MINING

Teacher Guide
including
Lesson Plans, Student Readers, and More Information

Lesson 1 - Mining Industry

Lesson 2 - Coal Mining (Lab)

Lesson 3 - Aggregate and Concrete Industry

Lesson 4 - Aggregate and Concrete (Lab)

Lesson 5 - Mining Resources that Changed the World

designed to be used as an Electronic Textbook
in class or at home

materials can be obtained from the Math/Science Nucleus

EARTH SCIENCES - MINING

Lesson 1 - Mining Industry

MATERIALS:

reader

Objective: Students learn the importance of the mining industry.

Teacher note

Mining is important in creating products. Students will realize the importance of mining, whenever they look at products. We use mining products every hour of every day of our life. There are many careers in this industry, whether as a seller of the product or a miner of the raw materials.

It is estimated that the following amount of materials is needed to sustain one individual in a developed country. This would include metals used in cars and homes like aluminum, zinc, or steel. A summary is given below:

- 1,600 kg (3,600 lb) of aluminum
- 360 kg (800 lb) of zinc
- 11,300 kg (25,000 lb) of clay
- 25,400 kg (56,000 lb) of steel
- 360 kg (800 lb) of lead
- 680 kg (1,500 lb) of copper
- 12,200 kg (27,000 lb) of salt
- More than 226,000 kg (500,000 lb) of coal
- More than 453,000 kg (1 million lb) of stone, sand, gravel, and cement

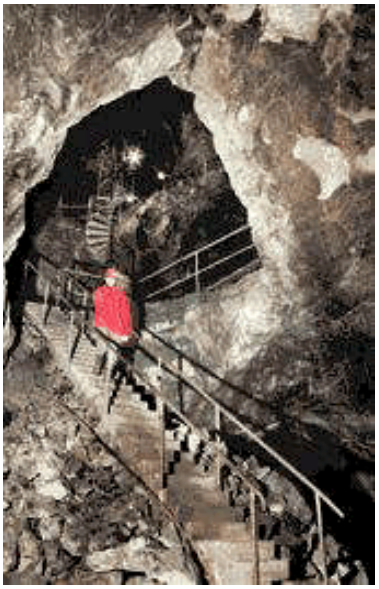
There is a great deal of information on different mining commodities on the internet. However, you may want to check your state or country's agency on mines, which can provide local information.

As an added assignment you might want the students to increase the list of products from mining that is included in the reader. The more they research the more they will appreciate the mining industry. The following websites may be of interest.

Minerals Information Institute
http://www.mii.org
Steel Industry
http://www.steel.org/
Abandoned mines
http://www.aqd.nps.gov/grd/amlbrochure/

Mining is the exploration and removal of minerals or other substances of economic importance. It is an old industry that has evolved along with humans. Products from mining are so commonplace that we sometimes don't think about where our modern conveniences come from. The first weapons that were ever fashioned by "cavemen" were probably stones that they "mined" at a local river bed. Stones were used to create shelter and coal was mined to help them maintain their fire

Companies mine coal, oil, and gas which are fuels. **Metals** from rock that contain a high concentration of that metal (**ore**) or **precious metals** (i.e., gold), as well as **nonmetallic** products such as sodium, potassium, and crushed stone are mined. These products are used in homes offices, transportation, communication, and weapons. For example, it takes more than 30 different minerals from the mining industry to make a television.



Sala Silver Mine, Sweden

Two major types of products are mined including metals and nonmetals. Minerals that are mined in their native form would include gold and silver. **Mineral ores** are more commonly mined. They are enriched rocks with the metal that is needed for extraction. For example, you cannot find a piece of pure iron. The iron would have to be extracted from other mineral ores like hematite or magnetite.

Non metallic substances include coal, sand and gravel (**aggregates**), gypsum, and oil. Although oil is technically mined, it is always considered a separate industry because of its large size. Enclosed is a list of products from the mining industry and their uses. This is just a short list, of the thousands of metals and nonmetals products.

Gypsum mine, India

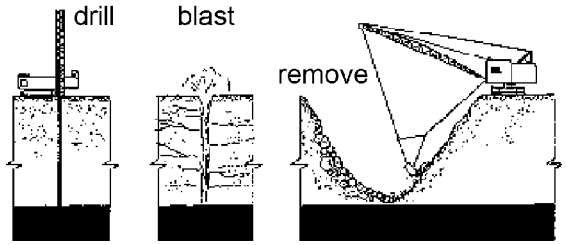
Products from Mining Industry

metal/nonmetal	products
Coal	Generating electricity, making iron and steel, manufacturing chemicals and other products
Sand and gravel	Building roads, homes, schools, offices, and factories
Iron ore	Steel products (kitchen utensils, automobiles, ships, buildings)
Aluminum ore (bauxite)	Military aircraft, naval vessels, pots and pans, beverage cans
Copper ore	Electrical motors, generators, communications equipment, wiring
Silver ore	Electric and electronics circuitry, coins, jewelry, photographic film
Gold ore	Jewelry, satellites, sophisticated electronic circuits
Zinc	Diecasting, galvanizing brass and bronze, protective coatings on steel, chemical compounds in rubber and paints
Lead	Batteries, solder, electronic components
Clay	Bricks, paper, paint, glass, pottery, linoleum, concrete, wallboard, spackling, pencils, microwavable containers, vegetable oil
Gypsum	Concrete, wallboard, spackling, caulking, potting soil
Phosphate	Plant fertilizers
Diatomite	filtering everything from milk to swimming pools, industrial filler and insulation
asbestos	Insulating agent, roofing and flooring products
Boron	Strengthening agent for glass products, chemical fire retardant, soap and detergents, vitreous enamel
Feldspar	Glass making, ceramics, coatings, and plating
Limestone	Used in cement processing, steel furnaces, water treatment, paper production
Salt	Cooking, drinking water, plastics, ice removable, detergents

Mining of large deposits over an extensive area requires one of a variety of **extraction** methods. There are different types of mines to obtain raw material, and it depends on the shape and type of deposits. The types of mining can be grouped into surface mining and subsurface mining.

Opening to subsurface mine

Surface methods are the simplest and cheapest. Some deposits like coal, gypsum, and oil shale are deposited in relatively flat and continuous areas. These products are found in beds or **seams** that are between layers of rock. The material above the seam is called the **overburden**. The overburden can be removed if it is not too deep and create an **open pit** or **strip mine**.



Removing the overburden

Subsurface mining techniques are dependant on how deep the deposits are. Some veins of gold will branch off into many directions. **Excavating** these types of deposits can be very dangerous.

Some of the minerals produced, such as coal and salt, are ready to use right after they have been mined. These are referred to as "dig and ship." It may be necessary to wash or treat these **commodities** in different ways to enhance their quality, but their properties remain essentially unchanged.

Ready to ship

However, most metals usually occur in nature combined with other materials which is called an ore. Ores need to be treated, usually with chemicals or heat, to separate the metal from its host material. These processing techniques can be very complex and expensive, but they are the only way to recover the metal of interest. The table below shows ore minerals for the listed elements.

element	oxide	sulfide	carbonate
mercury	cinnabar		
tin	cassiterite		
lead	minim	galena	cerrusite
copper	cuprite	chalcopyrite	malachite
silver		argentite	
iron	hematite	pyrite	siderite

Steel worker

The mining industry is large and world wide. Like the oil companies many of the companies are **multinational** with large holdings in different countries. Mining has changed greatly in the past century, especially in the power of mining corporations in local and national affairs.

The labor movement, including the health of workers and the long term effects of mining on people and community has also changed the balance of power. The powerful steel industry for example, uses iron ore to produce steel. The steel industry is the backbone of bridges, the framework of cars and the skeleton of large buildings. As the industrial revolution continued to grow, the demand of iron ore exploration increased dramatically.

Either we grow products or we mine them in developing and sustaining a society. Mining is not only important, it is essential.

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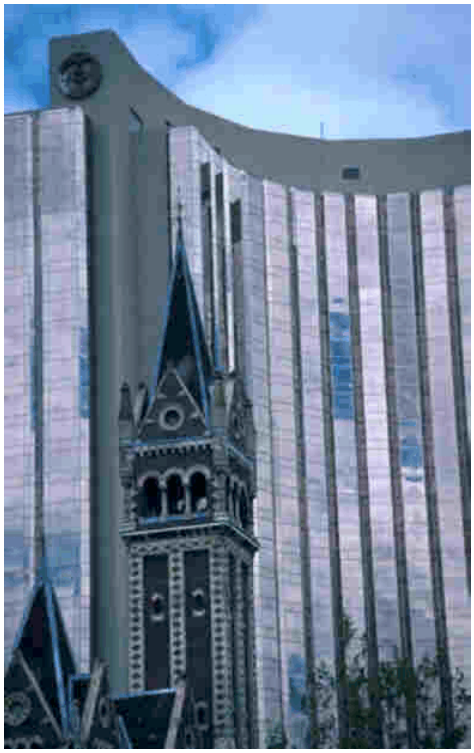


Steel and concrete, building a nation

EARTH SCIENCES - MINING

Lesson 2. Coal Mining (Lab)

MATERIALS:

reader
samples of wood, peat, different grades of coal

Objective: Students compare different types of coal.

Teacher note

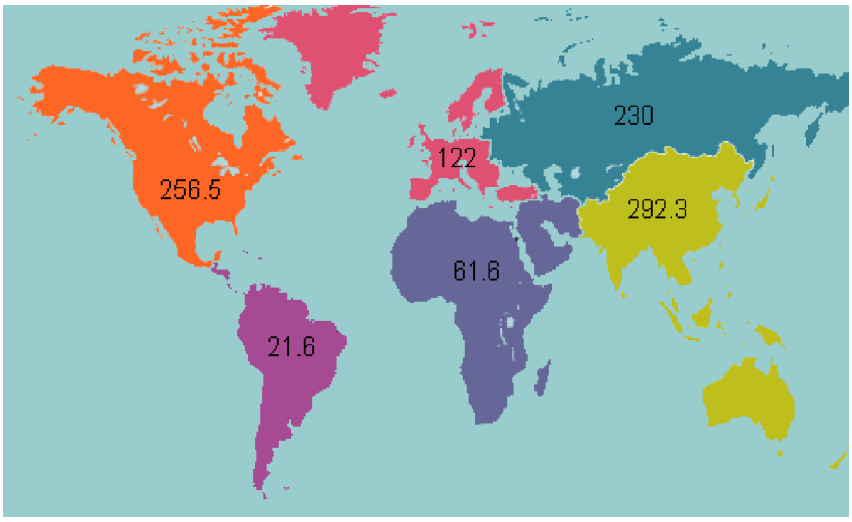
Coal was once a symbol of destruction of the environment and abuse of mine workers. The demand for coal during the later part of the 1800's and early 1900's and lack of heavy equipment for mining, drove companies to push miners to produce more. This combination of demand and exploitation of workers lead to miner strikes which could have crippled the growth of the United States and England.

Underground mining cost the lives of many men and many died of “black lung” disease. The dust of the coal would almost “coat” the lining of miners’ lungs and cause respiratory failure after just a few years exposure in the mines.

This lab has students identify the different types of coal, which is considered a sedimentary rock. There are 4 basic types of samples for students to identify including peat, lignite, bituminous, and anthracite coal. There are many different grades from lignite to anthracite, depending on the maturation history of the area.

Samples for these labs could be obtained from local sources. Look in your phone book or internet for local suppliers. Even ask students to bring in samples if they have seen coal. Include wood and charcoal (burnt wood) so students can compare and contrast.

American Coal Foundation
http://www.acf-coal.org
Kentucky Geologic Survey
http://www.uky.edu/KGS/coal/webcoal/pages/coal3.htm
United Mine Workers of America
http://www.umwa.org



Numbers refer to millions of tons coal reserves

Throughout history, coal probably has fueled more expansion of industrialized society than any other fuel. Today, it is used to create steam from water which turns generators to create electricity. Many countries in the world still use coal to cook. Typically, it takes about one ton of coal to produce 2,500 kilowatt-hours of electricity. Coal is by far more plentiful than **domestic** oil or natural gas, making up about 95 percent of America's fossil energy reserves.

Historically coal has been used to heat and work wherever sources of coal were near by. In the 1300's Hopi Indians in America regularly mined coal to cook and heat their homes. In the 1700's coal was better and more abundant than wood in the emerging industrialized nations of United States and Europe. Coal fueled most of the steam engines which were vital for rail and ocean transportation. By 1875 a by-product of coal (coke) replaced charcoal to make steel.

There are four basic forms in the evolution of coal including **peat**, **lignite**, **bituminous**, and **anthracite** coal. Peat is compressed plant remains derived from swampy regions. It is the raw material from which coal is made. It is used in various areas of the world, especially in the British Isles where it is cut into cubes and dried to be burned in stoves. There are substantial quantities of fuel peat worldwide, mainly in Canada, Russia, Northern Europe, and in tropical countries such as Indonesia.


Peat fields, Ireland


Lignite

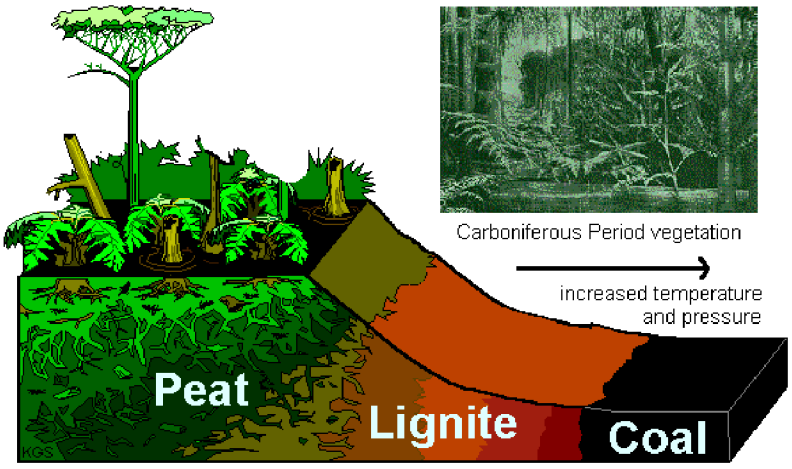
Lignite is a brownish-black coal with generally high moisture and ash content, and the lowest **carbon** content and heating value. About 79 percent of lignite coal is used to generate electricity, 13.5 percent is used to generate synthetic natural gas, and 7.5 percent is used to produce **fertilizer** products.

Bituminous

After millions of years of more heat and pressure from within the Earth's surface, lignite changes into bituminous or hard coal. Bituminous coal is an intermediate grade of coal that is the most common and widely used in the United States. A grade referred to sub-bituminous is a dull black coal with a higher heating value than lignite, but lower than true bituminous. Bituminous coal is primarily used for power generation, and the production of cement, iron and steel.

Bituminous coal in nature, transforms into a harder form called anthracite coal. Anthracite is the hardest type, consisting of nearly pure carbon. Anthracite coal has the highest heating value and lowest moisture and ash content. It is used for domestic and industrial purposes, including smokeless fuel.

Anthracite

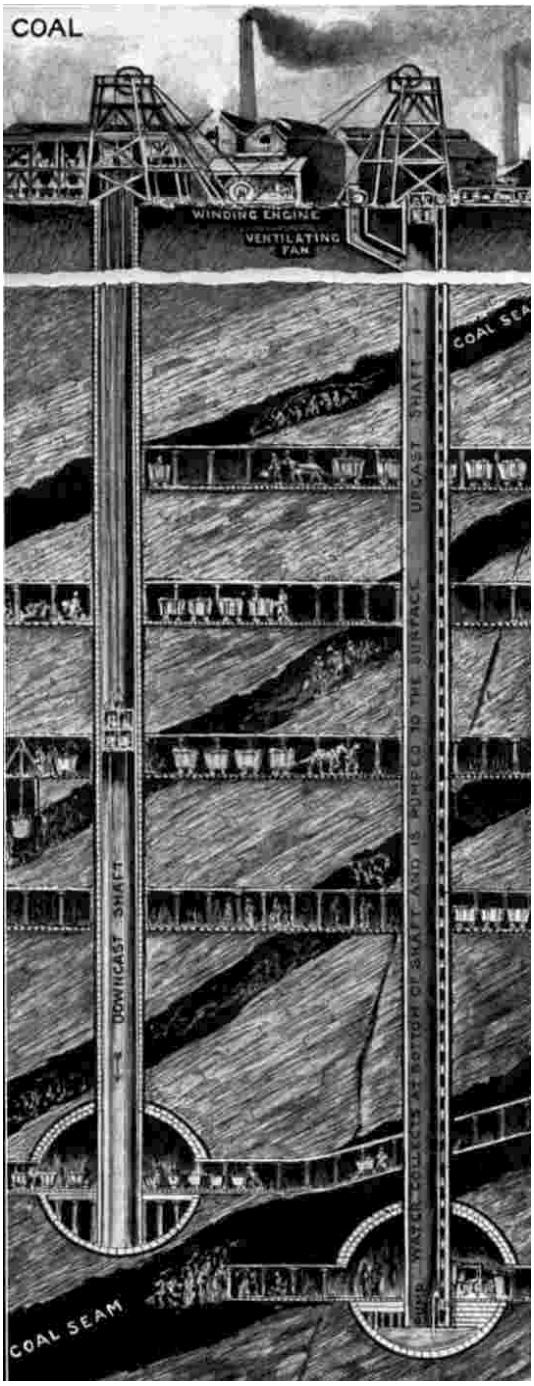


Carboniferous Period vegetation

Coal is basically a sedimentary rock made of various amounts of decaying organic matter. The origins of coal require a swampy area that has abundant plant life. This occurred mainly in swamps and in lagoons producing a spongy, brown material called peat.

Geologic forces buried the peat under the Earth's surface and layers of peat were further compacted by heat and pressure. The compressed peat was eventually converted to coal. The greater the heat and pressure, the harder the coal.

There are times in geologic history where coal formation was dominate. The **Carboniferous Period**, named for abundance of carbon derived from plants (280 to 345 million years ago). Vast regions in North America and Eurasia produced large coal fields which are still mined.

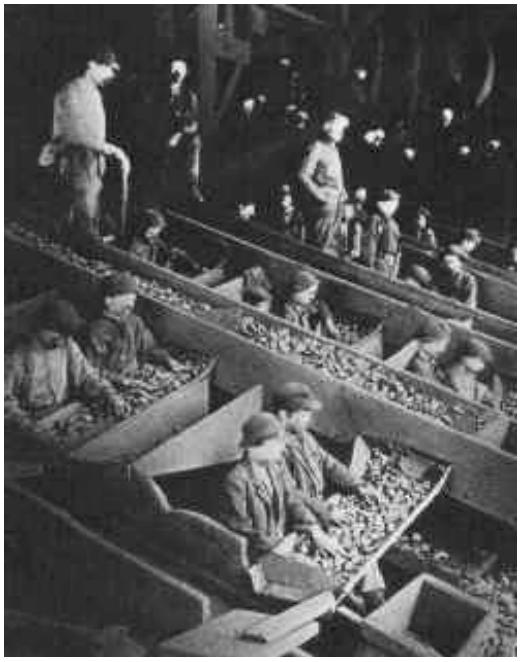


Subsurface mining of coal

There are two basic ways to mine coal, surface and subsurface mining. Surface mining involves removing the overburden (earth and rock covering the coal) with heavy earth moving equipment and scooping out the coal. Presently, after mining is completed in surface mines, they reclaim the area by reestablishing vegetation and plant life.

The second method extracts coal from seams of coal within sedimentary strata. The coal is reached by drilling two openings into the coal bed to transport workers and equipment and to send coal to the surface. Both openings serve to circulate air in the mine. This is a difficult way of extracting coal, especially prior to equipment specializing in coal extraction.


Surface mining of coal



"Breaker" boys

In the United States and England the history of coal extraction is a lesson on exploitation of workers and the growth of unions. Work in the subsurface mines was back breaking. Hand drills would cut into the coal to insert dynamite. Explosions would dislodge the coal and then men would put the coal in carts to be brought to the surface. The men would spend 10-16 hours in cramped, unsafe conditions. Many men left their young wives and children widows as many men died in mine disasters from explosions to suffocating from lack of oxygen.

Young breaker boys were used to sort the crushed coal into sellable pieces. This type of child labor helped to enact Child Labor Laws in the United States. The need for coal and **exploitation** of workers became a national concern in the early 1900's.

Opening to a coal mine

Theodore Roosevelt in the early 1900"s

EARTH SCIENCES - MINING

PROBLEM: How are grades of coal different and how does it effect energy efficiency?

HYPOTHESIS:

MATERIALS: anthracite, bituminous, lignite, and other grades of coal, charcoal,
PROCEDURE: See if you can identify your sample. Describe each specimen. Note you may have more than one sample of the same type.

number	type	describe

EARTH SCIENCES - MINING

Lesson 3 - Aggregate and Concrete Industry

MATERIALS:

reader

Objective: Students learn about the mining of aggregates.

Teacher note

The making of aggregate and concrete is rarely considered an industry by most people. It is so abundant and all around us, we just don't see it. In developing countries the need for this raw material is vital.

Some countries have the natural resources to allow mining of these aggregates. Geologically, areas such as glacial, marine, lake, stream, and eolian (wind) deposits are major sources for the aggregate business.

The concrete used in the building industry forms in the same way as geological cements. Concrete is made of rocks, sand, and cement. It is one of the most inexpensive, widely used, and durable building materials available. Man-made geological cements have been used for a long time. Cement dates back more than 5,000 years to the construction of the Great Pyramids in Egypt. The cement used by the Egyptians was a "calcined" gypsum (dried to remove water), which today is commonly known as plaster of Paris. The Mycenaeans and Phoenicians realized that the calcined gypsum cement was not very strong, and found that a lime-based ("lime" = CaO) cement was much stronger and durable. This lime-based cement is very similar to the cement in modern concrete. The most impressive use of concrete in the ancient world was by the Romans, who improved the strength of the cement and used it to construct most of their famous monuments and buildings.

In 1824, Joseph Aspdin developed a process for measuring out limestone and clay, converting them to powder, heating the powder, and then grinding them into another powder finer than flour. He found that if he mixed this cement with water and aggregate, the resulting material had nearly twice the strength of many natural mineral cements. This cement was named "Portland cement" because the limestone was mined on the English island of Portland.

Ancient stone building, Parthenon, Athens

Up to the late 1800's the mining of crushed stone was done by man and mules. Mines employed men to use sledge hammers using their muscles to work the quarries. Wagons pulled by animals would send the stone to market. It was a slow and back breaking job. Today modern machinery with power and capacity can move the largest boulders and rip into the surface of the Earth with ease.

We usually don't think about roads as a major technological accomplishment requiring its own industry. Nor do we look at stone or concrete building as a marvel of human knowledge. But they are!

Making a road

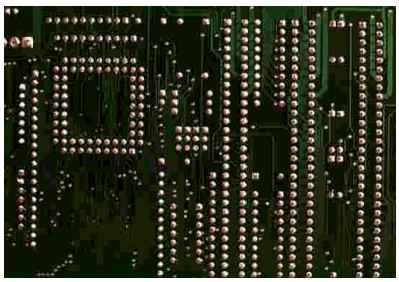
Gravestones

What do we mean when we say aggregate? The word aggregate refers to any combination of sand, gravel and stone. Sand and gravel are a clean (without soil) mixture of fine or coarse grained material, usually mined for steam channels beaches, or in the oceans. Stones are usually quarried in large open pit mines.

Products from the aggregate industry even include the raw material (quartz sand) to produce silicon in the computer chip making business. The aggregate industry also produces the gravel, sand, and cement needed for concrete and asphalt products. Concrete is used to construct buildings and roads, while asphalt is primarily for roads.

Quartz sand

Large rocks are used as "**rip rap**" which helps in shoreline protection, channel protection, and slope protection. Landscaping of homes and industries are also users of rocks for decorative and drainage purposes. Stones are even quarried for gravestones.



Silicon

An aggregate is just a rock, you might think. Not so, because not all rocks can qualify. Crushed stone can be composed of limestone, granite, or any hard rock that is produced by blasting and then crushing.

When you are making a road or building there are physical, chemical, and **mechanical** properties you have to consider. For example the particle shape can prevent skids at high speed on roadways. If you choose aggregates with smooth surfaces, it will promote skidding. If you use aggregates that are more angular you increase resistance, but then you might increase tire wear.


Mining landscape rocks

Size and sorting of the particles are important. When roads are being made, you need to compact the aggregate to make an even surface. If you have too many different sizes then you might have too much pore space. Fluids could seep through and cause erosion under a roadway. That could cause major troubles for vehicles.


Landscaping that helps drainage


Stones for the house and road

Aggregates should have a resistance to different chemicals. Imagine having a road built with salt. After heavy rains, the entire road would collapse. Other rocks, especially clastic sedimentary rocks are not resistant to water. Metamorphic rocks are sometimes too **fractured** to be used. Igneous rocks and some chemical sedimentary rocks, like chert, are suitable aggregates for use in the building and road industries of today.

Mechanical properties refer to how the aggregate performs with strength and stability. You do not want aggregates that will break down when the first truck drives on a road.

Modern concrete uses three types of aggregates and are mixed in proportions that are expressed in three numbers. For example, 1:2:3 means one part **Portland cement**, two parts of clean sand, and three parts gravel or pebbles.


Concrete with stone steps

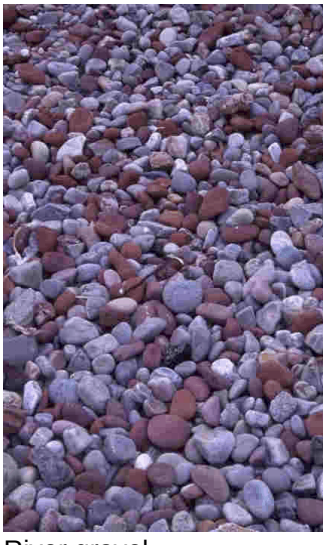
A common misconception about concrete is that it hardens or dries through evaporation. Actually, concrete hardens because of chemical reactions that take place when water is added to the dry concrete mixture. This produces new chemical compounds that lock in water between their molecules. This process, known as **hydration**, forms crystals that bind the concrete mixture together. These new crystals fill in the spaces between the aggregate, cement, and sand. The speed of hydration depends on the temperature, amount of water, and the type of cement.

The process of hydration takes **curing** time. The concrete mixture can lose up to half of its strength if not kept wet during the first seven days after pouring. The full hydration time for common cement is about 28 days. The longer the curing time, the more hydration takes place, and the stronger the concrete becomes. Concrete thus becomes stronger as it grows older.

There are basically two types of aggregate mining. Aggregates that are ready to be used without major blasting and screening is the most prized. Geologically you would look for glacial, marine, lake, stream, and **eolian** (wind) deposits that have not yet become sedimentary rocks. These would be the cleanest deposits. Other deposits may include poorly cemented sedimentary rocks, especially for pebbles and gravel and hard consolidated rocks like igneous or chemical sedimentary for road fill.

If they are looking just for sand deposits, they can mine them on an ancient beach. For example, there are ancient sand dunes at Sand City in California. The mining operation just bags the old sand and sells it as play sand (coarser grained) and sand for concrete (finer grained).


Sand City, California


River gravel

How do you mine aggregates? Once you find suitable rocks that can be used as aggregate you then have to remove and crush the material. Usually a mining operation is an open pit, so you would remove the top soil and then blast the rock face. Dynamite is cheap and does the job very efficiently.

After the rocks are crushed by the blast then they are screened into different sizes, depending on the needs of the nearby industry. Gravel and pebble size is used in the construction industry; fine grained is used in concrete industry; and larger pieces are used in the landscaping business.

Silos for aggregate storage

EARTH SCIENCES - MINING

Lesson 4 - Aggregate and Concrete (Lab)

MATERIALS:

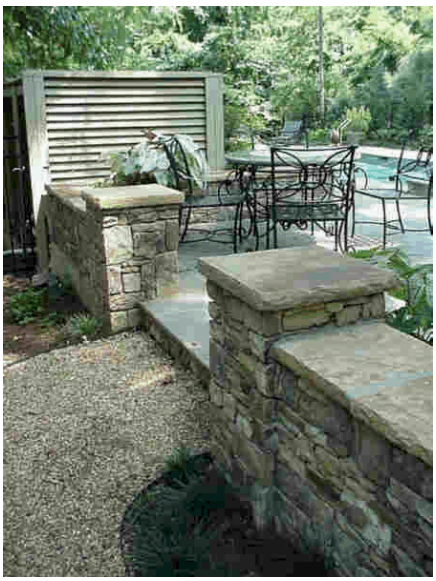
reader
concrete
asphalt
decorative rocks
magnifying lenses
Swift GH microscope

Objective: Students compare local concrete and aggregates products.

Teacher note

This lab can either be a field trip or obtaining samples nearby. Aggregates are everywhere. Record where you got the materials because in lab the students will have to determine where you might have found the samples.

You may want to go to a landscaping retailer and see if they can suggest some samples. Remember once you get the samples you can repeat this lab over and over. You may also want some students to add to your collection for extra credit.



Products from aggregates are used everywhere, that we sometimes don't see the products. Aggregates can be used for making your front yard look nice to roads to drive on.

In this lab you will look at different local aggregates. See if you can determine if it comes from a road, a sidewalk, a building, or a decorative area. On your lab sheet describe the sample and where you think it came from. After the lab, your instructor will go over where the samples came from. On your way home, see if you can see other products from aggregates.

EARTH SCIENCES - MINING

PROBLEM: Can you recognize local uses of aggregates?

HYPOTHESIS:

MATERIALS: different aggregate samples provided by your teacher
PROCEDURE: Look at samples and describe their characteristics. Consult sedimentary rock labs for help in description (size, sorting, roundness). Can you tell where the sample comes from and how it is used?

sample	describe	where is it from/use

EARTH SCIENCES - MINING

Lesson 5 - Mining Resources that Changed the World

MATERIALS:

reader
Internet

Objective: Students learn how mining has changed the world.

Teacher note

The history of how different mining products have changed the course of history are too numerous to describe in this reader. Metals from mining are used to make weapons of war to vehicles to transport goods. However, this reader is intended to act as a springboard for students to learn more information on their own.

The internet has many different sites with this information, below are just a few. You may want students to find sites on different mining products that interest them. When students find out the importance of mining, it is hard to stop their minds from thinking.

Gold History (World)
http://www.gold.org/Ginfos/Gi2pro.htm

California Gold Rush
http://www.calgoldrush.com
http://www.goldrush.com/~joann
http://www.pbs.org/goldrush/
http://collections.ic.gc.ca/motherlode/home.htm

Copper Industry
http://www.copper.org/history/copper.htm
http://www.naciente.com/essay88.htm

Salt
http://www.saltinfo.com/indexpage1.htm
http://www.cargillsalt.com/cargillsalt/csalt_history.htm

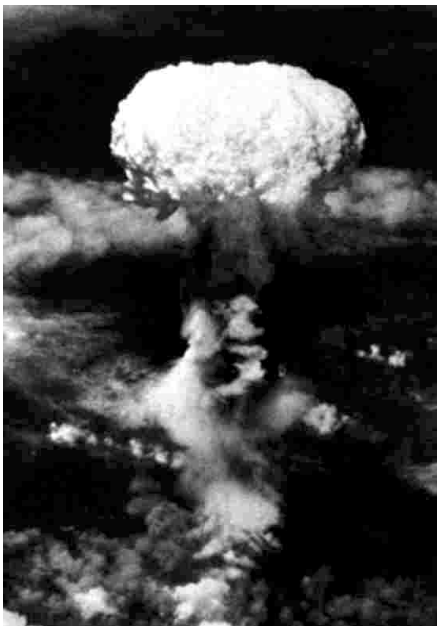
Mineral resources can change the course of history. When a resource is needed, a country will “stop” everything to get that product. In wars, the invasion of neighboring countries is usually to gain their resources. The steel industry during World War II was converted totally to the war effort. Sometimes the impact of that **commodity** is itself, the cause of wars and the beginning of conflicts that span over centuries.


Early weapons from metals

Gold is a mineral resource that shaped humans’ idea of wealth. The Bronze Age began when they discovered that heating copper with tin created a useful metal. Extraction of iron from different mineral ores created a metal that could make vehicles, buildings, and weapons. Salt is a mineral resource that caused major wars for the very rights to use this simple, but important product.

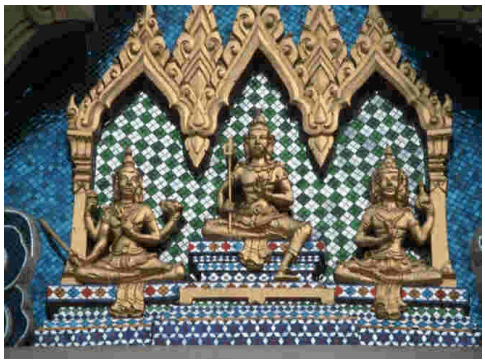

Uranium ore from Australia

The **atomic bomb** uses uranium, which is mined. Uranium only became valuable since the explosion of the first atomic bomb in 1945, during World War II. Today, most of the world's uranium is for peaceful uses, especially to generate electricity in nuclear power stations. A controlled atomic process produces heat, which converts water to steam to drive the **turbines** which generate electricity.


Atomic Bomb in World War II

Gold ingot

In 1500 BC, gold was mined in the region of Nubia (Egypt) one of the richest societies of all time. The demand for this precious mineral throughout the world was the reason for creating gold as the international standard in trade. Gold was used because it was the first metal that could be used to make weapons stronger. Gold has the property of being highly malleable, but still strong. Gold does not tarnish or corrode and is a symbol of eternity. Even after other metals were better than gold for weapons, the gold still was a symbol of wealth.

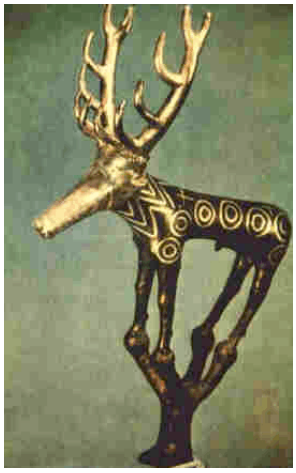


Thailand gold gilded temple

Wars throughout history were fought for this established wealth including Alexander the Great in Macedonia (300 BC), Charlemagne in Europe (700 AD), and King Ferdinand in Spain (1511). The “discovery” of the Americas was all in the search of gold.

Prospecting for gold in the western United States helped to bring settlers into the region. In the 1800's easterners and Europeans heard of the unbelievable wealth west of the Mississippi. Dreams of instant wealth drove hundreds of thousands of people to the promised land to prospect for minerals.

Gold is a heavy, **malleable**, yellow metal. Since gold is mainly found in granitic rock, the weathering of granite plays an important part of mining “**placer**” deposits Miners used these properties to “pan” for gold. This technique allows the denser gold flakes to settle to the bottom of a pan. This technique is still used today.


Copper alloy, 2300BC

In history, copper is the first kind of metal ever used. Cyprus in the Mediterranean area, for centuries was the largest producer of copper throughout antiquity. The word copper comes from "Cycrum," the Latin name known for Cyprus. Copper when heated with tin will form bronze. The Bronze Age, around 3000 B.C., introduced a metal to advance civilization.

Miners on Cyprus left behind thousands of copper producing pits and more thousands of crude hammering stones with which the pits had been worked. The ancients apparently worked the copper bearing rock by alternately using fire and cold water, to break the copper ore into smaller pieces from which they could extract the metal with hand held hammering stones or stone hatchets. With this copper, they made tools that were prized possession. Cyprus became a wealthy nation because of their abundant copper resources.


Copper ore

Copper is still an important commodity. Copper is a major industrial metal because of its properties including high **ductility**, malleability, thermal and electrical conductivity, and its resistance to **corrosion**. Copper ranks third after iron and aluminum in terms of quantities used. Electrical uses of copper include power transmission and generation, building wiring, telecommunication, and electronic products.

Building construction is the single largest market, followed by electronics and electronic products, transportation, industrial machinery, and consumer products. Copper by products from manufacturing and obsolete copper products are readily recycled and contribute significantly to the copper supply.


Open copper mines, Arizona

Halite or salt

Salt was so important in the days prior to refrigerators, because it preserves meats and other food. In the Roman Empire, 100 million people used about one million tons of salt per year. The Romans would even pay their soldiers part of their salary in salt. The word “salary” comes from the word (salarium) meaning salt. Many wars were fought over control of salt production.

Salt, also known as the mineral halite, has many uses. Almost every person in the world has some direct or indirect contact with salt every day. People use salt to flavor or preserve their food or apply rock salt to walkways to remove ice in the winter. Mining salt can be through brine wells, solar evaporation, or mining of ancient salt deposits.

Solar evaporation in the San Francisco Bay

Earth Science - Mining - Unit Test

Part I. Definitions: Match the number of the term or concepts in Column 1 with the letter of the correct definition in Column 2.

Column 1	Column 2
1. Copper	a. non metallic resource
2. Aggregate	b. hydrogen and carbon are major components
3. Anthracite	c. black coal of not the highest grade
4. Concrete	d. decomposed plant matter
5. Lignite	e. removal of overburden to mine
6. Bituminous	f. metallic resource
7. Salt	g. brown coal
8. Bronze	h. cement plus aggregate
9. Open pit mine	i. any combination of sand, gravel and crushed stone
10. Peat	j. copper and tin alloy

Part II. Multiple Choice Choose the best answer to complete each statement.

1. The term aggregate does not apply to
    a. sand
    b. gravel
    c. coal
    d. pebbles

2. Concrete is a human-made
    a. granite
    b. gneiss
    c. coal
    d. conglomerate

3. Material on top of a mineral deposit is called a
    a. underburden
    b. overburden
    c. seam
    d. vein

4. Rip-rap stones are used for
    a. Coal extraction
    b. Shoreline protection
    c. Gravestones
    d. Asphalt

5. Which of the following does not use products from the aggregate industry?
    a. concrete
    b. gravestones
    c. coal
    d. decorative rocks

6. Which metals are used to make bronze?
    a. copper and tin
    b. gold and tin
    c. tin and pyrite
    d. gold and copper

7. Which is not a grade of coal?
    a. lignite
    b. bituminous
    c. tar
    d. anthracite

8. The following is not an ore.
    a. hematite
    b. pyrite
    c. cinnabar
    d. gold

9. To extract the metal from an ore you use
    a. oil
    b. salt
    c. heat and salt
    d. chemical and heat

10. Subsurface mining involves
    a. following a vein with substance of economic value
    b. blasting the top
    c. following a bed
    d. reclamation

Answers:

Part I.

1. F
2. I
3. J
4. H
5. G
6. C
7. A
8. J
9. E
10. D

Part II

1. C
2. D
3. B
4. B
5. C
6. A
7. C
8. D
9. D
10. A