Sedimentary Rock Lab: Identifying Unknown Rocks

You will need:

- Sedimentary samples
- Hardness kit
- Dilute HCl acid

Recall:
Sedimentary rocks form when weathered material from older rocks consolidates into a new rock. There are two main types of sedimentary rocks: **clastic** and **chemical** (separated into inorganic and biochemical).

Clastic sedimentary rocks are composed of fragments of older rocks that have been eroded, deposited, compacted, and cemented. **Siliciclastic** sedimentary rocks are the most common type of clastic rock and are formed mostly from silicate minerals, like quartz. Sandstone is a classic example of a siliciclastic rock.

Chemical sedimentary rocks form when minerals precipitate from a dissolved load of ions in water. Common ions that form chemical sedimentary rocks include silica, calcium, and salts. The mineral halite, or rock salt (its rock name), forms when dissolved sodium and chloride ions oversaturate a body of water and precipitate into a chemical sedimentary rock.

Biochemical sedimentary rocks are composed of sediment derived by biological processes. They are either composed of organic material, like coal, or formed from the precipitation of calcite ions that were sourced from marine organisms (like reefs).

CLASTIC SEDIMENTARY ROCKS

Clastic rocks are classified based on the **size**, **shape**, and **sorting** of the clasts, or grains or sediments, in the rock. Different sized clasts are given specific names:

Sediment	*Size Range*
Boulder	>256 mm
Cobble	64 to 256 mm
Pebble	2 to 64 mm
Sand	1/16 to 2 mm
Silt	1/256 to 1/16 mm
Clay	<1/256 mm

Grains that have sharp or rough edges are said to be **angular**, while grains that have smooth surfaces are **rounded**. Angular grains indicate that the rock fragments have not been transported very far or have not been significantly reworked. Rounded grains indicate transportation over long distances or a long time spent being smoothed by moving water.

The degree of sorting of a clastic rock examines the range of clast sizes in one rock. A rock that has a wide range of clast sizes, e.g. a rock that contains pebbles, sand, and mud, is said to be

poorly sorted. A rock that has all of the same sizes of sediment, e.g. a fine-grained sandstone, is said to be **well sorted**.

COMMON CLASTIC ROCKS

Conglomerate: Composed of rounded pebbles, cobbles, or boulders; deposited in a high energy environment because it takes a strong current to move large-sized sediment. The round grains indicate the sediment was transported far or was significantly reworked to remove sharp edges. Conglomerates may be deposited in the headwaters of streams, on alluvial fans, on beaches, or by glaciers.

Breccia: Composed of angular pebbles, cobbles, or boulders; like conglomerate, deposited in a high energy environment. Unlike conglomerates, the angular grains indicate a short transport distance and little to no reworking. Breccias are usually deposited as a result of a slope failure, like a rock slide or rock fall.

Sandstone: Composed of sand-sized particles; deposited in an environment of moderate energy. May contain marine or terrestrial fossils and called ***fossiliferous sandstone***.

> ***Quartz sandstone:*** >95% of the grains are quartz. Commonly deposited on or near beaches and sand dunes, where the constant movement by waves, currents, and wind is effective for well-sorting the grain sizes.
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> ***Arkose***: Composed of quartz and at least 25% feldspar, and commonly containing other minerals or rock fragments. May be pink-y due to K-feldspar content. Deposited rapidly or in a cold or arid environment to prevent chemical alteration of the feldspars.
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> ***Graywacke***: Contains a large amount of silt or clay-sized matrix (and therefore is often gray in color). The sand grains may include quartz, feldspar, dark minerals, and other rock fragments. Characteristically poorly sorted and commonly deposited by debris flows or underwater slumps.

Mudrocks: A broad group of very fine-grained siliclastic rocks, including siltstone, mudstone, claystone, and shale. These smallest particles can only be deposited in low energy environments, like lakes, deeper parts of the ocean, and on floodplains.

> ***Siltstone***: Composed of silt-sized particles (1/256 to 1/16 mm) Commonly has a massive, structureless appearance. Distinguished by geologists in the field by testing for "grittiness" between teeth.
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> ***Mudstone:*** Composed of a mixture of silt and clay-sized particles. Will fracture conchoidally into blocks, instead of fissile-y breaking along planes like shale.
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> ***Claystone***: Composed of clay-sized particles (<1/256 mm) that have lithified. Will not feel gritty between teeth.

Shale: Made from clay minerals and a varying amount of silt. Shale is characteristically fissile, which means it easily breaks apart in layers. Shale can contain a varying amount of organic matter and is deposited in deep water settings. May also contain fossils.

COMMON CHEMICAL AND BIOCHEMICAL ROCKS

Chert: Composed of microscopic crystals of quartz or amorphous silica. May precipitate inorganically or from the accumulation of organisms with skeletons made of silica (biochemically). Usually deposited in deep ocean basins. Looks "massive" in appearance, which means it is not made of visible fragments. Harder than a steel file and fractures conchoidally (like quartz). Will not react with acid and varies in color from white to dark grey or other colors.

Limestone: Composed primarily of calcite. Can be easily identified by reaction with acid. Limestones are deposited in warm, shallow seas, either by precipitation of calcium and carbonate ions dissolved in seawater or by the accumulation of calcium carbonate shells.

Micritic limestone: Micrite is short for "microcrystalline calcite" and describes non-clastic limestones formed from the precipitation of calcium and carbonate ions in supersaturated waters.

Fossiliferous limestone: A limestone that formed when organisms with calcite skeletons died, accumulated, and cemented together. Will have the shells of marine organisms held in a massive limestone matrix.

Coquina: A bioclastic limestone composed almost entirely of transported and broken fragments of calcite shells and skeletons.

Chalk: A bioclastic limestone composed of the calcite skeletons, called "tests", of microscopic organisms called coccolithophores. Able to be scratched with your fingernail.

Evaporite minerals: Minerals formed by chemical precipitation in a body of water that experiences more evaporation than fresh water influx, like lakes or inland seas in arid regions.

Gypsum rock: A deposit of the mineral gypsum formed from the precipitation of dissolved calcium and sulfate ions. Has a hardness of 2, so is able to be scratched by your fingernail, like chalk. Unlike chalk, will not fizz in contact with acid.

Rock salt: A deposit of the mineral halite formed from the precipitation of dissolved sodium and chloride ions. Has a hardness of 2.5, cubic cleavage, and tastes salty.

Coal: An organic sedimentary rock that forms from the accumulation and compaction of plant matter. Commonly deposited in swamps, where there is an abundance of organic material and insufficient oxygen to promote decay. Coal is formed as the plant matter is buried and becomes a rock under increasing temperature and pressure. The plant matter goes through stages as

temperature and pressure increase, which increases the percentage of carbon and decreases the amount of water in each stage:

Peat: Unconsolidated plant remains. Brown and crumbly; not a rock.

Lignite: Coal produced when peat is buried at shallow depths; soft and brownish-black with a low carbon and high moisture content.

Bituminous coal: The common sedimentary rock, coal; harder and shinier than lignite, with a higher carbon content. Black and relatively light in density.

Anthracite coal: A metamorphic rock that has undergone the most pressure and temperature alteration, has the highest carbon content, and burns the most efficiently.

IDENTIFICATION TIPS

Ask yourself: Is the rock clastic or chemical?

1. If clastic:
    a. What is the dominant grain size in the rock?
    b. How well are the grains sorted?
    c. If the grain size is visible, how well rounded are the grains?
    d. What is the name of this rock type?
    e. Picture in what environment(s) this rock might have been deposited.

2. If chemical:
    a. What is the hardness of the rock?
    b. Does it react with acid?
    c. Are there any fossils or crystals in the rock?
    d. What is the name of this rock type?
    e. What mineral makes up this rock?
    f. Picture in what environment(s) this rock might have been deposited.