SEDIMENTOLOGY

GGY 4031
LECTURE NOTES 5a

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Sedimentary Structures: large-scale features of sedimentary rocks generated by a variety of processes over long periods of time such as:

- ✓ during transport and deposition of sediments (primary structures)
- ✓ after deposition but before lithification (penecontemporary structures)
- ✓ after lithification (secondary structures).

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Classifications of Structures

- ✓ ***Descriptive:*** based on observable characters
- ✓ ***Genetic:*** based on interpretations of origin

These classifications requires understanding the following:

- ✓ time of development relative to time of deposition (primary sedimentary structures and secondary sedimentary structures)
- ✓ mechanism that produces them (physical, chemical and biogenic structures)

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	Physical	Chemical	Biological
Primary	Stratification Sole marks	Stratification	Bioturbation (tracks, trails)
Secondary	Deformation Intrusion Dessication	Nodules Concretions Deformations Stylolites	Bioturbation (Burrows)

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PRIMARY STRUCTURES

Generated mainly by **these** fundamental processes:

- ✓ deposition (depositional structures)
- ✓ erosion (erosional structures)
- ✓ biogenical (biogenic structures).

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Deposition Structure

- ✓ ***Stratification***: rock layering (planar-tabular shape) brought about by deposition

When dealing with ***stratification***, consider the following:

- ✓ What was the depositional conditions that changed with time to give rise to stratification?
- ✓ What is it that makes the stratification manifest? *(**Changes in texture, structure and composition**?)*

Stratification is usually obvious, especially on the larger scale outcrops but sometimes subtle and hard to find & require skill. In looking for the ***stratification***, always think in terms of changes in texture, structure and composition from bed to bed.

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In identifying *stratification* pay attention to the following:

- ✓ obvious differences in grain size
- ✓ obvious differences in composition
- ✓ Obvious differences in color/shade caused by slight differences in composition
- ✓ differential weathering caused by differences in composition/texture; these range from gross to subtle
- ✓ zones of larger or smaller concentration of individual components, like pebbles or fossils in otherwise homogeneous sediment
- ✓ preferred orientation of nonspherical components (technically not stratification itself, but it can reveal the stratification; often useful in unstratified conglomerates)

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Stratification Terminologies

- ✓ ***Bed/bedding:*** tabular or lenticular layers of sedimentary rock that have lithologic, textural, or structural unity that dearly distinguishes them from strata above and below or strata thicker than 1 cm
- ✓ ***Laminae/laminations: strata/***layers thinner than 1 cm. **Layer** is sometimes loosely and informally used for any bed or stratum of rock.

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Stratification Terminologies		
Bedding	Very thick-bedded	≥100 cm
	thick-bedded	≥30 cm
	Medium-bedded	≥10 cm
	Thin-bedded	≥3 cm
	Very thin-bedded	≥1 cm
Lamination	laminated	$\leq 1cm$
	Thin-laminated	$0.3\ cm$

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- ✓ **Parting** is the tendency for stratified rocks to split evenly along certain stratification planes.

Parting Terminologies	
Massive	100 cm
Blocky	30 cm
Slabby	10 cm
Flaggy	1 cm

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Other stratification terminologies:

- ✓ ***Bedding or bounding planes:*** upper and lower surfaces of beds. These **surfaces** represent planes of non-deposition, an abrupt change in composition (which reflect changes in depositional conditions), or an erosion surface. Some bedding surfaces may be post-depositional features formed by diagenetic processes

Shapes of the bedding or bounding surfaces vary from:

- ✓ Planar, (even), to wavy to broadly curved
- ✓ Parallel to non-parallel, and continuous to discontinuous

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In terms of internal structures, **three** general categories can be distinguished:

- ✓ *Massive/structureless beds:* The term **massive** is used to describe beds that appear to be homogeneous and lacking in internal structures
- ✓ *Laminated beds:* consists of alternating laminae of different composition or texture
- ✓ *Graded beds:* beds showing vertical gradation in grain-size

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Massive or Structureless beds: homogeneous in character throughout. and may represent:

- ✓Intervals of essentially uniform conditions of sedimentation
- ✓Prolonged settling of finer sediments (out of suspension)
- ✓Through mixing after deposition by burrowing organisms
- ✓Diagenetic destruction of primary textures to produce a more homogeneous rock

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Laminated beds: **r**epresent intervals in which there was minor alternation of conditions, such as slightly fluctuating energy levels alternatively depositing silt and very fine sand
Lamination can be:

- ✓ primary-an expression of variation in grain-size or any aspect of composition or
- ✓ Secondary-produced or accentuated by diagenetic processes

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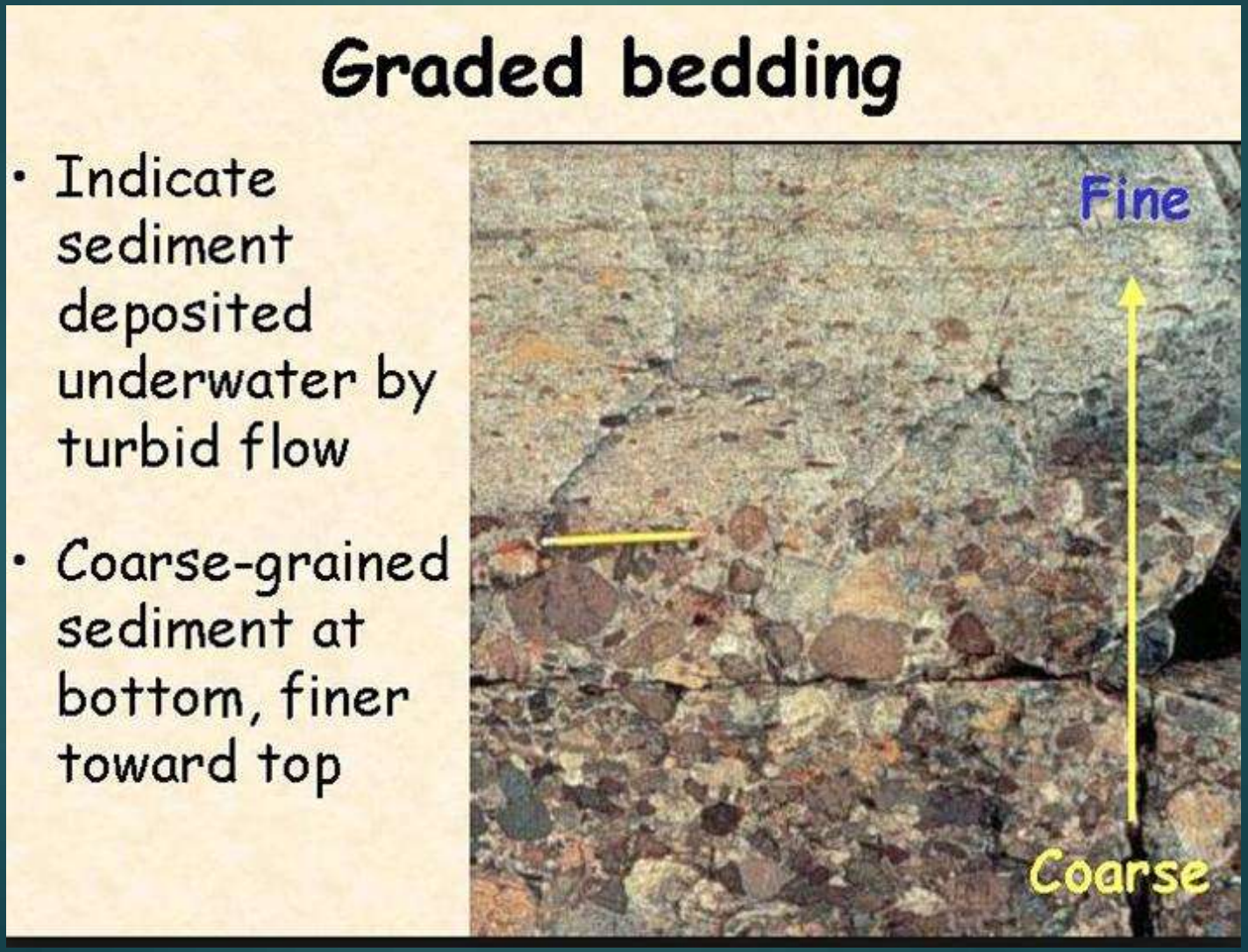
•*Graded Beds:* show gradation from coarser particles at the base to finer particles (normal grading)



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In *reverse* or *inverse grading:* beds coarsens upwards. This type of grading is relatively uncommon but is characteristic of sediments deposited by grain flow and debris flow

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Significance of Graded Bedding

- ✓ Normally graded beds generally represent depositional environment which decrease in transport energy as time passes, but also form during rapid depositional events.
- ✓ indicate a sudden strong current that deposits heavy, coarse sediments first, with finer ones following as the current weakens.
- ✓ Represents turbidite strata, also form in terrestrial stream deposits.