

Lesson 1: How will you get your taconite to market?

By Craig Croone, Northfield Middle School

Topic: Shipping on the Great Lakes

Time: 1-2 class periods depending on depth, and detail of research, and modeling.

Target: Grade 8 standards; applicable for grades 6-10.

Lesson Overview:

The goal of this lesson is to get students thinking about how products get from where they are produced to where they are used. To accomplish this, the lesson will use Minnesota taconite (the product) and how does it get to where it is used (the eastern steel mills). This lesson will fit nicely into a geology and/or mining in Minnesota unit as an extension activity.

Objectives:

The student will be able to demonstrate through discussion and description a basic understanding of the value of shipping and how shipping works, on the Great Lakes:

1. The methods of shipping taconite from Minnesota to markets in the east.
2. Cost benefits of shipping that is the cost per mile per ton to ship on water vs. land.

Minnesota Science Standards Addressed:

1. History and Nature of Science. B. Science inquiry, 3. The student will use appropriate technology and mathematics skills to access, gather, store, retrieve and organize data.
2. History and Nature of Science. D. Historic Perspectives, 2. The student will cite examples of how science and technology contribute to changes in agriculture, manufacturing, sanitation, medicine, warfare, transportation, information processing or communication.
3. Earth and Space Science. A. Earth Structure and Processes, The student will investigate the impact humans have on the environment.

Vocabulary:

Iron Ore- An ore is any rock or mineral that may be mined for profit.

Taconite- Magnetic magnetite is removed and processed into marble sized pellets using clay lime and taconite ore.

Magnetite – An iron oxide Fe_3O_4 This iron ore is found

Bentonite – clay that is used as a binder for the taconite pellets

Limestone Flux – added to the taconite pellets to promote better steel formation in the furnaces.

Promotes fusing of the metal atoms and prevents oxidations.

Materials needed:

- Samples of taconite pellets
- Videos for background information: “Where Steel Begins” from the American Iron Ore Association and “Tell Us about Taconite: An Introduction to the Iron Mining Industry of Minnesota.”
- Cardboard cutouts to scale of ships, trucks, and rail cars for use in tracing and making their own cutout silhouettes. You could have these readily available if time is an issue.
- Room set up in such a fashion that the middle is a “big open lake.” Desks and chairs could be left round the room to simulate the difficulty in terrains both natural and urban when traveling over land.

Pre-assessment: Ask students to list all the ways that products may be transported from one place to another.

Procedure:

1. Each student or groups of students will have a small pile of taconite pellets at their lab station.
2. Students will work individually or in small groups to decide how they want to get their taconite to market. From their lab station near the back of the room to steel mills in the front of the room. The middle of the room is a “great lake,” If you are to stay on land you must travel around it. Depending on time, you can have student measure distances on your room model to see which is the shortest route.
3. Have on hand or have students make cardboard silhouette models to scale of trucks/trains/ships. This will enable the students to visually see which will carry more of their pellets. Note pellets here are NOT to scale.
4. Ideally students will begin to see that shipping via the “great lake” is the way to go. It is the shortest distance between two points.
5. Introduce other information by questions like:
 - a. Is distance your only concern?
 - b. What about cost per mile?
 - c. How can you calculate cost per mile?
 - d. Where could you find information on the cost of trucking vs. railroads vs. ore ships? This one could be assigned as homework research or depending on computer availability it could be done in class as part of the lesson. To shorten the lesson, the teacher could have the current costs per mile available as a hand out.

Assessment:

Assess student understanding with a class discussion or written answers in a journal to the following questions as seen in #5 of the procedure.

Websites:

<http://www.taconite.org/>
<http://talc.geo.umn.edu/mgs/>
<http://www.ironrangeresearchcenter.org/mining/about/index.htm>
<http://www.dnr.state.mn.us/minerals/index.html>
<http://duluthport.com/>
<http://www.duluthboats.com/2003sch/schedule.html>
<http://www.wunderground.com/MAR/LS/141.html>
<http://geography.about.com/library/misc/ucmesabi.htm>

References

Ojakangas, Richard. Matsch, Charles. (1984). *Minnesota's Geology*. pp. 125-149 Minneapolis, MN. University of Minnesota Press.

Sansome, Constance. (1990). *Minnesota Underfoot* pp. 62-72 Stillwater, MN Voyageur Press.

Westmoreland, Larson, and Hill. (1988) *Tell Us About Taconite* (Video) Iron Mining Industry of Minnesota Duluth, MN