Notes: Ch 6

Chapter 6 Notes

sedimentary rocks form at and near the earth's surface from consolidated sediments of weathered rocks and organic matter

I. Classification (on basis of how formed then composition or particle size)

1. Clastic - detrital - broken fragments of pre-existing rocks and minerals
   a. grain size:
      - Conglomerate - well rounded, course grained gravel and boulders
      - Breccia - angular, course grained gravel and boulders
      - Sandstone - rounded sand size sediments
      - Siltstone, claystone - very fine sediments, less than 1/256 mm
      - mudstone - fine, muddy sediment, silt/claystone i.e. shale - if breaks along parallel planes - most abundant of sedimentary

   b. sorting - a measure of the range of grain size
      - provides clues to mode of transport and deposition (i.e. ice - poorly sorted, rivers and wind - well sorted)

      - Well sorted - all grains similar size
      - poorly sorted - wide variation in grain size
      - matrix - finer material filling in the gaps in poorly sorted (glue)

2. Chemical - precipitated from solution
   - named for Composition
      - limestone - most abundant chemical sediment - calcium carbonate (calcite) - fizz
      - dolomite or dolostone - calcium-magnesium carbonate - powder fizzes
   - the above carbonates may be precipitated from fresh or salt water or depositions of $CaCO_3$ shells or skeletons
   - evaporite - salt water trapped and evaporates causing halite and other minerals to precipitate out
      - chert - SiO_2 precipitates out and solidifies
      - some clays - mudstones, precipitate out

3. Biogenic - produced by biological processes (organisms involved) i.e. shells, skeletons, coral
   - cherts can be silica skeletons of sponges, etc
   - coal - remains of land plants, tec. not a rock - fossil fuel

Note: warm, wet climate (flat) → chem mature, angular sed ← H_2O had lots of contact
cold, dry climate (hilly) → chem immature, round sed

II. Sedimentary Environment – where formed
- depositional setting, origin and distance travelled
- if in a stream
  - textural maturity (physical) increases with distance trav.
  - chemical or mineralogical maturity - more minerals dissolved if travelled long way/time
  - ferromag weather more easily than quartz
  - particles carried by wind/ice don't erode easily
- more rain = more chem breakdown = chem maturity
- warm = more chem breakdown, except calcite
- topography - more hilly, faster transport, less time needed for chemical breakdown → chemically immature

Clastic Sedimentary Environment
- wind, deserts, sand dunes
- rivers - finer sediments tend to stay in suspension
  - form deltas
- beach - active waves, well sorted/rounded
- tidal flat - fine mud settles out
- deep sea floor - very fine sediments

Chemical Sedimentary Environment
- must be under or close to water
- shallow - warm water → carbonates (limestone)
- restricted warm basins - evaporites
- cold deep, far from land - predominantly chemical deposition i.e. silica-rich muds → chert

III. Lithification
- to become rock, occurs at low T and P, may involve any of the below processes

→ Diagenesis - if changes result from increased T and P (not quite meta)
- occurs in upper few km of crust <200°C
- may not become a solid (no lithification)
- recrystallization, chemical changes (ie limestone to dolomite), etc.
- water flowing through dissolves and precipitates new material

general term for the processes that turn sed. into rock

Processes!

✡ Compaction - pressure from above sediments so volume of pore space between grains decreases, water squeezed out, grains stick together, but cementation is usually needed too

Recrystallization - under pressure some minerals (halite, calcite) may have individual mineral grains grow courser, interlock, pore space reduced

✡ Cementation - sticking together of mineral grains by deposition of additional materials between grains
- fluids flow through sediments and dissolved minerals may precipitate out = glue

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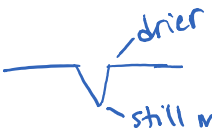
IV. Structures and Features of Sedimentary Rocks

bedding - layering (stratification)
- lamination - layers < 1cm thick
- stratum - each visually distinct layer that corresponds to a particular period

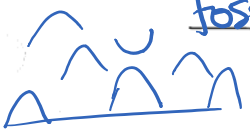
graded bedding - usually course (biggest) at bottom and fine (smallest) sediments at top
- formed when poorly sorted sediments forced to stand still suddenly (turbidity current)
- not always horizontal - depends on topography

cross-bedding - sloped layers on top of horizontal ones

ripple marks - symmetric - waves near shore
- asymmetric - wind or water flow in one direction; flattened on side from which current flows



mud cracks when fine grained, waterlaid sediment dries out; much of mud volume is water so when dries cracks appear



fossils - preserved by: carbon films
intact
recrystallization by diagenesis
replacement
mold or cast

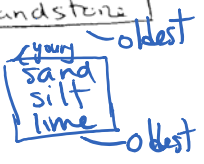
trace fossils - animal tracks, worm borrows, etc

- carbonates formed near shore just where wave bottom touches

V. Facies
- describes collectively a set of conditions that lead to a particular type of rock (or sediment), or to distinguish the rock that represents those conditions
- limestone, mudstone, sandstone may all be facies of one rock unit deposited simultaneously (pg 123)
- sediment becomes finer the further from source

transgression - process of the ocean advancing over what was dry land; sea level rising, like now; transgressive sequence

regression - process of the ocean retreating over land
- opposite to above



paleographic maps - constructed predominantly through interpretation of sedimentary rocks (what world looked like during earlier eras)

ble 4–1
The Standard Grain-Size Scale for Clastic Sediments[a]

	Name	Millimeters	Micrometers	φ
GRAVEL	Boulder	4,096		−12
	Cobble	256		−8
	Pebble	64		−6
	Granule	4		−2
SAND	Very coarse sand	2		−1
	Coarse sand	1		0
	Medium sand	0.5	500	1
	Fine sand	0.25	250	2
	Very fine sand	0.125	125	3
MUD	Coarse silt	0.062	62	4
	Medium silt	0.031	31	5
	Fine silt	0.016	16	6
	Very fine silt	0.008	8	7
	Clay	0.004	4	8

[a]As devised by J. A. Udden (1898) and C. K. Wentworth (1924). The φ scale (Krumbein, 1934) was devised to facilitate statistical manipulation of grain-size data and is commonly used. $\phi = -\log_2 \text{mm}$.

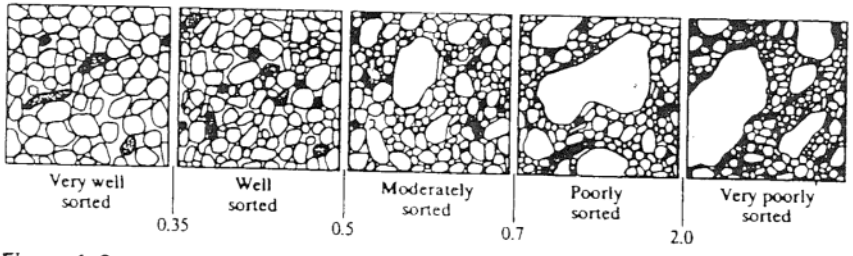


Figure 4–3
Classification of degrees of sorting as seen through square hand lens. Silt- and clay-size sediments are indicated by fine stipple. Values of standard deviation that divide each class of sorting are also shown. [R. R. Compton, 1962, *Manual of Field Geology* (New York: Wiley).]

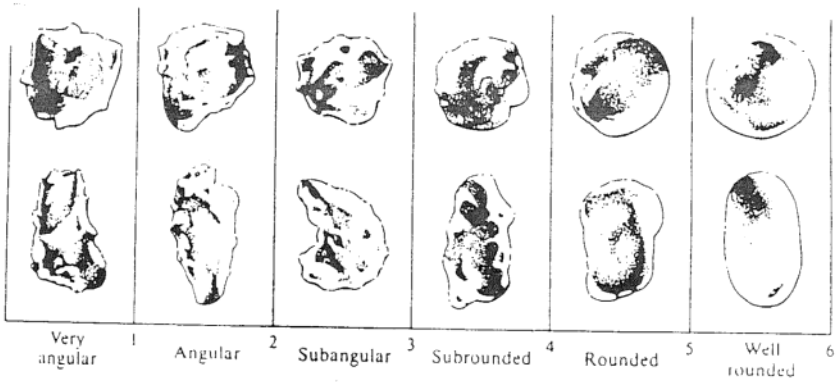


Figure 4–5
Terminology for degree of roundness of detrital grains with hand lens. The numbers assigned to each roundness class permit calculation of mean roundness and standard deviation. [M. C. Powers, 1953, *Jour. Sed. Petrology, 23.*]

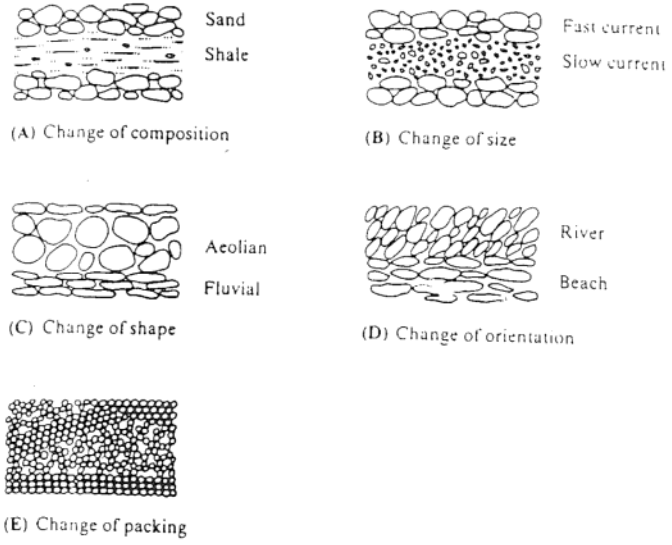


Figure 4–15
Idealized examples of some types of textural changes sensed by naked eye as bedding. [J. C. Griffiths, 1961, *Jour. Geol., 69.* Reprinted by permission of The University of Chicago Press. Copyright © 1961 by The University of Chicago.]

GEOLOGY 12 Name _____

CHAPTER 6 WORKSHEET

SEDIMENTS AND SEDIMENTARY ROCKS

1. Sediments are unconsolidated accumulations of rock, mineral grains, and organic matter that form at and near the earth's surface.
2. The finer material that fills in the spaces around the larger clasts in a clastic rock is called the matrix.
3. A recognizable and mappable rock unit, typically deposited under a uniform set of conditions, is called a(n) formation.
4. Clastic sediments are composed of broken up pieces of preexisting rocks and minerals.
5. Mineral grains that range in size from 1/16 to 2 mm are classed as sand.
6. The difference between a conglomerate and a breccia is mainly that the fragments making up a breccia are angular in shape.
7. By definition, the range of grain sizes present in most conglomerates makes them poorly sorted.
8. The most important chemical sedimentary rock is limestone.
9. Dissolved silica may precipitate to form the chemical sedimentary rock chert.
10. Although it is actually made of organic matter instead of minerals, coal is considered a sedimentary rock. (by some)
11. During lithification, the weight of overlying sediments will cause the sediments to compact by squeezing the grains more tightly together.
12. Pore fluids containing dissolved silica or calcite are involved in the process of cementation in which mineral grains are "glued" together.
13. Inclined bedding caused by deposition from currents of wind or water is called cross-bedding, a common sedimentary structure.
14. A current flowing primarily in one direction, such as a stream, may produce asymmetrical ripple marks on the streambed.
15. Mudcracks typically form in fine or clay sediments, which easily expand and contract.
16. Fossils are the remains or evidence of ancient life.
17. A fossil mold is an impression in the surrounding sediments of the original organic material.
18. Most carbonate sedimentation occurs in shallow water environments where the water is warm and the precipitation of calcite is facilitated.

19. Carbonate sediments also form in caves where they are sometimes known as dripstone. (i.e. stalagmites and stalactites)

20. Rivers and beaches are environments where clastic sediments are most likely to be found.

21. As one moves from the shore area farther out to sea, the size of sediments generally becomes smaller / finer.

22. As clastic sediments travel farther from their source area, they are likely to become more enriched in resistant minerals, such as quartz.

23. In warm climates, chemical weathering can occur at a faster rate, so that sediments approach chemical maturity sooner.

24. In a shallow marine environment, sandstone represents the shore or beach facies or environment.

25. A column or section rock which goes from limestone at the bottom to shale then to sandstone at the top probably represents a regression of the sea over time.

26. Cross-bedding and asymmetric ripple marks are particularly useful for determining paleocurrents in ancient rocks.

27. A sedimentary rock that is rich in coarse quartz and feldspar fragments probably is derived from a granitic source area.

28. The primary characteristic used to classify clastic sedimentary rocks is

A. the location in which the sediments were deposited
B. the distance of the rock from the source area for the sediments
C. the size of the sediments in the rocks
D. the composition of the sediments in the rocks

29. The major difference between clastic and chemical sedimentary rocks is

A. how the sediments that make up the rocks are formed
B. their textures
C. their permeability and porosity
D. the environments in which they can be found after diagenesis

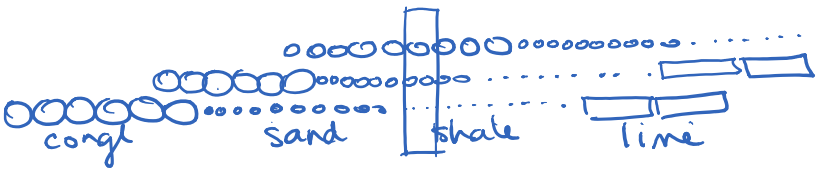
30. The terms mudstone, siltstone, claystone, and shale may be used for rocks having grains that

A. are 2 to 256 mm in diameter
B. are less than 1/16 mm in diameter
C. are 1/16 to 2 mm in diameter
D. are composed of clay only, no matter what size the grains may be

31. A rock composed of calcite in the form of fossil seashells which are partially recrystallized and cemented together would be classified as

A. an evaporite, because the seawater previously around the shells has left
B. a carbonate, because rocks made up of calcite in any form are carbonates
C. clastic, because it is made up of broken pieces
D. clastic, because rocks containing cemented grains are usually clastic

Sea level falling



conglomerate
sandstone
shale
limestone

sea level was falling