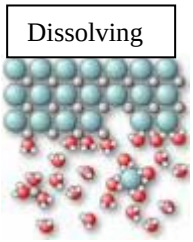
Sedimentary Processes

1) **Sediment** ≡ material that has been <u>deposited</u> in layers at the Earth's surface by:
   a) mechanical transport by gravity, water, wind or ice (clastic)
   b) chemical precipitation from solution (chemical or crystaline)
   c) biological production by organisms (biogenic)

2) 7% of crust by volume but 75% of surface area

3) Sed. material is derived from :
   weathering (aka erosion "wx") ≡ mechanical or chemical breakdown of rocks at the Earth's surface

   a) **Mechanical wx** = physical disintegration of rx
      i) Abrasion (rubbing)
      ii) Frost wedging
      iii) Unloading
      iv) Thermal shattering (exp. Moon)
      v) Biological – roots, burrows



   b) **Chemical wx** = dissolving of ions in the rx
      i) Rain, snow, ice, dew

   c) **Transport** (gravity energy) causes sediment grains (clasts) to become generally:

      i) "soft" minerals are lost, "resistant" minerals remain
         (1) mafics & feldspars oxidize to silt & clay
         (2) quartz grains left as sand

4) Deposition ≡ settling or precipitation of sed. material
   a) Rock texture & structure tell you about <u>depositional environment</u>
      i) Agents
         (a) water – rivers, creeks, sheetwash, ocean currents, waves
         (b) ice – glacial till, moraine, v. poor sorting
         (c) wind – dunes: v. good sorting

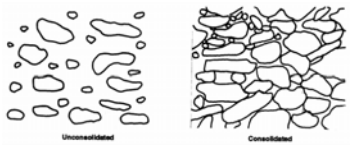
   b) Depositional environment: Energy (high – moderate – low)

Higher Energy -->

      i) **river** – conglomerates, sandstones, channel fills
      ii) **beaches** – mature qtz, feldspar-rich sands - some cross bedding
      iii) **continental slope** – turbidites (graded bedding)
      iv) **sand dune** – cross bedded sandstone ("*Aeolian*")
      v) **deep marine** – lithograph limestone
      vi) **evaporates** – ppt. dry lake or sea

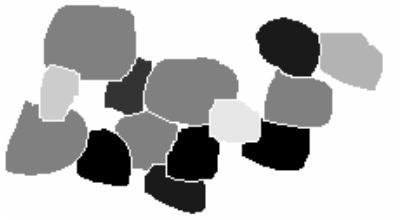
5) Lithification (diagenesis) == conversion of sediment to rock by:

   a) compaction – weight of overlying sed. decreases void space (can initially be 60%)



   b) cementation – ppt. in pore space
      i) calcium carbonate (calcite) $CaCO_3$
      ii) silica (quartz) SiO_2
      iii) iron oxide (limonite) Fe_2O_3

   c) recrystalization – under pressure grains re-xlize at points of contact



Classification of Sedimentary Rocks

(see CHART in Lab #6 page 4)

Sedimentary rock ID based on:

1) Depositional type
   a. clastic – settling of material
   b. chemical (crystalline) – ppt. of material

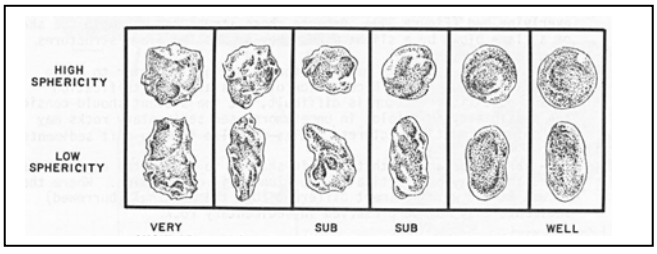
2) Mineral content (composition)

3) Texture
   a. particle size – Wentworth Scale (see Lab #6)

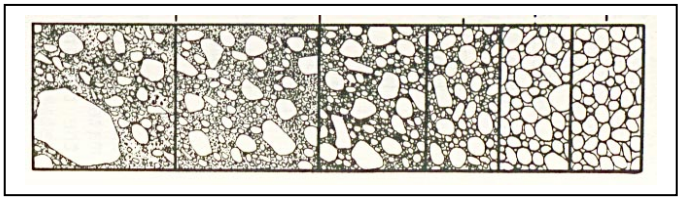
Phi Units*	Size	Wentworth Size Class	Sediment/Rock Name
-8	256 mm	Boulders	Sediment: GRAVEL Rock RUDITES: (conglomerates, breccias)
-6	64 mm	Cobbles	
-2	4 mm	Pebbles	
-1	2 mm	Granules	
0	1 mm	Very Coarse Sand	Sediment: SAND Rocks: SANDSTONES (arenites, wackes)
1	1/2 mm	Coarse Sand	
2	1/4 mm	Medium Sand	
3	1/8 mm	Fine Sand	
4	1/16 mm	Very Fine Sand	
8	1/256 mm	Silt	Sediment: MUD Rocks: LUTITES (mudrocks)
		Clay	

* Udden-Wentworth Scale

   b. rounding



   c. sorting



Common Sedimentary rock types (see CHART in Lab #6 page 4)

1) Clastic ("chunks")

- conglomerate – rounded pebbles + matrix
- breccia – angular pebbles + matrix
- quartz arenite (sandstone) – well sorted, quartz sand
- arkose – angular sand, >25% feldspar
- greywacke – arkose w/ >20% clay ("dirty sandstone")
- siltstone – silt (gritty)
- claystone – clay (not gritty)
- shale – laminated claystone

2) Biochemical (crystalline texture – ppt.)

- carbonates [$CaCO_3$] – limestone (will fizz in dilute HCl)
  Types:
  - lithographic (micrite) – fine grained
  - crystalline – coarser grained
  - oolitic – tiny spheres (oolites)
  - coquina – fossiliferous

  - dolomite [$Ca(MgCO_3)_2$]– Mg from sea water, like limestone (doesn't fizz)

- chert – SiO_2
  - siliceous ooze (esp. diatoms), waxy luster, conc. frac., often w/ chalk
  - chalcedony, flint, jasper

- evaporates – drying of inland lakes and seas
  - halite – salt domes (diapirs)
  - gypsum