Name:___________________________

Lab 8: Sedimentary Rock Identification

Clastic Sedimentary Rocks

Clastic sediments are made of particles of mineral or rock fragments, known as clasts, that have been weathered from preexisting rock and transported by gravity, water, ice, or air. Chemical weathering involves the dissolution or decomposition of these minerals, whereas mechanical weathering consists of processes such as abrasion and cracking that do not change the mineral content of the material. During transport, clasts are abraded and become increasingly rounded (smooth surfaced) and equidimensional (spherical). Chemically and mechanically stable minerals, such as quartz, survive this transportation better than the less stable minerals and are therefore concentrated in sediments that have been transported for long times and distances. Transportation also tends to segregate particles by size. High-energy environments (e.g. rivers, coasts) can transport large clasts, while low energy environments (deep ocean) can transport only small clasts. Different transport processes can be more or less selective about which grain sizes are moved, therefore the degree of sorting can be indicative of the transport medium. For example, glacial ice is not selective at all and can move the widest range of clasts (tiny clay-sized particles to boulders the size of buildings), while wind typically moves grains sized within the narrow range of silt to fine sand. A sediment with clasts of uniform size is known as well-sorted, while one containing a wide range of clast sizes is poorly-sorted. Sediments that consist primarily of well-sorted, rounded, and spherical quartz grains indicate that the material has been subjected to long or repeated periods of transport and is designated as mature. On the other hand, sediments that consist of various minerals and rock fragments that are angular, non-spherical, and poorly-sorted are indicative of sediments that have not been transported far and are called immature. Factors relating to maturity are outlined in the following tables and figures:

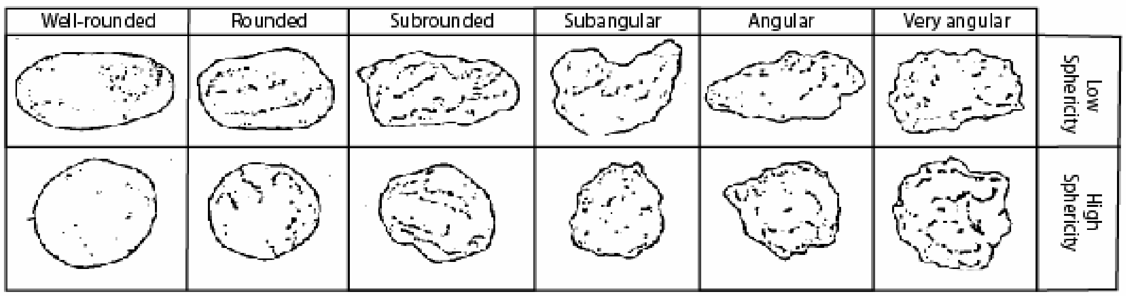
Stability of common minerals under surficial weathering conditions

Note that there is a relationship between this series and Bowen's reaction series. The minerals formed at highest temperatures and pressures are the least stable, while those formed at lower temperatures and pressures (closer to surface conditions) are more stable.

Most Stable	Fe Oxides
↑	Al Oxides
	Quartz
	Clay minerals
	Muscovite
	Potassium Feldspar
	Biotite
	Sodium-rich Plagioclase
	Amphibole
↓	Pyroxene
	Calcium-rich Plagioclase
Least Stable	Olivine

Degrees of rounding and sphericity

The degree of rounding is often a function of transport duration; the longer a clast is in transport, the more rounded it will become. The degree of sphericity also depends somewhat on transport duration, though some mineral grains start out more equidimensional than others. Quartz, for example, often is found in nearly equidimensional grains in granite, while amphibole and feldspar crystals are elongated.



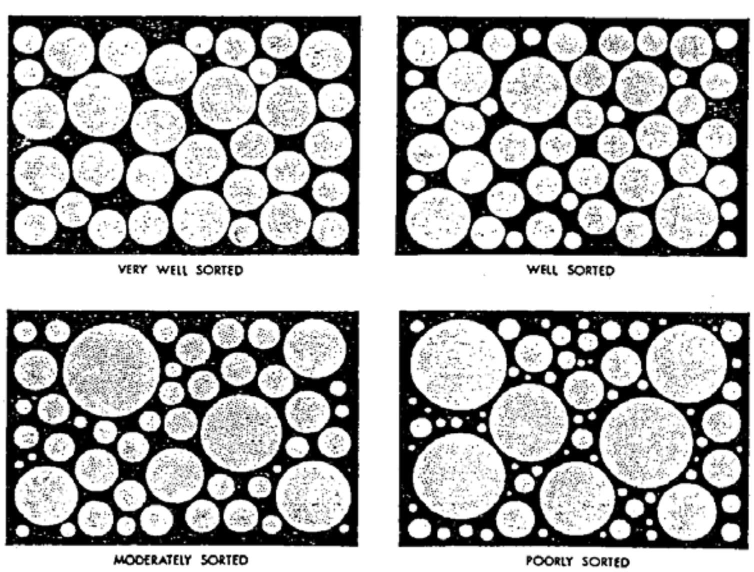
Guide to grain size

Note that (a) A conglomerate may instead be called a breccia if its clasts are angular. (b) Sand can be further divided into fine sand (1/16 to about 1/8 mm), medium sand (1/8 to 1 mm) and coarse sand (1 to 2 mm). (c) The term clay can refer either to a range of grain size (< 1/256 mm) or to a family of sheet silicate minerals known as clay minerals.

Name of particle	Range limits of diameter (mm)	Names of loose sediment	Name of consolidated rock
Boulder	> 256	boulder gravel	boulder conglomerate
Cobble	64 to 256	cobble gravel	cobble conglomerate
Pebble	2 to 64	pebble gravel	pebble conglomerate
Sand	1/16 to 2	sand	sandstone
Silt	1/256 to 1/16	silt	siltstone
Clay	< 1/256	clay	mudstone and shale

Guide to grain sorting

Note that the degree of sorting is independent of the absolute sizes of the grains involved.



Clastic sedimentary rock classification key

Texture	Grain Size	Composition	Other Texture	Rock Name
Clastic	Gravel (particles larger than 2 mm)	Gravel-sized clasts mostly rock fragments	Rounded grains	Conglomerate
		Gravel-sized clasts mostly rock fragments	Angular grains	Breccia
	Sand (particles visible, but less than 2 mm)	Commonly quartz, feldspar, rock fragments		Sandstone
		Predominately Quartz		Quartz sandstone
		Predominately feldspar		Arkosic sandstone
		Predominately Lithic		Lithic sandstone
	Silt (particles not visible, feels gritty and cannot be scratched by fingernail)	Most often quartz, some feldspar		Siltstone
	Clay (particles not visible, feels smooth and is easily scratched by fingernail)	Clay minerals and quartz		Mudstone or shale

Chemical Sedimentary Rocks

Chemical sedimentary rocks are formed by the precipitation of compounds from aqueous solutions. For example, limestone forms from the precipitation of calcium carbonate (calcite) from seawater. Often, biology plays a key role in the formation of limestones as the calcite comes from the shells of sea creatures. Another example of a chemical sedimentary rock is an evaporite, a rock that forms when water is evaporated from closed basins in arid climates. As evaporation progresses, the remaining water can become highly saline and eventually will become supersaturated with respect to a variety of dissolved constituents, leading to their precipitation from solution. Common evaporite minerals include gypsum and halite.

Silica is undersaturated in sea water so one would not expect to find it as a direct precipitate from sea water. However, small siliceous organisms such as diatoms, radiolarians, and some sponges are highly efficient in removing silica from sea water to form their skeletons. After these organisms die they sink and accumulate on the sea floor. Many cherts are formed by lithification and recrystallization of such deposits.

Organic Sedimentary Rocks
An unusual sedimentary rock is coal, a carbon-rich rock that forms when organic matter (trees and other plant matter) is buried and compressed in an oxygen-poor environment so that decomposition does not proceed. This is common in swampy settings.

Chemical and organic sedimentary rock classification key.

Texture	Composition	Other Properties	Rock Name
Chemical (crystalline)	Microcrystalline quartz	Scratches glass	Chert
	Halite	Three perfect cleavages at 90°, tastes salty	Rock Salt
	Gypsum	Softer than fingernail, cleavages not at 90°	Rock Gypsum
	Calcite	Readily reacts with dilute hydrochloric acid	Limestone
	Dolomite	Powdered rock reacts with dilute hydrochloric acid (much less reactive than calcite)	Dolostone
Organic	Plant material (carbon)	Brown to black, low specific gravity	Coal
Biochemical	Calcite	Fossils and fine grains	Fossiferous Limestone
	Calcite	Entirely composed of shell fragments	Coquina
	Calcite	Ooids (layered spheres)	Oolitic Limestone
	Quartz	Diatoms, very white color, often low density and friable	Diatomite

Sample	Clastic or Chemical	Representative Grain Size	Sorting	Roundness and Sphericity	Composition	Other (e.g. fossil content)	Rock Name
1							
2							
3							
4							
5							
6							
7							

Sample	Clastic or Chemical	Representative Grain Size	Sorting	Roundness and Sphericity	Composition	Other (e.g. fossil content)	Rock Name
8							
9							
10							
11							
12							
13							
14							