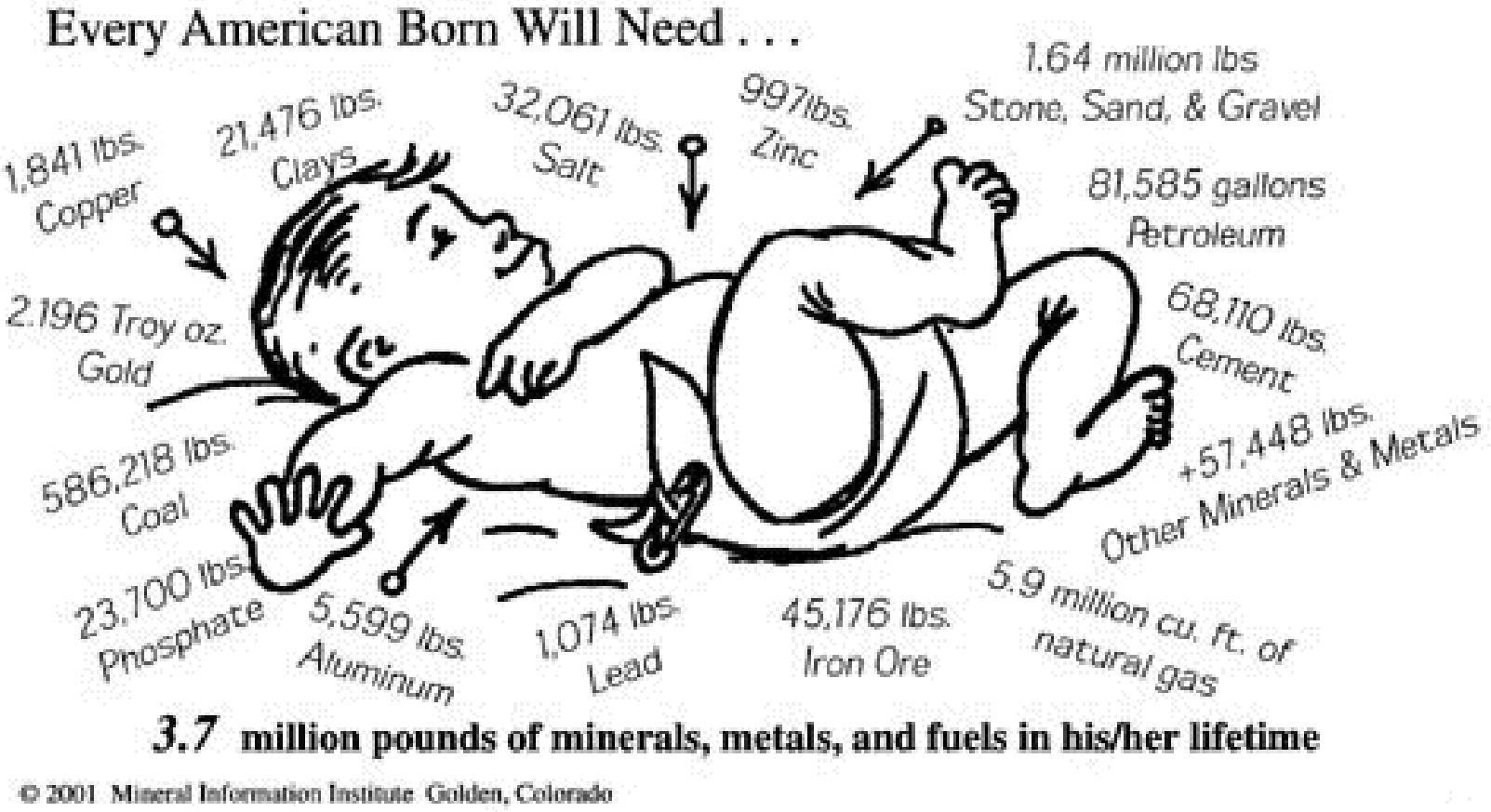
Minerals

- Natural
- Solid
- Inorganic
- Definite chemical composition
- Crystal structure due to internal arrangement of atoms

http://www.minerals.net/gemstone/index.htm



http://www.mii.org/www.mii.org

General Facts about Minerals

- More 3,000 have been identified
- A few are “native elements” -- made of only one element, such as sulfur, gold. copper, and graphite (carbon)
- Most are compounds, especially the silicate group (Si, O).
- Other important groups are oxides, carbonates, and sulfides.

Less than a dozen commonly form most of the rocks

- Quartz
- Feldspar (group)
- Muscovite (white mica)
- Biotite (black mica)
- Calcite
- Pyroxene
- Olivine
- Amphibole (group)
- Magnetite, limonite, and other iron oxides
- Pyrite

Common uses include:

- Aluminum--packaging, transport, building
- Beryllium--gemstones, fluorescent lights
- Copper--electric cables, wires, switches
- Feldspar--glass and ceramics
- Iron--buildings, automobiles, magnets
- Calcite--toothpaste, construction
- http://www.mii.org/commonminerals.php

Minerals are identified by their key characteristics

- hardness
- crystal shape (form)
- luster
- color
- streak
- cleavage/fracture
- density (specific gravity)
- special properties
  --reaction to acid
  --fluorescence
  --salty taste
  --magnetism

Mineral Hardness

- Ability to scratch another mineral
- Mohs scale from 1 (talc) to 10 (diamond)
- Quartz (most common mineral and most dust particles) is 7

http://mineral.galleries.com/minerals/elements/diamond/diamond.htm

Crystal Shape (Form)

- External structure due to internal arrangement of the atoms
- Six basic groups of shapes, with about three dozen variations

http://www.minerals.net/mineral/carbonat/aragonit/aragoni1.htm

Luster

- Describes how light reflects off the surface
- Main categories are “metallic” and “non-metallic”
- Non-metallic includes “dull,” glassy,” waxy,” “pearly,” and othershttp://www.minerals.net/mineral/sulfides/pyrite/pyrite2.htm

http://www.minerals.net/mineral/sulfides/pyrite/pyrite2.htm

Color

- results from ability to absorb some wavelengths and reflect others
- some minerals have characteristics colors
- others vary due to chemical differences or impurities (atoms mixed inside the main elements)

http://www.minerals.net/mineral/carbonat/calcite/images/4assortd.htm

Streak

- Color of the powder when rubbed on a "streak plate" (unglazed porcelain)
- May be same as hand-specimen or different
- Some paint is based on powdered minerals (streaks).

http://www.minerals.net/mineral/oxides/hematite/hematit6.htm

Mineral cleavage/fracture

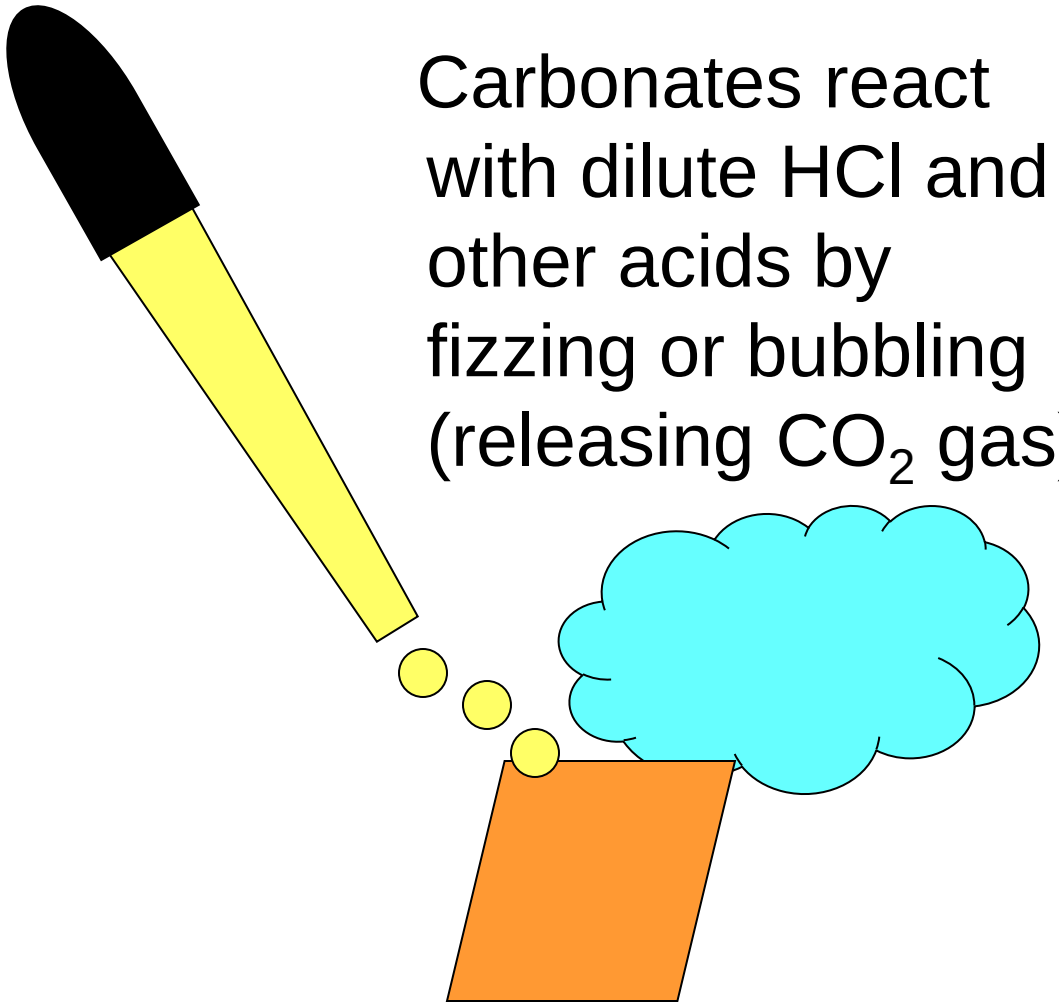
- Some minerals split along flat surfaces when struck hard--this is called mineral cleavage
- Other minerals break unevenly along rough or curved surfaces--this is called fracture
- A few minerals show both cleavage and fracture

Density (Specific Gravity)

- All minerals have density (mass / volume), but some are very dense
- Examples include galena, magnetite, and gold
- Specific Gravity means the density of the mineral compared with the density of water

http://www.minerals.net/mineral/elements/gold/gold1.htm

Special Characteristics--the “Acid Test”



Carbonates react with dilute HCl and other acids by fizzing or bubbling (releasing CO_2 gas)

Special Characteristics--Fluorescence

- Some minerals will glow when placed under short-wave or long-wave ultraviolet rays
- Franklin and Ogdensburg NJ are famous for their fluorescent minerals

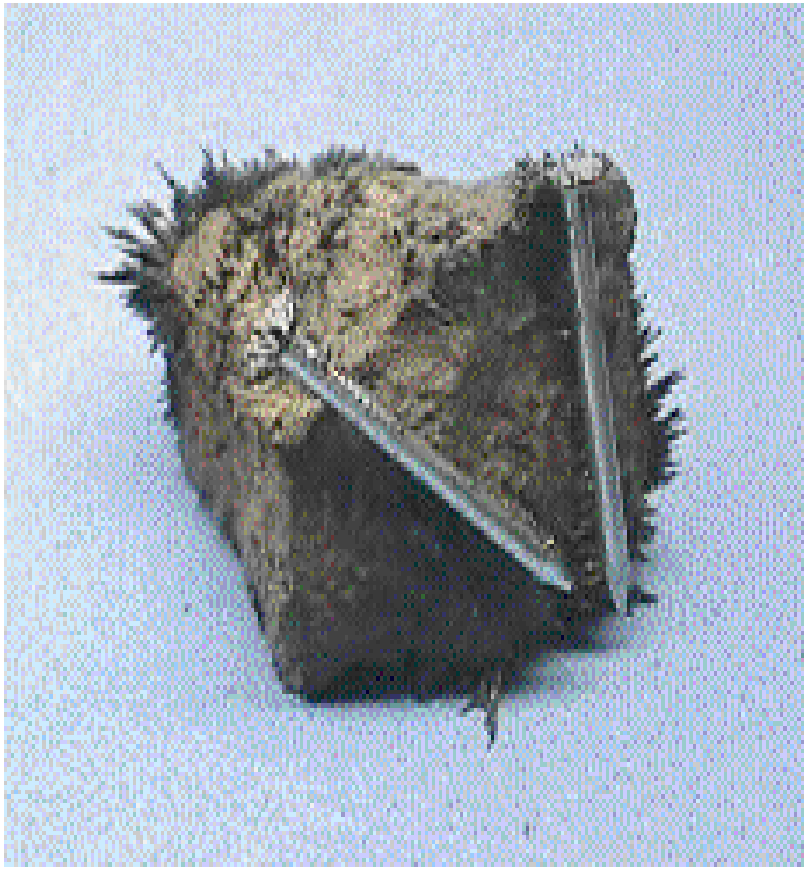
http://www.sterlinghill.org/Tour%20information.htm

Special Characteristics-- Salty Taste

- DO NOT TASTE MOST MINERALS!
- Halite is the exception--it will taste salty

http://mineral.galleries.com/scripts/item.exe?LIST+Minerals+Halides+Halite

Special Characteristics--Magnetism



- Many iron minerals will produce an invisible magnetic force field
- “Lodestone” was used by Vikings more than 1,000 years ago as compasses

http://www.minerals.net/mineral/oxides/magnetit/magneti4.htm

Properties of Common Minerals

LUSTER	HARDNESS	CLEAVAGE	FRACTURE	COMMON COLORS	DISTINGUISHING CHARACTERISTICS	USE(S)	COMPOSITION*	MINERAL NAME
Metallic luster	1–2	✔		silver to gray	black streak, greasy feel	pencil lead, lubricants	C	Graphite
	2.5	✔		metallic silver	gray-black streak, cubic cleavage, density = 7.6 g/cm^3	ore of lead, batteries	PbS	Galena
	5.5–6.5		✔	black to silver	black streak, magnetic	ore of iron, steel	Fe_3O_4	Magnetite
	6.5		✔	brassy yellow	green-black streak, (fool's gold)	ore of sulfur	FeS_2	Pyrite
Either	5.5 – 6.5 or 1		✔	metallic silver or earthy red	red-brown streak	ore of iron, jewelry	Fe_2O_3	Hematite
Nonmetallic luster	1	✔		white to green	greasy feel	ceramics, paper	$Mg_3Si_4O_{10}(OH)_2$	Talc
	2		✔	yellow to amber	white-yellow streak	sulfuric acid	S	Sulfur
	2	✔		white to pink or gray	easily scratched by fingernail	plaster of paris, drywall	$CaSO_4 \cdot 2H_2O$	Selenite gypsum
	2–2.5	✔		colorless to yellow	flexible in thin sheets	paint, roofing	$KAl_3Si_3O_{10}(OH)_2$	Muscovite mica
	2.5	✔		colorless to white	cubic cleavage, salty taste	food additive, melts ice	NaCl	Halite
	2.5–3	✔		black to dark brown	flexible in thin sheets	construction materials	$K(Mg,Fe)_3$ $AlSi_3O_{10}(OH)_2$	Biotite mica
	3	✔		colorless or variable	bubbles with acid, rhombohedral cleavage	cement, lime	$CaCO_3$	Calcite
	3.5	✔		colorless or variable	bubbles with acid when powdered	building stones	$CaMg(CO_3)_2$	Dolomite
	4	✔		colorless or variable	cleaves in 4 directions	hydrofluoric acid	CaF_2	Fluorite
	5–6	✔		black to dark green	cleaves in 2 directions at 90°	mineral collections, jewelry	$(Ca,Na)(Mg,Fe,Al)(Si,Al)_2O_6$	Pyroxene (commonly augite)
	5.5	✔		black to dark green	cleaves at 56° and 124°	mineral collections, jewelry	$CaNa(Mg,Fe)_4(Al,Fe,Ti)_3Si_6O_{22}(O,OH)_2$	Amphibole (commonly hornblende)
	6	✔		white to pink	cleaves in 2 directions at 90°	ceramics, glass	$KAlSi_3O_8$	Potassium feldspar (commonly orthoclase)
	6	✔		white to gray	cleaves in 2 directions, striations visible	ceramics, glass	$(Na,Ca)AlSi_3O_8$	Plagioclase feldspar
	6.5		✔	green to gray or brown	commonly light green and granular	furnace bricks, jewelry	$(Fe,Mg)_2SiO_4$	Olivine
	7		✔	colorless or variable	glassy luster, may form hexagonal crystals	glass, jewelry, electronics	SiO_2	Quartz
	6.5–7.5		✔	dark red to green	often seen as red glassy grains in NYS metamorphic rocks	jewelry (NYS gem), abrasives	$Fe_3Al_2Si_3O_{12}$	Garnet

*Chemical symbols: Al = aluminum, C = carbon, Ca = calcium, Cl = chlorine, F = fluorine, Fe = iron, H = hydrogen, K = potassium, Mg = magnesium, Na = sodium, O = oxygen, Pb = lead, S = sulfur, Si = silicon, Ti = titanium

✔ = dominant form of breakage

Useful Web Sites

- http://www.mineralseducationcoalition.org/
- www.galleries.com/Minerals
- State Mineral information: http://minerals.usgs.gov/minerals/pubs/state/

- Other USGS educational resources: http://education.usgs.gov/secondary.html