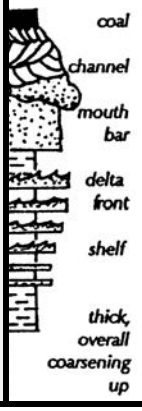
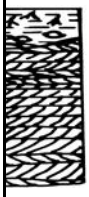
Table 2.4: Clastic Sediments: Terrestrial Environments

Descriptor		Terrestrial						
		Glacial Environments		Alluvial Fans	Braided Rivers	Meandering Rivers		Desert Dunes
		Till	Outwash			Channel	Alluvial Plain	
Typical Colour		Grey, grey-green if fresh; tan, brown if weathered	Grey, grey-green if fresh; to tan, red, brown if weathered	Red, pink, brown	Red, pink, brown, grey-white	Red, tan, brown	Red, tan, brown	White, tan, reddish
Typical Grain sizes And nature of grains	Breccia	Coarse and immature		Very coarse and immature				
	Conglomerate		Medium, immature	Coarse-medium, immature	Very coarse to medium, immature	Channel center		
	Sandstones	May contain sand to clay size particles in addition to gravels.	Coarse to fine, immature	Very coarse	Very coarse to medium, immature	Medium to fine, usually with some <sand fines	Fine sands from flood peak, with silt	Medium to fine, well sorted, often quartz rich
	Siltstones		As lenses or beds			At top (inside corner) of point bar	typical	
	Clays						some	
Sedimentary Structures		Massive: no visible bedding. Striations (scratch marks) may be present on some clasts.	Horizontally bedded, cross-bedded, Erosional contacts	Matrix supported (Gravels may be surrounded by fines)	Horizontally bedded, Grain supported (Gravels may have no fines in-between)	Ripple cross beds common, erosional contacts	Horizontally bedded, Sand may be in lenses	Cross beds 10's to 100's of metres high
Fossils		Typically none	Typically none	Rare trees or vertebrates	Rare trees or vertebrates	Tree fragments, vertebrates	Plant fragments	Rare vertebrates
Trace fossils		Typically none					Scoyenia, Root traces	
Sequence or most typical deposit			Channels cross cutting, eroding and filling 	Massive deposits of thick, coarsening upwards and fining upwards cycles. Unsorted and unstratified debris flows	Proximal: Massive  Also, channels cutting and eroding 	Ideal below  Many variants possible	Laminated silts, thin overbank flood sands	Cross beds 10's to 100's m high 

Table 2.5: Clastic Sediments: Transitional and Marine Sedimentary Environments

Descriptor		Transitional			Marine				
		Delta Complex	**Tidal Flat: Supra- & Intertidal**	**Beach And Barrier Island**	**Lagoon or Delta Bay**	**Shelf**		**Contin-ental Slope/ Sub-Marine Fan**	**Deep Shelf or Basin Floor**
						Storm Dominant	Tide Dominant		
Typical Colour		Grey black in basal silts to white in channel sands	Grey to black	White	Grey to black	Greenish to tan	Greenish to tan	Grey to dark grey	Dark grey to black
Typical Grain sizes And nature of grains	Breccia								
	Conglom.			Short systems only		Gravels at storm deposit base			
	Sandstones	Coarse to fine in main channel	Typical	Coarse to medium, mainly quartz sands	Storm wash in beds	Typical	Proximal Medium grained	Turbidite sequences.[1] (FUS Sand/ gravel beds at base, to silts, to clays at top)	
	Siltstones	As overbank deposits between channels	Typical	Possible	Typical	Typical inbetween storms and distal	Typical distal		Short fining upwards sequences
	Clays	in bays between channels	Typical		Typical	Typical in-between storms and distal	Typical distal		Typical
Sedimentary Structures		Delta top: sands in channel deposits with overbank silts. Front: Bedding angled offshore. coarser near shore becoming finer. Delta base: Horizontal silts to sands, cut by turbidite[1] deposits	Inter: Horizontally bedded. Symmetrical cross beds. Supratidal: cm. scale asymmetrical and symmetrical cross beds.	Gravel beaches grain supported	Storm overwash sands with cross beds, silts laminated	Coarser near shore.	Very large scale cross beds (Note: colour distinguishes from dunes.)	Matrix supported gravel at base, ripples in middle, parallel laminations at top Proximal: sands Distal: shales with sand lenses.	
Fossils		Plant material, invertebrates		Tree trunks, broken shells	Brackish water animals, plant traces	Abundant, diverse marine invertebrates	Sparse marine fossils	Rare marine floaters (eg: jellyfish) or swimmers	
Trace fossils			*Glossi-fungites*	*Skolithos*	*Cruziana*	*Cruziana*		*Nereites*	*Zoophycus*
Sequence or most typical deposit			Intertidal: Alternating sand and mud, sands may be in lenses/ channels, symmetric cross beds. Supratidal: as above with asymmetric cross beds, mud cracks, Sands may be storm deposits	Repeating: 	Bay: FUS and CUS cycles Lagoon:  Lagoon: organic rich muds	Proximal: Typical hummocky sequences  Distal: 	Proximal: Planar cross beds  Distal: 	Proximal:  Turbidites: FUS  Distal: 	Occasional silts from distal turbidites  Mostly thinly laminated shales, may contain pyrite

[1] **Turbidity Currents** are bottom-flowing density flows in which suspended sediments collapse downhill similar to a snow avalanche. Sediment on the delta front or continental shelf slope is disturbed by storm waves, earth movement or sediment overload and "avalanches" towards the lake bottom or deep basin. The deposits created are called **turbidites.** Typical turbidite deposits formed are from bottom to top: T_A) Graded bedding in sands/gravel T_B) lower parallel laminations, T_C) Current ripple laminations, T_D) Upper parallel laminations and, T_E) Pelmicrite or mud. Not all divisions are required to be present.

Table 2.6: Carbonate-dominated systems*

Descriptor		Transitional	Marine			
		Tidal Flat: Supratidal & Intertidal	**Lagoon or Subtidal**	**Reef**	**Shelf**	**Basin Floor**
Typical Colour		Light grey	Dark and light grey	Light grey	Light to medium grey, green, brown	Dark grey to black
Carbonates	Intraclasts	Intramicrite				
	Fossils		Small patch reefs[1]: biomicrite to biolithite	Biolithite Biosparite	Storm:Biomicrite Tidal: Biosparite	
	Ooids	Oomicrite	Oomicrite		Tidal: Oosparite	
	Peloids	Pelmicrite	Pelmicrite, pelsparite		Storm: Pelmicrite	
	None	Micrite typical	Micrite			Micrite
Dolomites	Dolostone	Typical	In evaporative basins			
Chert		As nodules[2]	As nodules[2]			Bedded forms
Evaporites	Gypsum	Typical if arid	Typical if arid		Nodular forms	
	Halite	Typical if arid	Typical if arid			
Typical sedimentary sequences		Supra-Tidal: Mud cracks, algal laminates, massive micrite, gypsum Intertidal: sand bars with ripple cross beds, wavy beds, channels	Widely variable. Micrites and Biomicrite dominant. Storm washes of sand sized intramicrite, oomicrite and oosparite Whole shell Biomicrites	Massive mounds made by intact corals (biolithite), or multiple fossils in piles (Biosparite)	Storm Dominant: Hummocky units of bio- and pel-micrite interbedded with (layered with) micrite. Tide Dominant: Thick cross beds of biosparite and oosparite	Thinly laminated or massive micrite, occasional fossils. Often thinly laminated. May be low Oxygen= black, may include chert nodules, pyrite
Other Sedimentary Structures			Often interbedded with clastics	Fossil debris may form slumps and debris flows off the reef front	Often interbedded with shales/silts	Rare mass flow deposits – distal parts of turbidites on the shelf.
Fossils		Algae, invertebrates	Snails, arthropods (eg: crabs), clams, sponges	Corals and other reef builders	Abundant diverse marine fossils: Echinoderms, cephalopods (eg: squid), deep corals	Rare floaters or swimmers.
Trace fossils		*Glossifungites*	*Cruziana*	*Trypanite*	*Cruziana*	*Zoophycus*

*Note: There is a continental slope/submarine fan facies in carbonate-dominated environments. However, this facies involves more complex descriptions of carbonates beyond the naming of carbonates covered in Lab 1, and hence this facies have been omitted.

[1] Patch reefs are small, isolated, mound-like areas of reef not connected to each other.

[2] Nodules are formed when fluids move within sediment that is already deposited. Ions are re-dissolved, and then re-precipitated during the sediment lithification process. They are "chemical sediments within chemical sediments"