QUATERNARY DEPOSITS (05)

I Main Topics
- A Distribution of Quaternary deposits
- B Types of Quaternary deposits
- C Dating methods for Quaternary deposits

II Distribution of Quaternary deposits

http://www.wae.com/px/newcom/quaterna.htm

http://geology.er.usgs.gov/eastern/us-namap.html

http://geopubs.wr.usgs.gov/open-file/of00-444/

- A Surficial deposits (mostly Quaternary) cover 95-97% of land area
- B Quaternary deposits: poorly consolidated sediments
- C Soils: these develop in-place

III Types and properties of Quaternary deposits; see attached table
- A Depositional environment ⇒ composition, grain size, & sorting
- B Tremendous variety of surficial deposits; site-specific mapping and testing commonly is called for.

IV Dating methods for Quaternary deposits (not comprehensive!)
- A Reasons for dating
  1. To determine time intervals between periodic events (e.g. quakes)
  2. To relate possible causes and effects (e.g. tsunamis and deposits)
  3. To determine rates of geologic processes (e.g. erosion)
- B Relative dating
  1. Stratigraphic methods
     - a Classical methods
     - b Tephrochronology
     - c Magnetostratigrapy
  2. Fossils (including pollen)
  3. Relative amounts of weathering
     - a Degree of soil development
     - b Weathering of clasts
  4. Relative amounts of erosion (e.g. by water and wind)
  5. Relative amounts of deposition

C "Absolute" (quantitative) dating

Technique	Age range (years)	Comments
^{14}C	150-80,000	Most widely used
Uranium series e.g. ^{234}U- ^{230}Th	10,000 - 350,000	Organic carbonates U-Th good for marine
^{39}Ar-^{40}Ar	>10,000	Rapid improvements
Amino acid racemization	> ~50,000	Applicable to bone, shells
Desert varnish	15,000 - 500,000	Active debate
Dendrochronology	<8200	Also indicates climate
Fission track	> 100	Large uncertainties
Varve chronology	<20,000	Geographically restricted
Obsidian rind hydration	> 10,000	Large uncertainties
Tritium	<30	V. good for groundwater

Depositional Setting	Grain size	Sorting	Hydraulic Conductivity	Deposit Shape	Comments
Fluvial deposits					
Meandering					
Channels	Gravel & sand	Good		Sinuous tongues	Commonly superposed
Bars	Gravel & sand	Excellent		Lens	
Overbank	Silt & clay	Fair		Sheet	
Splays	Sand	Good		Tongues	
Oxbow lakes	Sand, silt, clay	Fair-good		Horseshoe	
Braided	Gravel & sand	Good		Braided	
Alluvial fans					
Braided	Gravel & sand	Good		Braided	
Debris flow	Gravel-clay	Poor		Tongue	
Interfan	Sand, silt, clay	Fair-poor		Irregular sheet	
Lake deposits					
Varves	Clays	Good		Sheet	
Channels	Sands	Fair-good		Tongue	
Marine clays	Clays	Good	6E-13 -- 2E-9	Sheet	Can be "quick"
Swamps/marshes	Peat	Fair		Sheet	
Deltas					
Topset	Sand	Fair-good			
Foreset	Sand & silt	Fair			
Bottomset	Clay	Fair			
Distributaries	Sand & silt	Fair-good		Fingers	
Sources: Costa and Baker, 1981, p. 120, p.320; Carmichael, 1989, p. 689-707; Freeze and Cherry, 1979, p. 29.					

Depositional Setting	Grain size	Sorting	Hydraulic Conductivity	Deposit Shape	Comments
Beach deposits	Gravel & sand	Excellent		Sheet	
Tidal flats	Sand, silt, clay	Fair		Sheet	Beware of "quick sands"
Glacial deposits			8E-13 -- 2E-6		
Unstratified	Gravel-clay	Poor			
Ground Moraines	Gravel-clay	Poor		Sheet	
Lateral moraines	Gravel-clay	Poor		Tongue	
Terminal moraines	Gravel-clay	Poor		Horseshoe	
Stratified		Good	″E-5		
Eskers	Gravel & sand	Good	E-8 -- E-4	Sinuous tongues	
Eolian Deposits					
Sand dunes	Sand	Excellent	2E-5 -- 2E-4	Lens/sheet	
Loess	Silt	Excellent	E-9 -- 5E-6	Sheet	Brittle: can collapse
"Gravity" deposits					
Colluvium	Gravel--clay	Poor		Sheet	Blankets many slopes
Talus	Gravel	Excellent		Cone	Unstable
Reefs	Coral	NA	Generally "high"	Annulus or sheet	These usually are hard; properties highly depedent on degree of alteration
Gravel			E-3 -- 1		
Clean sand			3E-5 -- 8E-3		
Med-coarse sand			E-4 -- 3E-2		
Fine sand			E-7 -- E-4		
Silty sand			9E-8 -- 8E-4		
Silt			E-9 -- 2E-5		
Clay			< E-7		

Sources: Costa and Baker, 1981, p. 120, p.320; Carmichael, 1989, p. 689-707; Freeze and Cherry, 1979, p. 29.