

GEOL 103 Writing Assignment 3. Sedimentary Rocks

Name _____

To be counted, must be turned in by Thursday, Sept 28. Don't write books for each answer; try to be concise, yet precise. Graded primarily for thoroughness; use this exercise to study by. Don't feel compelled to always use complete sentences.

1) In your own words, what steps can any rock (ign., mmorphic, or sed) follow to become a sedimentary rock?

Any rock exposed at the Earth's surface is subjected to water, which contains CO₂ to make it slightly acidic, and the acidic water helps dissolve mineral (Chem. weathering). Several types of physical processes (phys. weathering) also break rocks and minerals into smaller particles, increasing chemical weathering. The rocks and mineral grains that are not completely dissolved are eroded and transported by wind, water, or glaciers. When wind or water energy dies down, sediments are deposited. Sediments are often buried, and the several physical and chemical change of diagenesis cause the sediment to become rock (become lithified).

2) Explain in your own words what sorting, rounding, and sphericity are, and how they help us understand sedimentary rocks.

Well-sorted sediments have similar grain sizes. Rounding (sharp corners rounded off) and sphericity (grains become more spherical) of grains occurs due to rocks and minerals breaking against each other during transport. All three increase with increased transport.

3) How many minerals that make up sedimentary rocks can you name?

Quartz, calcite, dolomite, mostly potassium feldspar, clays (e.g., kaolinite), halite (rock salt), gypsum, occasionally micas (muscovite, biotite). Sedimentary rocks can also contain fragments of igneous, sedimentary, or metamorphic rocks.

4) Why don't many minerals from igneous rocks end up in sedimentary rocks?

Because they formed at high T & P, mafic minerals usually weather too quickly to be preserved in sedimentary rock.

5) In your own words, what does the term depositional (or sedimentary, as used in your text) environment mean?

A set of physical, chemical, and sometimes biological conditions that determine the type of sediment that can be collected for possible preservation as sedimentary rock.

6) What do the following tell us about the depositional environment of a sediment?

A. large angular grains – **little transport, high transport energy rapidly dissipated, suggesting e.g., steep terrain**

- B. small, but visible rounded grains – **significant transport, enough energy to round and sort grains, suggesting e.g., beach or sand bar in a river/creek**
- C. graded bedding - **energy stirs up sed of several size, but energy dissipated rapidly, suggesting e.g., nearshore marine sed reworked by a short-lived storm**
- D. cross-bedding – **unidirectional current (not back-and-forth waves), suggesting e.g., river sed or ocean current with consistent direction (not usually beaches)**
- E. invisible grains made of clay minerals – **very low energy environment that allows tiny particles to settle out to the bottom, e.g., deeper marine or many lake environments**
- F. whole animal shells – **usually offshore marine (could be riverine) setting such that shells are not broken by waves or storms**
- G. asymmetrical ripples – **produced by back-and-forth wave action (not unidirectional current), for example near shore marine environments, some large lakes, not rivers**
- H. mudcracks – **shallow water which periodically dries up, must have been slow –moving at some time to allow for deposition of very fine-grained material, e.g., shallow lakes, tidal mud flats**
- I. bioturbation of fine muds – **usually fairly deep marine sediments not disturbed by storms, otherwise bioturbation would be “erased”**

7) What are the main processes involved in lithification?

Compaction, primarily of very fine clay minerals (They are sheet silicates. When initially deposited, these flat particles can have lots of orientations. Upon burial, they get oriented ≈ horizontally, compacting the package of sediment.

Dissolution of unstable minerals like calcite, halite

Cementation: chemical precipitation of mineral material between grains (SiO_2 , CaCO_3 , Fe_2O_3) binds sediment into hard rock. Sed have water supersaturated with quartz or calcite or hematite flowing through them. One of these minerals precipitates from solution, taking up some of the open (pore) space between the original sediment grains.

Recrystallization of clay minerals like kaolinite between grains (similar to cement formation

8) For a sedimentary rock, what does the term “cement” (used as a noun) mean?

Pore-filling minerals taking up space between sedimentary grains, giving the rock greater strength.

9) What can you say about the relative amount of weathering experienced by sediments in a quartz arenite sandstone compared to an arkosic sandstone compared (see Fig. 5.16)?

Seds in a quartz arenite (quartz sandstone) experienced the greatest weathering (Quartz is very stable near surface). Seds in arkose experienced more weathering, and greywacke or lithic sandstone seds experienced the least weathering.

10) Why are carbonate rocks formed from coral reefs interpreted to have formed in clear marine water in tropical to subtropical environments? (Note: not all carbonate rocks form from coral reefs.)

Corals need sunlight and warm temperatures to grow. Cloudy or deep or cold water are not favorable for coral growth.

11) Briefly, how do evaporite deposits form? How could you demonstrate this in the kitchen?

Evaporation of salty water in a basin that at least partially enclosed, such as the Mediterranean Sea or a lake in the western US that has no outlet in an arid region. In the kitchen, heat water to evaporate it – a little salt should form as dissolved ions precipitation as evaporation increases.