underground and ½ surface workers. Actual job descriptions will be decided after the visit to the Calumet Visitor Center.
5. Students will create a name for their company and decide where they originated from. Most mining companies were from the East coast (Boston.) They will also decide upon a name for their company.
6. Using a map of the Keweenaw Peninsula, each group will choose where to put their mine. They will make a colored dot in the area they claim. This will be used after their visit. The group with the student who mined the most chips from their cookie in pre-activity #1 can choose their land first.
7. Optional: Students will create a symbol or logo for their mining company.

Post-Visit Activity 1:

Duration: 45 min

Location: classroom, indoors

Key Vocabulary:
stull, shaft, drift, stope, kibble, skip

Objectives:
Students will be able to describe at least 2 different mining jobs.

Method:
Students will review observations from their visit and read information about mining positions before discussing jobs with classmates.

Materials:

- T-chart labeled "underground jobs" and "surface jobs"

Post-Visit Activity 1: Mining Jobs and Key Occupations of a Mining Company

Background:

Underground miners needed to be observant and know how to identify the best and most efficient way to blast copper rock. They also needed to be strong enough to swing sledgehammers or operate machinery. As excavation occurred underground, timbermen were sometimes needed to install stulls and square-set timber in stopes for stabilization. Men were also needed to create shafts, drifts, and stopes by drilling and blasting rock. They were appropriately called shaft-sinkers, drifters, and stopers. Boys were also employed to work underground. Drill boys ran errands, carried water, and supplied sharpened drill steels for miners. Puffer boys operated small compressed air driven engines. In later years, motor boys operated the earliest electric haulage locomotives.

Underground Work Prior to 1870

Mining was done largely without machines underground and by using candles for lighting. Men worked in teams of three to drill and blast rock. One man held a drill steel with a star shaped or octagonal wedge tip. Two other men took turns hitting the steel with sledgehammers. Once the hole was large enough, black powder was inserted and a fuse was lit to blast the copper rock from the wall. Once the rock was blasted it fell to the ground, where it would be hauled to the shaft in wheelbarrows and loaded into a kibble, which would be hoisted to the surface. Sometimes, massive pieces of pure mass copper were found. Men used chisels to cut into the malleable copper until it separated into pieces small enough to move to the shaft and hoist from the mine.

Underground Work after 1870

Lighting was improved over time, from candles up to the mid-1870s, to sunshine lamps that used paraffin-based fuel, and then to carbide lamps. Trammers used tramcars (which were twice the size of the mineral cars used on the surface) instead of wheelbarrows to haul rock to the shaft. There, they unloaded the rock into specially designed skips instead of kibbles. Machinery such as the two-man, and later the one-man, drill were now being operated using compressed air. Black powder was replaced by nitroglycerin dynamite. These improvements increased production and gave more work to trammers and laborers, but lowered the number of more highly paid miners working in an area. Men needed to use chisels to cut into large pieces of mass copper until the early 1900s.

Surface

Over time, men, animals, and engines all hoisted copper rock up from the mines for processing on the surface. At first, men used windlasses with chains or hemp ropes to crank copper rock up to the surface. Later, horses were used to turn whims. Rock was brought up in kibbles (large metal buckets) and was moved into a sorting house. Then laborers heated up the rock on beds of timber, and as it cooled they hit it with a sledge hammer to break up large pieces. The rock was then sent to the stamp mill for even finer processing. This type of sorting and crushing was later done by engines and machines. By the 1860s steam engines became increasingly common. They were used to hoist skips, pump water, and lower and raise workers into and up from the mine. Steam engines also powered stamps to crush ore, a back-breaking task once accomplished by hand. At first, many mine companies used wood fires to heat the water in the boilers that powered the stamps, requiring loggers and sawyers to prepare the fuel. Wood was replaced by coal, which was transported by ship and later rail. Blacksmiths made tools and supplies, including horseshoes, and fixed broken equipment like drill bits. Men were also employed to operate and monitor equipment that sorted and crushed rock in rockhouses aboveground. Later, the shafthouse and rockhouse were combined into shaft-rockhouses, which were also mechanized. Once sorted, ore went to stamp mills for additional crushing, and then to the smelter for melting and casting. Surface workers pushed mineral cars filled with copper ready to be smelted. Administration oversaw all operations.

Suggested Procedures:

1. Review what students observed during their visit to the Calumet Visitor Center using the first floor exhibit area before reviewing the second floor exhibit area. Focus on displays that showed jobs related to the mining operations.
First Floor: two-man saw- timber supported mine shafts, provided fuel for the steam-engines; mineral car- trammers and surface workers; General Manager James MacNaughton's bag, coat, and hat; President Alexander Agassiz (telephone)
Second Floor: timber clear cut picture; pipe fitting-pattern maker; rock drill; trammers; Payroll display listing electrician, engineer, brakeman, blacksmith, captain, clerk, carpenter; Underage display- mill boys and drill boys. "best job" description (telephone)
2. Conduct a student-led discussion why immigrants came to mine if it was a dangerous and difficult job (money, opportunity, skilled in mining already, etc.)
3. Hand out short descriptions of jobs (found at the end of the lesson). Students that had "underground worker" as their job should read all about jobs underground. Students that had "surface work" as their job will read all about jobs on the surface.
4. Create a T-chart and sort out the jobs as underground or surface jobs.

Post-Visit Activity 2:

Duration: 45 min

Location: classroom, indoors

Key Vocabulary:

mineral car operator, laborer, miner, copper cutter, trammer, hoist operator, steam engine operator, blacksmith, surface worker, sorter, lander, logger, superintendent/ general manager, chief clerk, head mining captain, surface captain, shaft captain, shift captain

Objectives:

Students will be able to demonstrate their knowledge on a specific mine job through acting.

Method:

In assigned groups, students will have a job to act out based upon the time period of their mining company's operation.

Materials:

- Job descriptions
- Map of the Keweenaw Peninsula with copper vein depicted
- Optional: any props students would like to use

Post-Visit Activity 2: Act out Job

Background:

Refer to background from post-activity #1 and job descriptions found at the end of the lesson.

Suggested Procedures:

1. Students will gather in their groups from the pre-activity. Each student should know if they are surface or underground workers from the pre-activity.
2. Assign one group to be prior to 1880 and the other group to be after 1880.
3. Hand out the job descriptions to the students. These should be cut-out and handed face-down to the students. Have the jobs pre-sorted with underground separate from surface work. Mix in the administration descriptions as well. The amount of jobs will be determined by the amount of students in each group.
4. Students will read over their job description and determine how to act it out. They will also write a short script to say while they are acting it out.
5. The two groups will practice their presentation in separate areas.
6. After practicing, each group will take a turn at presenting the jobs.
7. Compare how the jobs were different depending on the era using a class discussion.
8. Determine if their mining companies chose a good place to mine using the map from pre-activity 2. This map will have a colored dot on the area they claimed. Compare this to a map of where the vein of copper was located on the Keweenaw Peninsula. (Observed during the visit) If their chosen area was not a "successful" spot, where would they choose to move and why?



Post-Visit Activity 3:

Duration: 20 min

Location: classroom, indoors

Key Vocabulary:
advertisement

Objectives:

Students will be able to create an advertisement that describes a mining job in a positive view.

Method:

Students will use poster size paper and markers or colored pencils.

Materials:

- Optional: Pictures of advertisements- these could be similar to the "wanted" poster found in the 2nd floor entry hall.
- Poster or large paper
- Markers or colored pencils

Post-Visit Activity 3: Create Advertisement

Background:

Companies hire in a variety of ways. They can use word-of-mouth or an advertisement. Advertisements are usually eye-catching and describe the product or job in a positive way. Many businesses and companies used paper notices to recruit new employees in the 1800s and 1900s.

Suggested Procedures:

1. Explain to students that they are going to advertise the position they held during the previous activity (post-activity 2) for their company.
2. Brainstorm words that would make the job appealing in a description.
3. Students will write an advertisement that is not more than 3-5 sentences. This will be approved before they start their poster.
4. Students will draw a picture on their poster and write the advertisement. Remind them that this needs to be large, neat, and eye-catching.



Glossary:

Advertisement- something shown to the public (such as a poster or commercial) that sells a product or promotes a job. Makes an announcement.

Company- a business that makes, buys, or sells goods or provides services for money

Drift- horizontal tunnel usually following a mineral vein

Drill boy- boy that worked underground who ran errands, carried water, and supplied sharpened drill steels to miners

Ingot- block of cooled copper; most common shape of cast copper

Kibble- cast-iron bucket used to haul up rock from underground

Laborer- general worker but also applied to surface worker that heated up rock on beds of timber to crack it before hitting the rock with a sledge hammer as the rock cooled to break up large pieces

Land reclamation- the process of restoring a piece of land to its original state or as close to its original state as possible.

Logo- a symbol that identifies a company

Motor boy- operated electric haulage locomotive

Poor rock- unused rock, separated from rock containing copper

Puffer boy- boy that operated small compressed air driven engines

Shaft- a hole, typically vertical, that gives access to a mine and can provide ventilation

Skip- large rectangular cart that was filled with rock and then hoisted to the surface

Slag- rock debris skimmed off the surface of molten copper

Stope- Step-like excavation underground

Stull- supporting timber in a mine

Surface mining- a process used to remove minerals near the surface of the Earth. It is accomplished using strip-mining, open-pit mining, or quarrying.

Tailings- waste rock removed after the stamping process and washed into a lake

Tram car- a four wheeled cart used in mines, usually follows a rail

Underground mining- a process of mining in which miners work under Earth's surface to extract minerals.

References:

Lankton, Larry. Cradle to Grave. New York: Oxford University Press, 1991

Lankton, Larry and Charles K. Hyde. Old Reliable. Hancock, MI: Book Concern Printers, 2003

Copper Country Trail Map:

http://www.coppercountrytrail.org/wp-content/uploads/2012/06/CCMineralMap_large.jpg

Keweenaw National Historical Park Brochure:

<https://www.nps.gov/kewe/planyourvisit/upload/KEWEBrochure2016.pdf>

Mining History:

http://www.minsocam.org/MSA/collectors_corner/vft/mi3c.htm

Name: _____

Date: _____

Cookie Mining

Directions:

1. Trace the outline of cookie A on a piece of paper. Map the location of the chocolate chips you can see on the top.
2. Count the number of chips you can see on the top and sides of the cookie. Record this number on the chart.
3. Using the toothpick, carefully mine as many chocolate chips as you can from the cookie. Set the chips aside in a pile.
4. Count the number of chips mined from the cookie. Record the number on the chart.
5. Put the cookie back together without the chocolate chips, trying to keep it within the outline of the cookie you created in step 1. Compare to your map of the cookie.
6. Repeat the procedure for the other cookie.

Cookie	Number of Chips on Surface	Number of Chips Mined
A		
B		

Which cookie was easier to mine and why?

What is reclamation and why is it important?

Mining Occupations

Underground Positions prior to 1880:

Miner (at least 3) - One of three men that drill. One holds the steel and two other miners take turns hitting the steel with sledges. They loaded the holes with black powder and lit fuses.

Copper cutter (at least 2-3)- A person that broke massive pieces of copper into smaller pieces that were able to be lifted and hauled out. They chiseled repeatedly until the rock broke along a line they created.

Trammer (at least 1)- A person that hauled the rock to a shaft using wheelbarrows.

Drill boy- A boy that worked underground who ran errands, carried water, and supplied sharpened drill steels to miners.

Surface Work prior to 1880:

Surface worker- hoist operator- A person that used windlasses with chain or hemp rope to crank up copper rock

Surface worker- shaft house mineral car- A person that pushed a small car filled with rock to a sorting house. They also pushed the car filled with copper to be smelted.

Laborer- sorting or rock house (at least 2)- Men who picked and sorted rock by size and kind of rock which was then sent to the kiln house.

Laborer-kiln house (at least 2)- Men that heated up 4-6 foot high stamp-rock and copper piles on four feet high beds of timber to crack the rock which they then hit with a sledge hammer to break apart.

Logger- A person who harvested wood for the boilers as well as for support beams underground.

Furnace man- A person working at the smelter that accessed melted copper in the furnace through access doors to skim off the slag of molten rock. They also used a paddle shaped instrument called a rabble to mix air into the copper. This oxidized impurities. They then eliminated any excess air using wooden poles before ladling the melting copper into molds.

Mining Occupations

Underground Work after 1880:

Miner (at least three)- Men that used two-man drills and one-man drills. They also loaded the holes with nitroglycerin dynamite and lit the fuses.

Copper Cutter (at least 2-3)- A person that broke massive pieces of copper into smaller pieces that were able to be lifted and hauled out. They tried using machines for this, but also chiseled repeatedly until the rock broke along a line that was created.

Trammer (at least 1)- A person that hauled the rock to a shaft using a tramcar.

Drill boy- A boy that worked underground who ran errands, carried water, and supplied sharpened drill steels to miners.

Puffer boy- boy that operated small compressed air driven engines

Motor boy- operated electric haulage locomotive

Surface Work after 1880:

Surface worker-hoist operator- A person that monitored when to crank up a skip or man-car using a steam powered hoist.

Surface worker-steam engine- A person that chopped wood and kept the fire burning for the boiler.

Blacksmith- A person who created and fixed metal parts for the operating machinery.

Surface laborer-sorter (at least 2-3)- A person who sorted and crushed rock in the rockhouse or shaft-rockhouse as well as the stamper. They had the help of steam-powered stamps and machinery to move the rocks. The rock was separated by hydraulic separators.

Lander- A person in the shaft-rockhouse that used levers to dump skips where he needed them after they were hoisted to the surface.

Logger- A person who harvested wood for the boilers as well as for support beams underground.

Furnace man- A person working at the smelter that accessed melted copper in the furnace through access doors to skim off the slag of molten rock. They also used a paddle shaped instrument called a rabble to mix air into the copper. This oxidized impurities. They then eliminated any excess air using wooden poles before ladling the melting copper into molds.

Mining Occupations

Management and Administration (both):

Superintendent/General Manager- An agent that corresponded to eastern officials and also supervised personnel.

Chief clerk- A person who kept the books, made payrolls, ordered supplies, and paid bills.

Head mining captain- The person who oversaw underground operations. He decided how to follow the lode and which areas should be stoped or worked. He was considered to be part manager, part geologist, and part engineer.

Surface captain- The person managing all shops and machinery above ground. He was in charge of all hoists, boilers, compressors, and rockhouses. He was also in charge of machine, blacksmith, and carpenter shops.

Shaft captain- A person who oversaw operations for each hoisting shaft.

Shift captain (2)- People below the shaft captain that are similar to general foremen. They spent time underground monitoring the work of crews. There was one for day work and one for night work.