Geology 1602

Lab 1 – Intro to sedimentary rocks

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Minerals

- Naturally Occurring
- Solid
- Formed by Geologic Processes
- Definable Chemical Composition
- Orderly Arrangement of Atoms
- Inorganic

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What is a Rock?

Coherent - grains stuck together

lithification

Naturally Occurring

no manufactured materials

Aggregate of Minerals

Grain - small piece of rock or mineral

- Cemented together in a rock
- Crystals grown together

Rock types

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Igneous

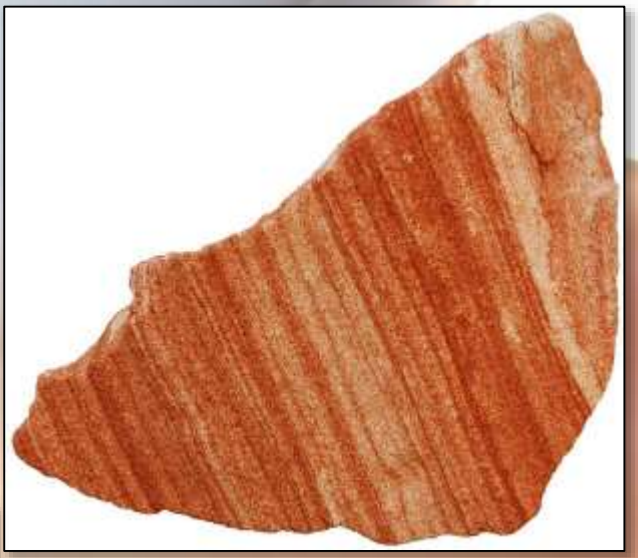
Formed from a melt

Sedimentary

Clastic, bio-clastic or chemical

Metamorphic

An igneous or sedimentary rock
That has been changed by
heat and pressure



Why study rocks?

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Contain information about:

- Life
- Environment (global)
- Depositional environment
- Source
- Chemical composition
- Tectonic processes
- Economic

Sedimentary Rocks

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Clastic Sedimentary Rocks

- Cemented bits of preexisting rocks
- Typically silicate minerals
- Aka: Detrital Rocks

Biochemical Sedimentary Rocks

- Shells of organisms
- Predominantly calcite

Chemical Sedimentary Rocks

- Inorganic minerals that precipitate from water
  - Salt
  - Gypsum
  - Sulfur

Common Minerals in Sedimentary Rocks

Quartz

- Sandstone
- Siltstone
- Conglomerate

Calcite

- Limestone

Feldspar

- Clay and Mudstones (shales)

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Clastic Rocks

Cemented grains

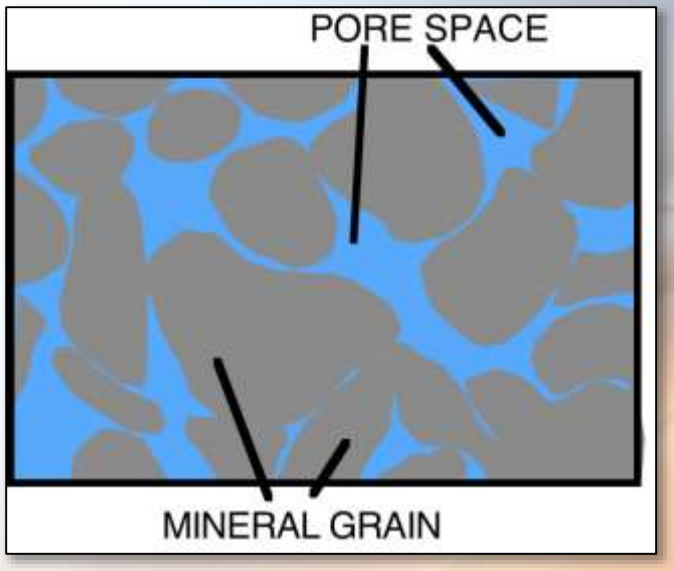
- common cements include: calcite
- silica (quartz)
- hematite (iron oxide)

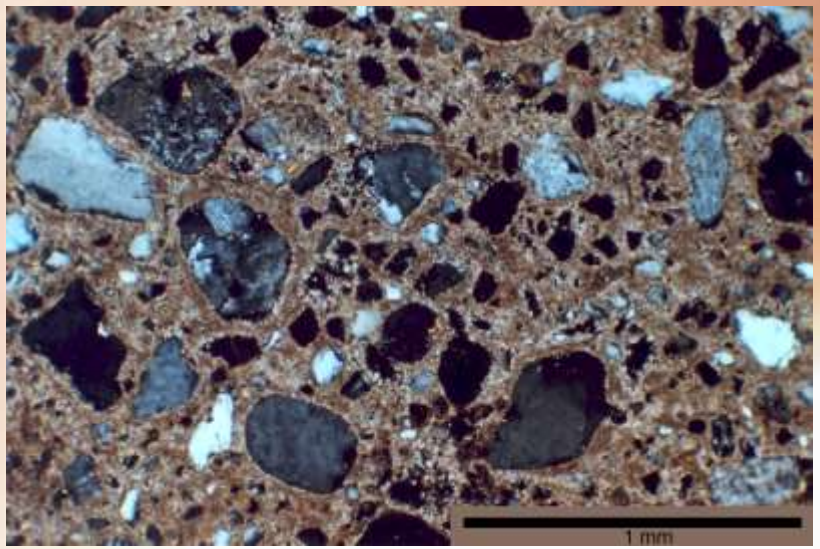
Calcite

- Limestone

Feldspar

- Clay and Mudstones (shales)





Basic Physical Characteristics of Rocks

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Grain Size

- How big are the grains?
- Equant - Inequant
- Do the grains share common dimensions

Composition

- Chemical/mineral makeup

Texture

- How are the grains arranged
- Do they connect, are they aligned?

Layering

- Bedding - sedimentary feature; deposition of grains
- Metamorphic foliation - alignment and rearrangement of crystals in metamorphic rock

Sediments

Sediment

- unconsolidated
  - fragments of weathered rock
  - silicate minerals
  - evaporitic/biogenic minerals
  - shell material & preserved organic material

Sedimentary Rock

- consolidated/lithified
  - form at surface of crust
  - lithified
    - cementation
    - compaction
  - Accumulate in basins
    - Depositional vs. erosional environments

Grain size

Conglomerate

- Boulder
- Pebble

Sandstone

- Sand

Siltstone

- Silt

Mudstone

- Clay

Boulder	*>256 mm*
Cobble	*64 - 256 mm*
Pebble	*4 - 64 mm*
Granule	*2 - 4 mm*
Sand	*1/16 - 2 mm*
Silt	*1/256 - 1/16 mm*
Clay	*<1/256*

Shale is a special case of mudstone, it is fissile where a mudstone is massively bedded

Course Quartz Sandstone

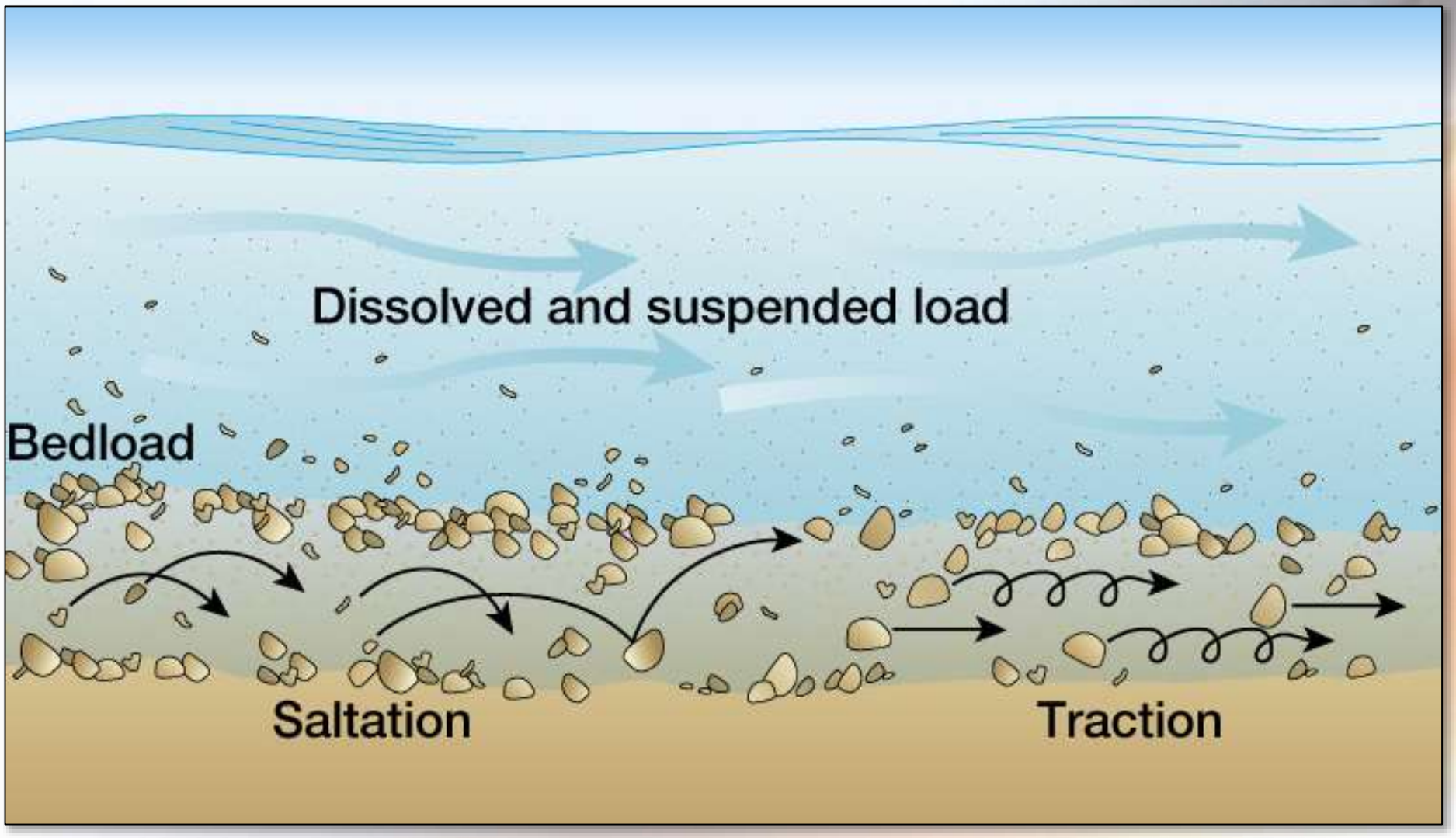
Pebble Conglomerate

Sandy Siltstone

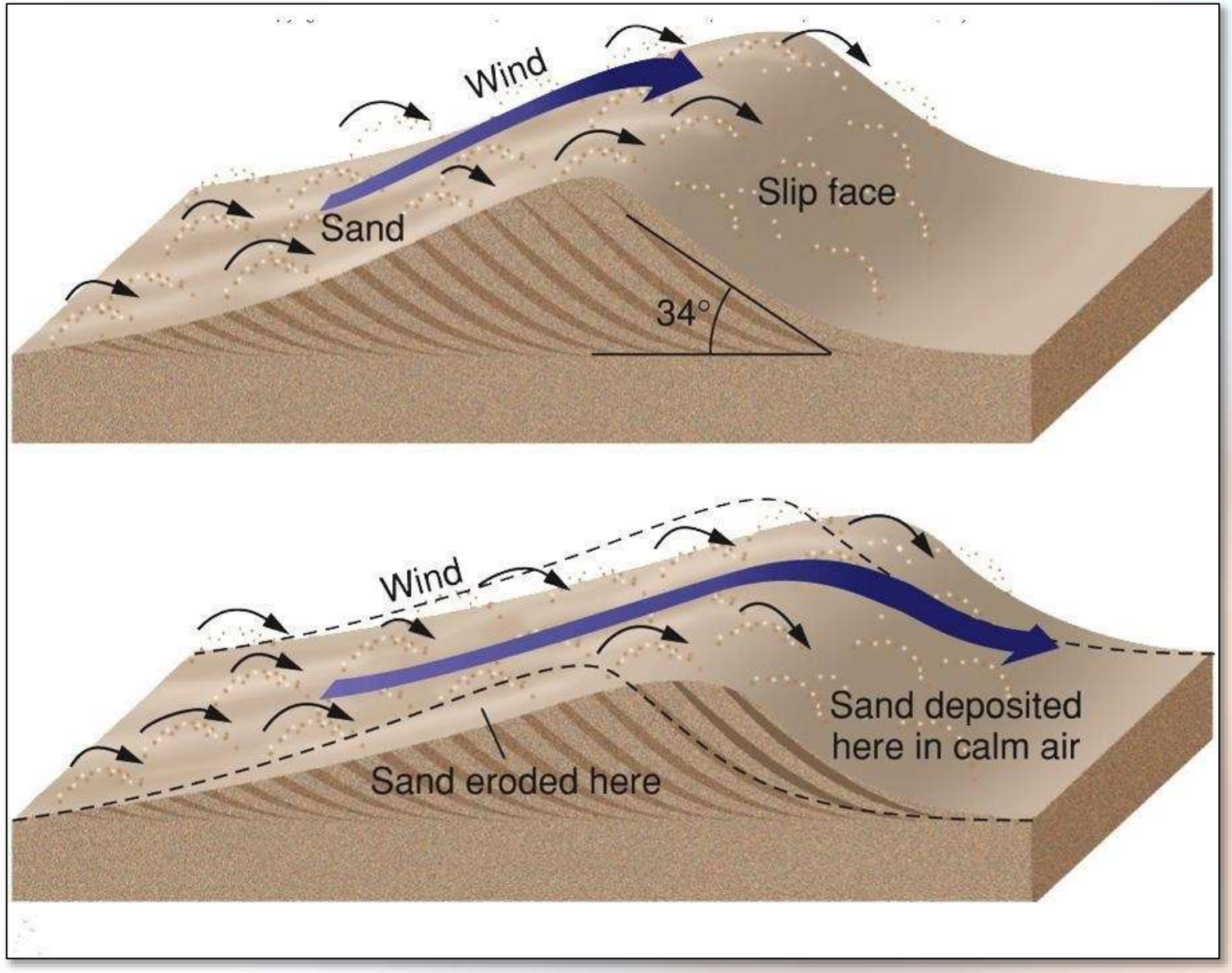
Weathering

- Breakdown of preexisting rock into sediment by chemical and physical processes
    - Chemical – dissolution, corrosion and oxidation of minerals
    - Physical - physical force breaking rocks down; freeze-thaw processes, fracturing, biologic processes & transport

Transport



Transport


Wind
Slip face
Sand
34°
Wind
Sand deposited
here in calm air
Sand eroded here

How to Make a Rock

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Weathering

Detritus/clasts form via physical and chemical weathering

Erosion

Processes that separate and initiate the carrying of clasts

Transport

Long-distance movement of sediment

Water, wind, ice

Deposition

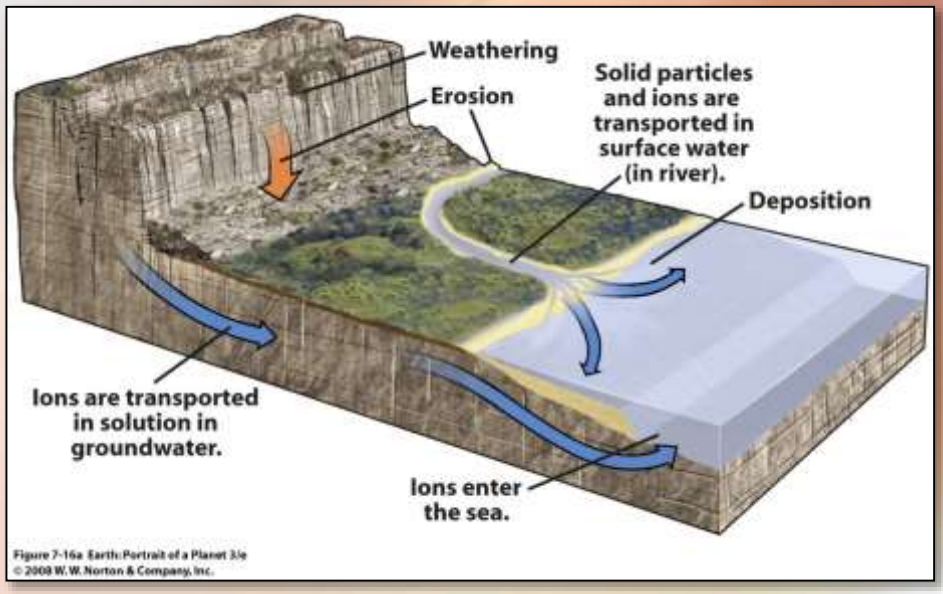
Settling out of transport medium

Velocity decreases and material can't be suspended

Lithification

Compaction - mud up to 50-80%

Cementation - minerals precipitate from water



Rock Cycle

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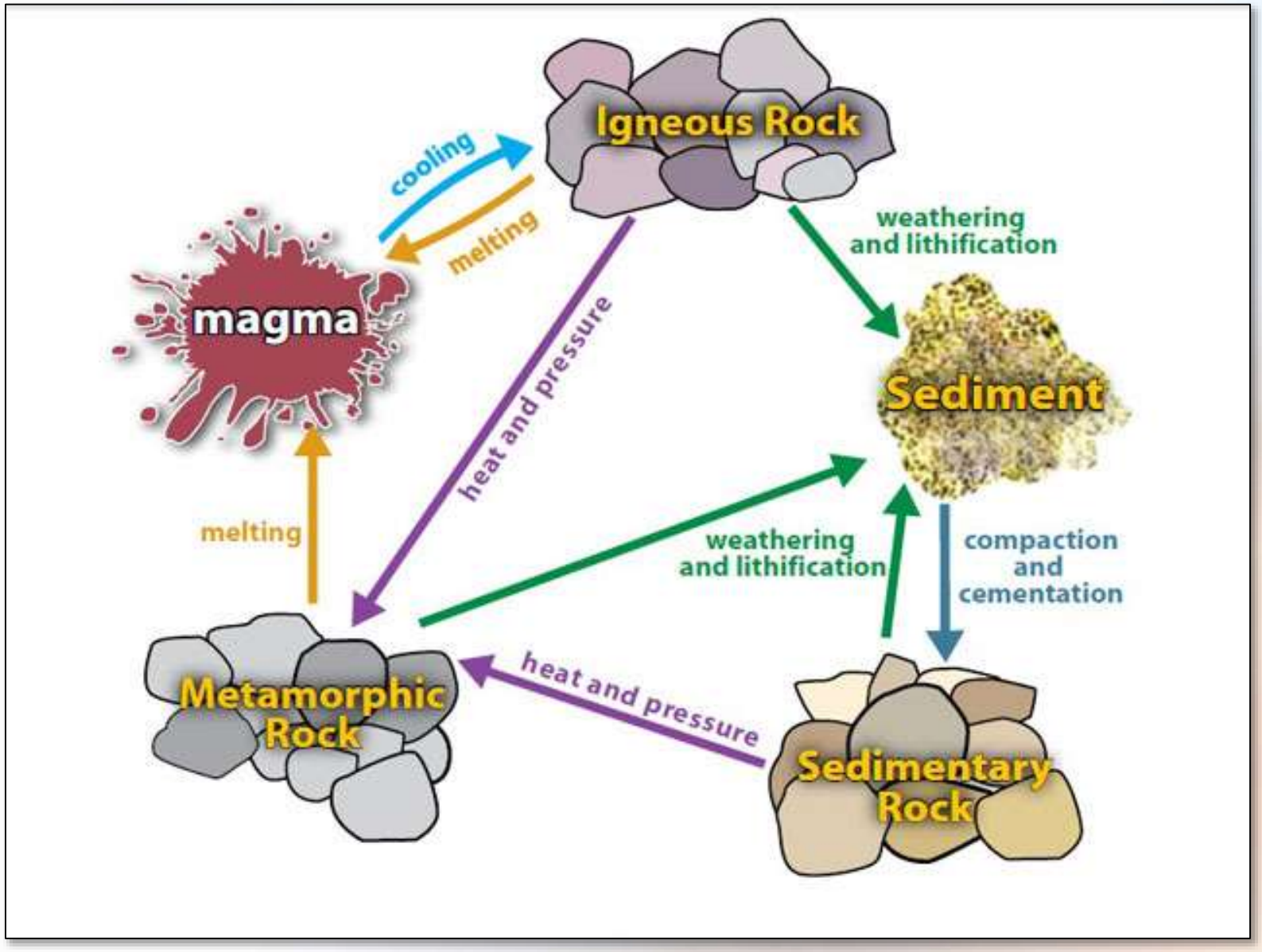

Classification of Clastic Sedimentary Rocks

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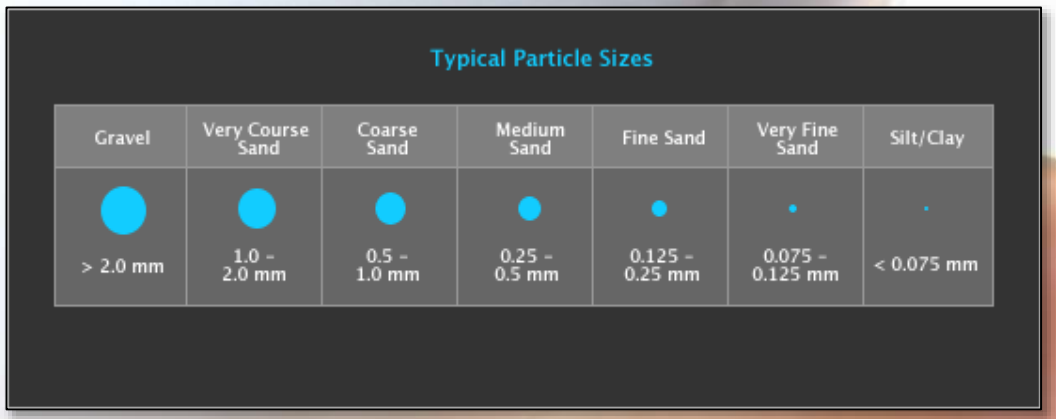
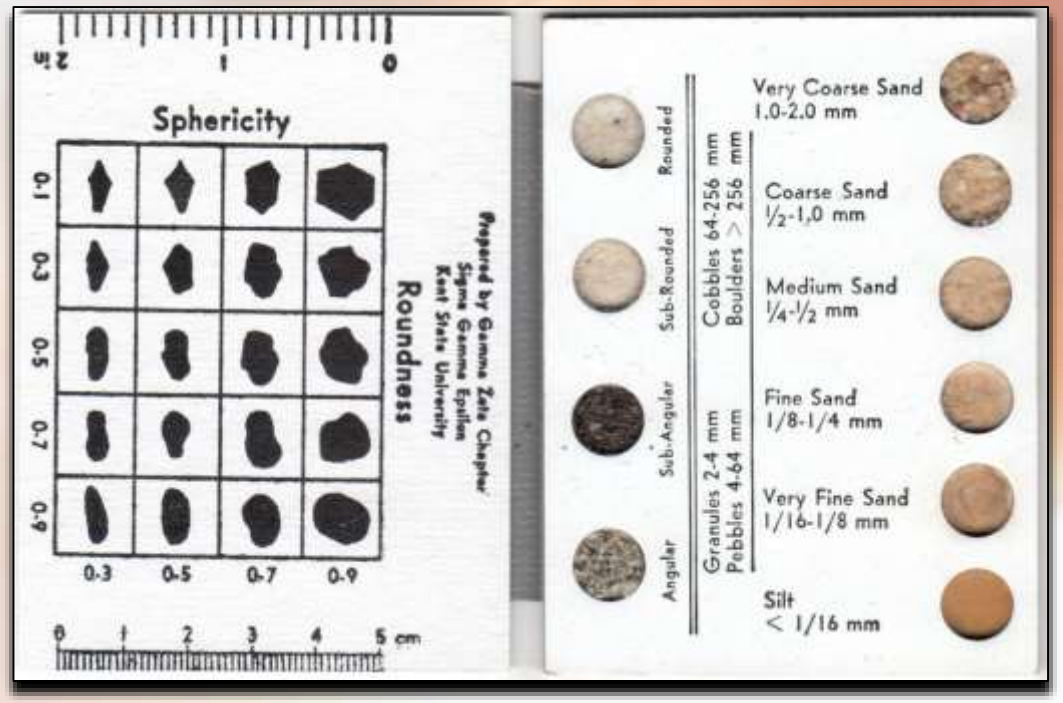
Clast Size (Use the hand lens to determine clast size)

- Diameter of rock fragments
- Boulder, cobble, pebble, sand, silt, clay
  - Gravel = cobbles + pebbles
  - Mud = wet clay

Clast Composition

- Small grains typically consist of one mineral type
- Larger grains (cobbles/boulders) may consist of rock fragments with more than one mineral
- A rock may contain a mixture of clasts of a single mineral or multiple mineral clasts





Sorting

- Well-sorted: all clasts are the same size
- Poorly sorted: mixture of more than one grain size. Small grains = matrix
- Well sorted rocks are mature, more time/energy/transport

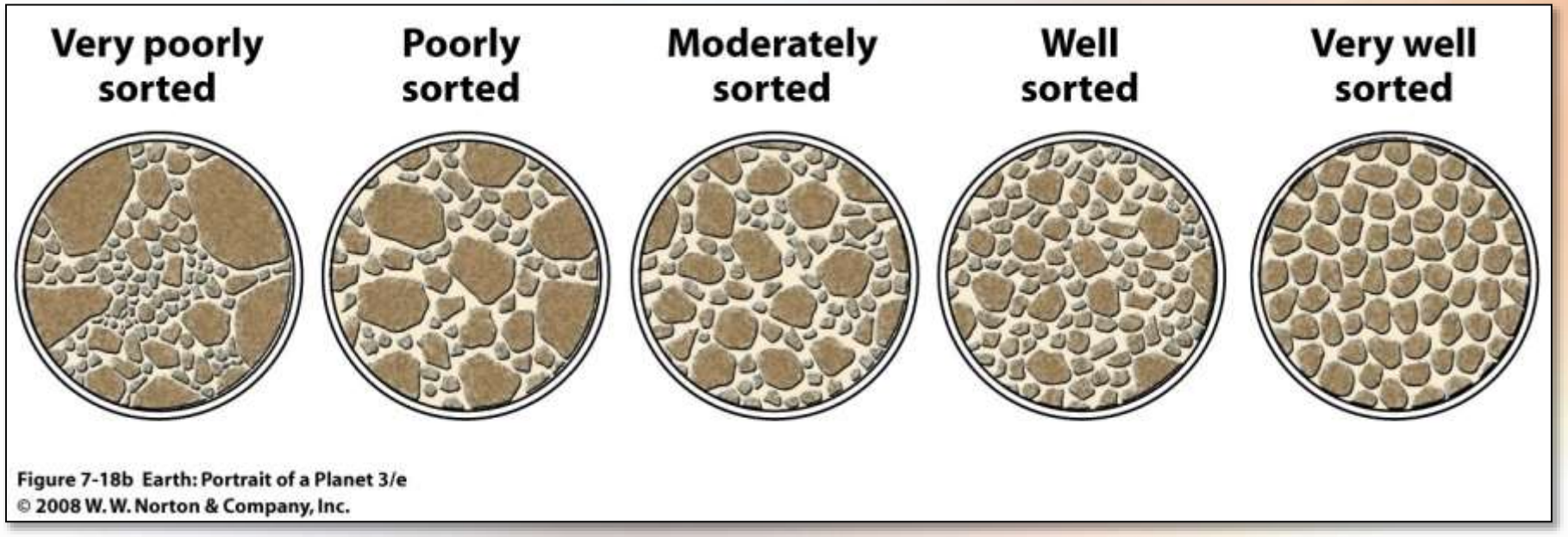


Figure 7-18b Earth: Portrait of a Planet 3/e

Maturity of Sediments

Maturity

- Reflects the degree to which the sediments have been weathered and transported.
- Less mature sediments are generally not re-worked and have less weathering/transport.
- More mature sediments are generally re-worked and have significant weathering/transport.
- May depend on lithology

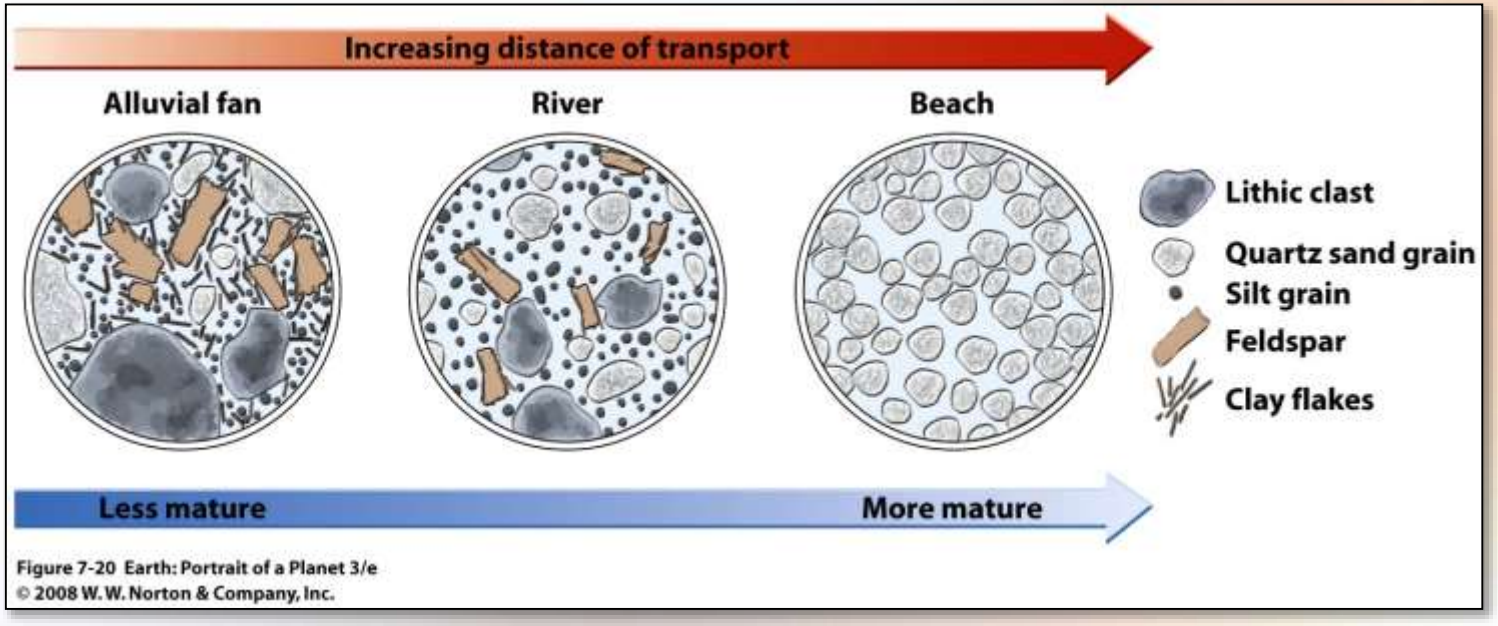


Figure 7-20 Earth: Portrait of a Planet 3/e

Grain Size and Energy

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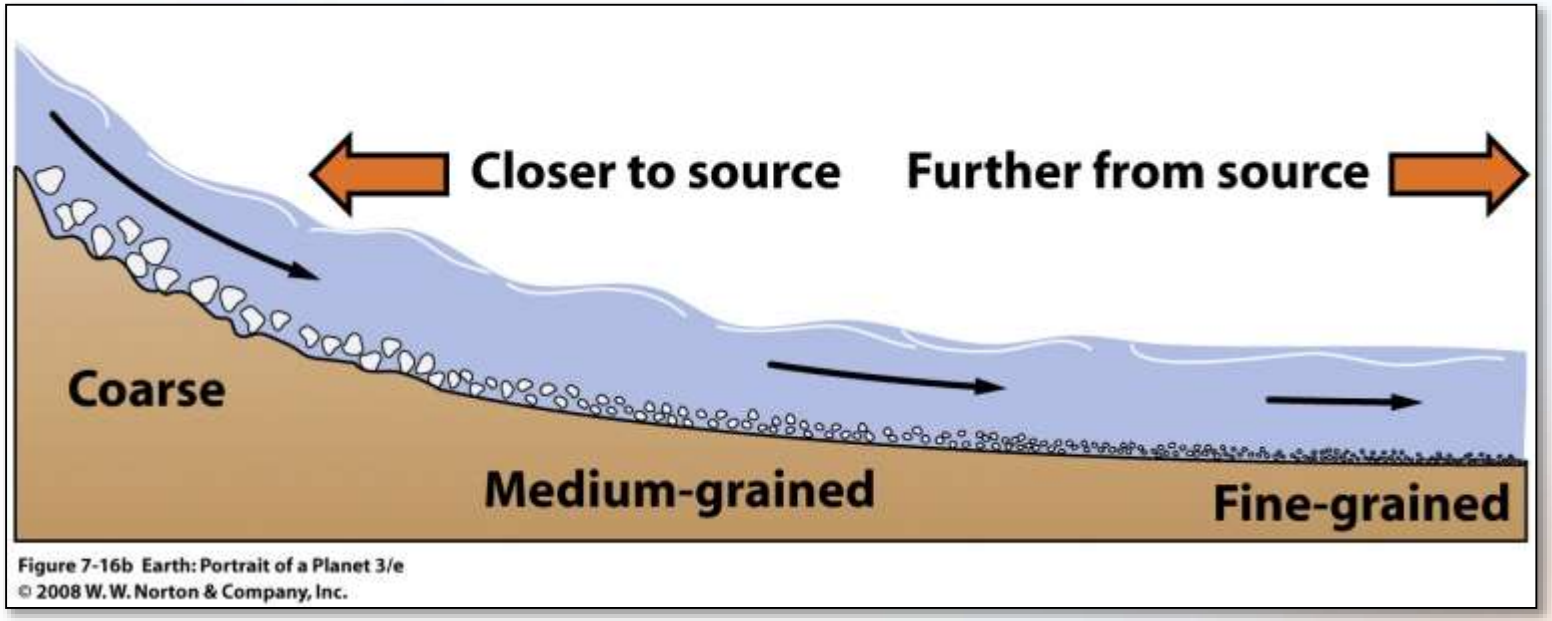

Figure 7-16b Earth: Portrait of a Planet 3/e
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Grain Size and Energy

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Common Sedimentary Rocks

Breccia

Large, poorly sorted, angular clasts

Conglomerate

Large, well-rounded, poorly sorted clasts

Arkose sandstone

Sand-sized grains, quartz & lithic grains, well sorted

Subrounded-subangular

Made of Feldspar typically red/orange colored

Quartz sandstone (arenite)

Sand-sized grains, pure quartz, well sorted, at least moderately rounded

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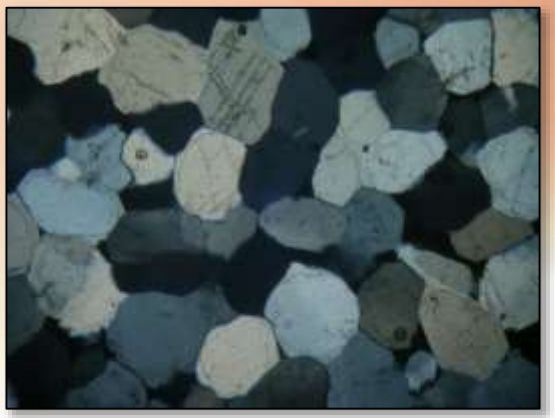

Common Sedimentary Rocks

Siltstone

Silt-sized particles, typically quartz & clay, cemented

Mudstone & Shale (more generic)

Clay-sized particles, clay minerals. Shale is fissile mudstone.

Sandstones can contain clay matrix

If matrix supported, wackestone

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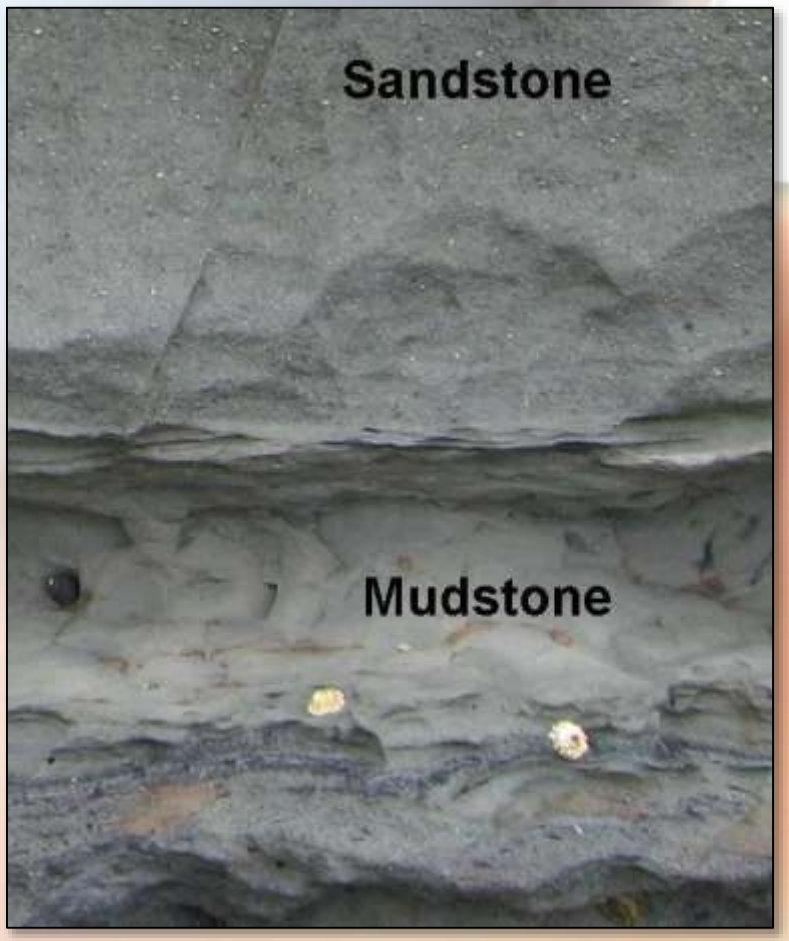

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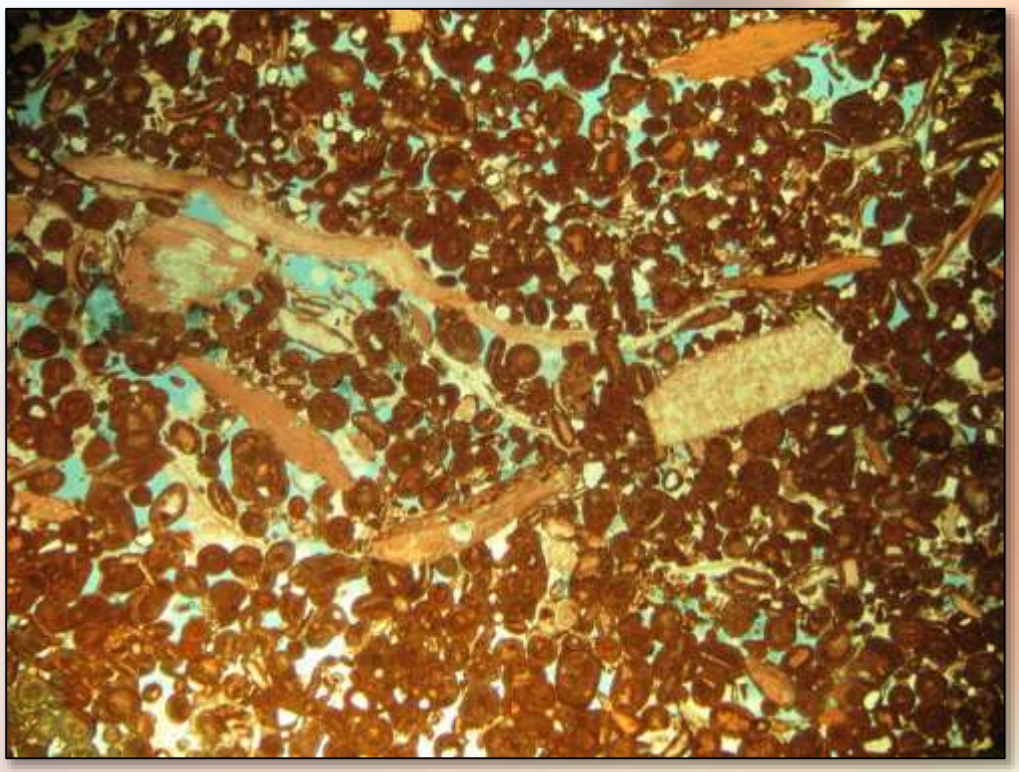

Assignment

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-Texture: Clastic/Chemical/Bioclastic

-Mineral Comp.: Quartz & Calcite (ex.)

-Sorting: Well Sorted ←→ Poorly Sorted

-Roundness: Well Rounded ←→ Very Angular

-Fossils & Fossil Condition: Present & Preserved

-Rock Name: Quartz-rich Breccia (ex.)

-Depositional Conditions: Shallow Marine (ex.)

Concepts

What is a mineral?
What is a rock?
What are the three basic types of rocks?
What is a sedimentary rock?
How are they formed?
What is the rock cycle?
What can rocks tell us?
How do we name a sedimentary rock?

Useful stuff!

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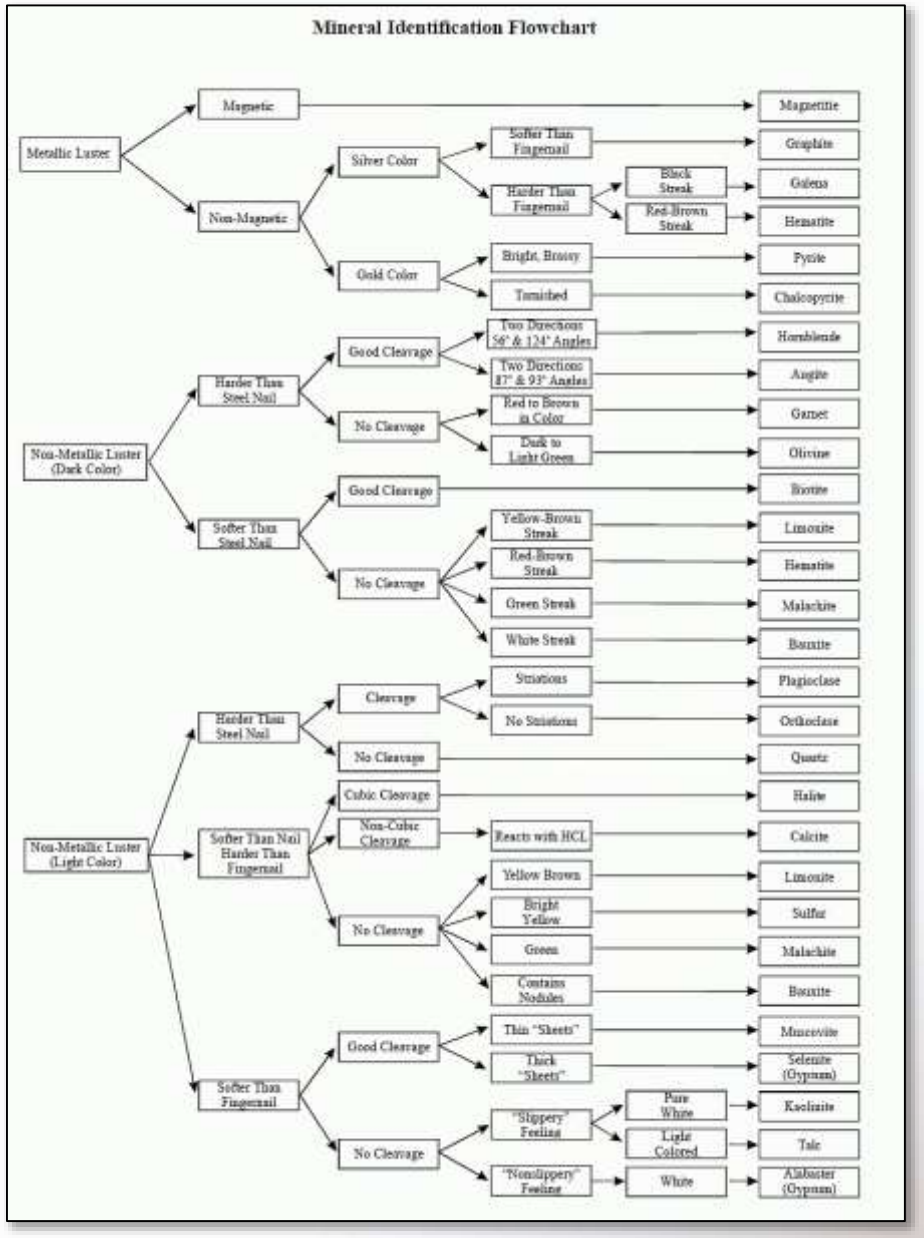

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Useful stuff!

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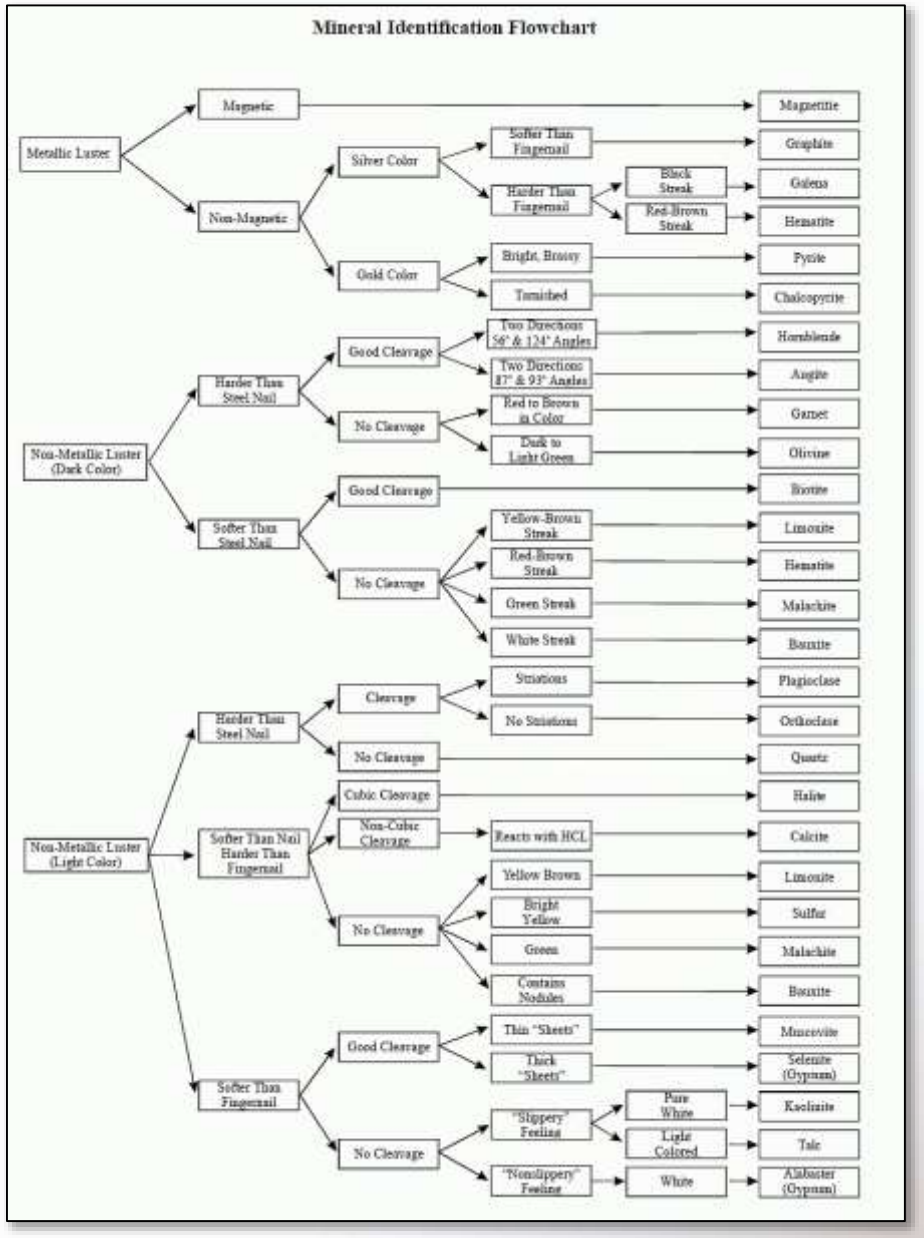

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Useful stuff!

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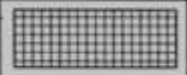
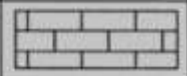
INORGANIC LAND-DERIVED SEDIMENTARY ROCKS					
TEXTURE	**GRAIN SIZE**	**COMPOSITION**	**COMMENTS**	**ROCK NAME**	**MAP SYMBOL**
Clastic (fragmental)	Pebbles, cobbles, and/or boulders embedded in sand, silt, and/or clay	Mostly quartz, feldspar, and clay minerals; may contain fragments of other rocks and minerals	Rounded fragments	**Conglomerate**	
			Angular fragments	**Breccia**	
	Sand (0.006 to 0.2 cm)		Fine to coarse	**Sandstone**	
	Silt (0.0004 to 0.006 cm)		Very fine grain	**Siltstone**	
	Clay (less than 0.0004 cm)		Compact; may split easily	**Shale**	
CHEMICALLY AND/OR ORGANICALLY FORMED SEDIMENTARY ROCKS					
TEXTURE	**GRAIN SIZE**	**COMPOSITION**	**COMMENTS**	**ROCK NAME**	**MAP SYMBOL**
Crystalline	Fine to coarse crystals	Halite	Crystals from chemical precipitates and evaporites	**Rock salt**	
		Gypsum		**Rock gypsum**	
		Dolomite		**Dolostone**	
Crystalline or bioclastic	Microscopic to very coarse	Calcite	Precipitates of biologic origin or cemented shell fragments	**Limestone**	
Bioclastic		Carbon	Compacted plant remains	**Bituminous coal**	

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Useful stuff!

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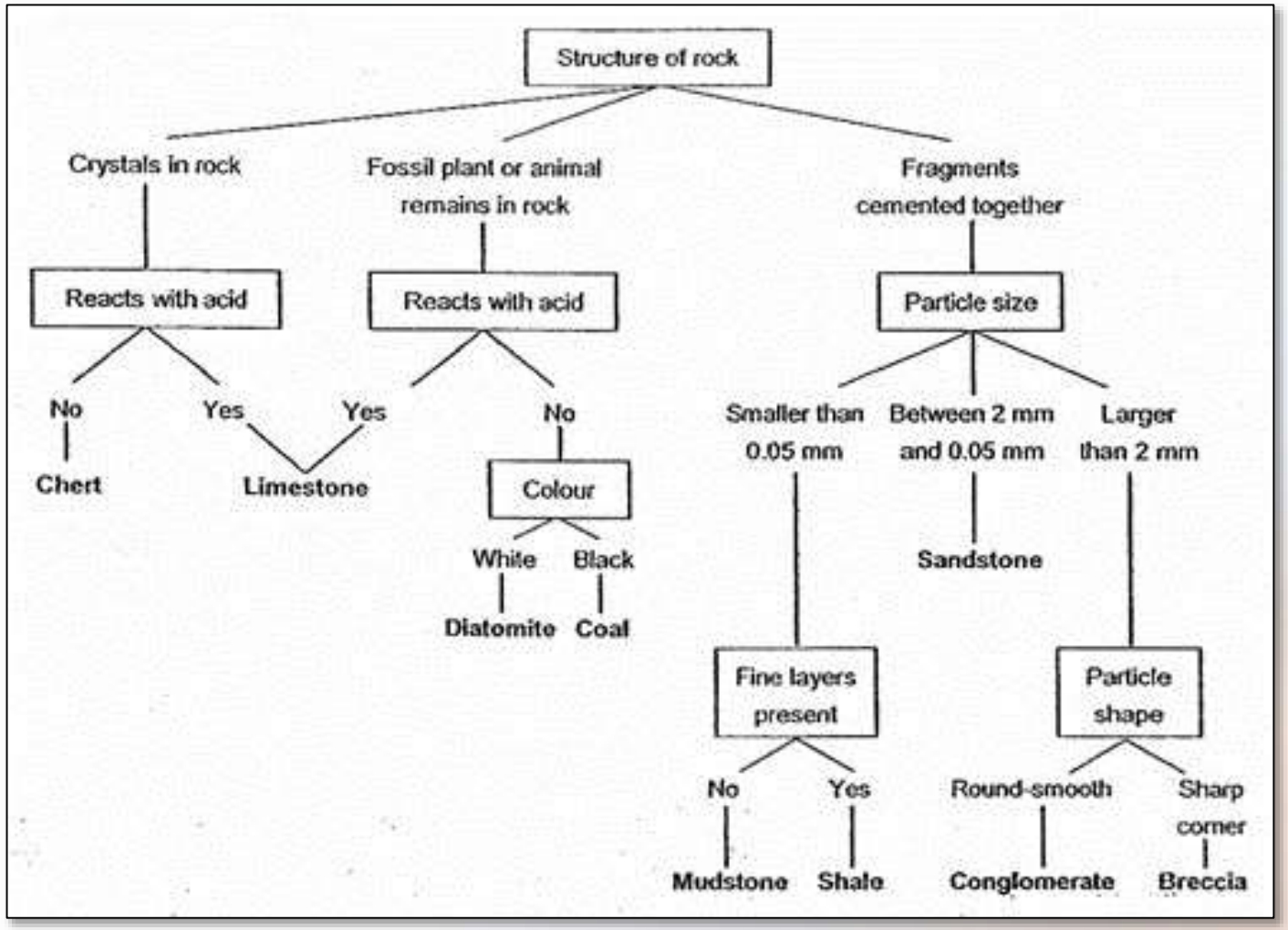

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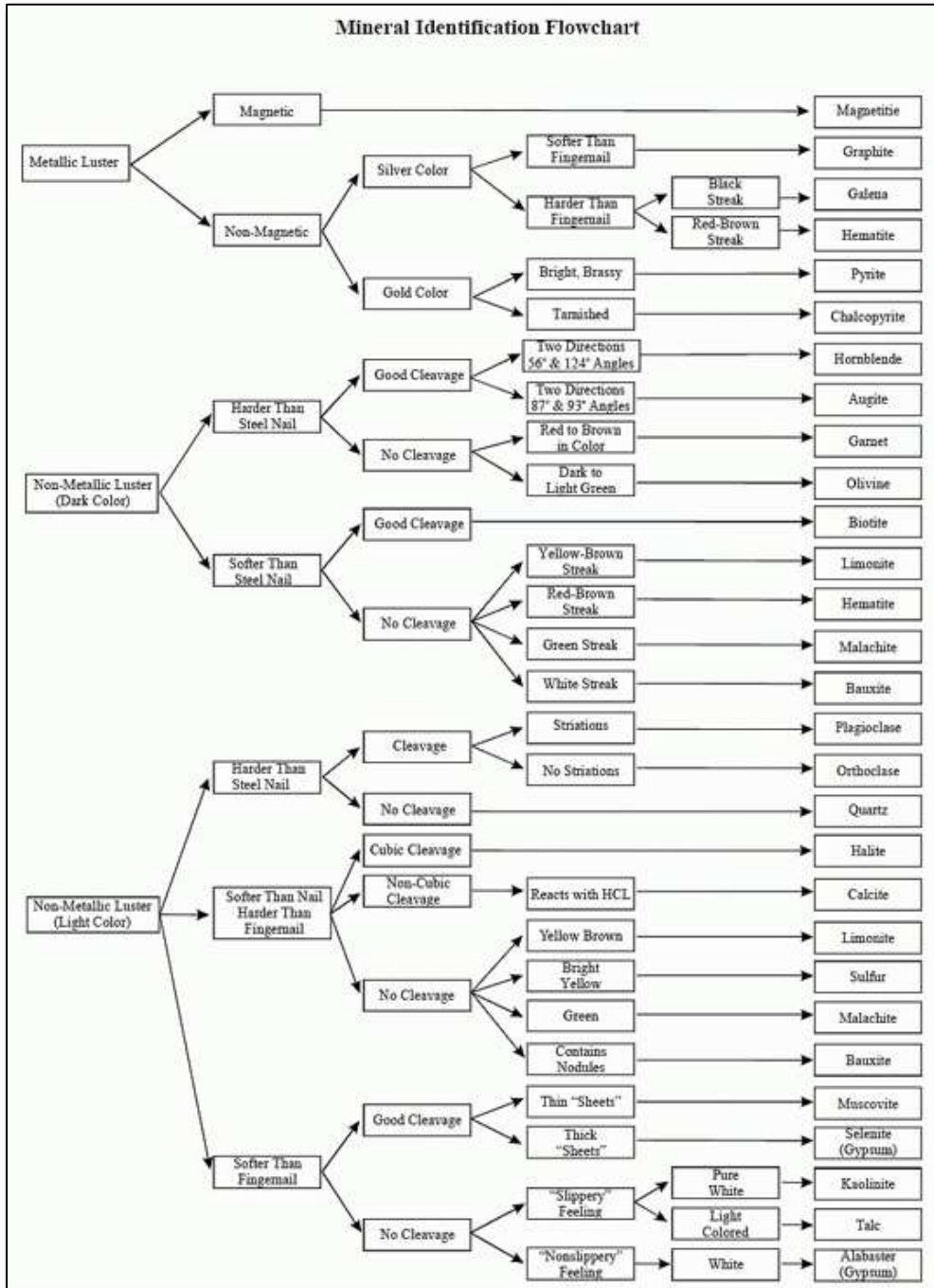

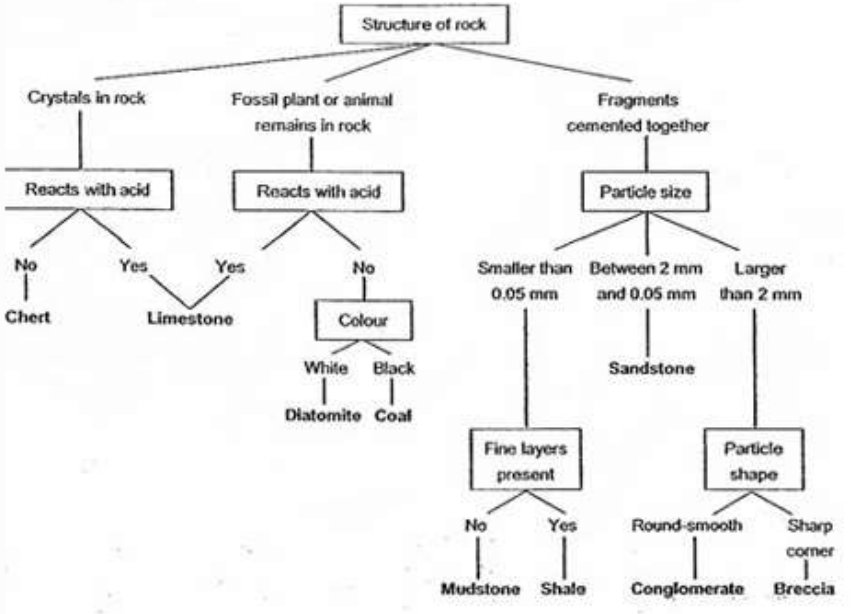

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		Gypsum		Rock gypsum	
		Dolomite		Dolostone	
Crystalline or bioclastic	Microscopic to very coarse	Calcite	Precipitates of biologic origin or cemented shell fragments	Limestone	
Bioclastic		Carbon	Compacted plant remains	Bituminous coal	

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