Physical Geology Lab – Sedimentary Rocks: Examination and Naming

Objectives

1. You will learn how to examine sedimentary rocks and assign an appropriate rock name based on the observed characteristics.

2. You will learn to recognize features in sedimentary rocks collectively known as "*primary sedimentary structures*." These are physical features in the rocks formed (or included) at the time of deposition.

Note: Before coming to this lab, it is very important to review this handout and the related parts of the text: Physical and chemical weathering (pp. 139-145), and basics of sedimentary rock types, naming and structures (pp. 153-164). Bringing your textbook to lab may be helpful.

Introduction

Sedimentary rocks make up only a small fraction of the total Earth's crust. However, it is important that geologists (and students) understand them because: 1) they cover about 65-70% of the crust's surface (ocean floor and continents); and 2) nearly all of our energy resources are extracted from sedimentary rocks.

As with minerals and igneous rocks, your ability to examine and name sedimentary rocks will increase most rapidly by studying as many samples as possible.

P*rimary sedimentary structures* are important clues to understanding the environment of deposition of the sediment, in particular the agent of sediment transportation and the energy conditions at the time of deposition. You will view samples with obvious sedimentary structures and suggest interpretations which can be made from them.

The combination of observed data about a sample permits you construct an interpretation of some of the history of the rock sample.

Examining Sedimentary Rocks for Naming

Sedimentary rocks are usually stratified (layered) and are composed of three main types of material: **clastic, organic and chemical**. Two of these types are usually obvious in most samples, and sometimes all three are present. When examining a sedimentary rock, the most important decision is *which of three components is* ***dominant*** in a particular sample. Once you decide that, naming is easily done by using the appropriate group of descriptions below and on the next page. As you examine the samples, look for and note any sedimentary structures.

Definitions of the three main components of sedimentary rocks

Clastic: broken; particles in the sample are broken up bits, fragments, pieces of pre-existing rocks and mineral grains. Most sedimentary rocks are clastic.

Organic: materials that are the result of organic growth; such as leaves, shells and coral. Includes decay products, especially graphite and hydrocarbons.

Chemical: minerals deposited in place, directly crystallized from water-rich solutions, either in the tiny spaces between clastic or organic particles ("cement") or as layers on the floor of a sedimentary basin.

<u>Examples of Sedimentary Structures</u>, and some of the sedimentary environments they may form in.

Sorting: How uniform the grain size is. For example, well sorted (places of constant energy; e.g., sand dunes), or poorly sorted (e.g., stream flood deposits).

Layer thickness: Thin bedded (deep sea floor), thickly bedded (river bars or beaches), or a numerical measurement.

Cross bedding: Layers locally deposited at a distinct angle to the overall direction of layering (sand dunes or rivers).

Graded bedding: Smooth transition in particle size from bottom to top of a single layer (bed) (sea-floor landslides).

Ripple marks: Small dunes of sediment that make smooth ridge and valley patterns (where ocean or river currents were flowing).

Fossils: Fragments (broken or whole) or other evidence of plants and animals (where the particular plants or animals lived).

<u>The Story of the Rock</u>

As you did for igneous rocks, you want to be able to describe and name samples, and tell the "story of the rock." Think about this for each sample you examine.

The starting point of the story of a sedimentary rock is the **weathering** of some preexisting rocks (producing clastic and/or chemical sediment), or the growth of some life form (organic). Then the material is **eroded** and **transported** (with many modifications along the way). Finally the material is **deposited** at a final resting place, and **lithified** by burial and/or cementation.

<u>Assignment</u>

Use lab time to examine and name as many sedimentary rocks as you can. There is such a wide variety of appearances that you need to touch and study many samples before you will be comfortable with the differences and similarities in this large group of rocks. About 10-12 kinds of sedimentary rocks can be found in a 'box of rocks' at your lab station, many other larger samples are placed throughout the lab room and your instructor will point them out.

The last 2 pages of this Lab packet are for you to record information, answer questions, write interpretations, and then turn in to the lab instructor.

Naming Sedimentary Rocks (rock names in **bold print**)

1) ***Clastic*** – primarily named by particle size, secondarily by other features.
    i) Many particles or fragments larger than sand size (>2 mm):
        (a) ***conglomerate*** (if large particles rounded);
        (b) ***sedimentary breccia*** (if many or most fragments are angular).
    ii) Sand size (feels like sandpaper, very coarse to medium to very fine; 2 mm to 0.1 mm):
        (a) ***sandstone*** – if no subtype fits; subtypes:
            1. ***quartz sandstone***, if virtually all grains are quartz.
            2. ***arkose***, if >25% of grains are feldspar (recognized by dull, white, powdery weathering products (clays) of feldspars. Layering often not prominent.
            3. ***greywacke***, dominantly sand of mixed sizes, but mixed with abundant silt, clay and shale fragments; often looks grey, greenish grey and "dirty". Layering often not prominent.
    iii) Silt size, finer grained than sand; grains cannot be felt with the fingers (but feel gritty between the teeth):
        (a) ***siltstone***
    iv) Clay size, very fine grained: (be careful, "clay" can mean a size of grain, or the name of a large group of minerals)
        (a) ***mudstone*** or ***claystone***
        (b) ***shale*** if obviously finely layered (a common rock type).

2) ***Organic*** – named by the type of organic material.
    i) ***coquina***, if broken shell fragments; sometimes well cemented, often not cemented.
    ii) ***coal***, if mostly carbonaceous plant debris (sometimes difficult to recognize); very dirty brown to black color. ***Peat*** is plant material in the beginning stages of conversion to coal.
    iii) ***coral,*** if mostly the hard structures that form coral reefs.

3) ***Chemical*** – named by the dominant precipitated/crystallized mineral.
    i) calcite → ***limestone***. Can be white to gray to black in color, depending on impurities; black color usually from carbon-rich decayed organics.
    ii) Some sub-varieties of chemical limestones:
        (a) ***Limestone breccia***: broken fragments of limestone, cemented with calcite.
        (b) ***Oolitic limestone***: limestone with distinct small, round, calcite pellets.
        (c) ***Fossiliferous limestone***: limestone with many shells or other obvious fossils.

    iii) dolomite →***dolomite.*** Product of Mg-rich water altering limestone (calcite) to dolomite; difficult to distinguish from limestone without chemical tests.
    iv) gypsum → ***rock gypsum***. Lower density than most rock. Usually white. Soft.
    v) halite → ***rock salt***. Recognized by white, soft grains, and salty taste.
    vi) quartz → ***chert***. Color varies: white, gray, black, yellow and red are common. (Many local names are given to different colors of chert: jasper and flint, for example.) Chert pebbles are abundant in the gravel of the Texas Coastal Plain.

Date: _____ Lab Section: _____ Name: _____

To turn in at end of lab meeting.

I. Neatly fill in this table for at least 10 different sedimentary rocks.

Dominant material (clas., chem., org.) and rock color	Particle size, avg and range (mm)	Cementation (good or poor)	Rock Name	Sed. structures (if any), and other features

II. Sketch and label two examples of sedimentary structures, and explain what each implies about the environment of deposition of the sediment. Include a scale bar on your sketches.