



UNIVERSITY OF SOUTH ALABAMA

GY 402: Sedimentary Petrology

Lecture 14:

Immature Siliciclastic Sedimentary Environments

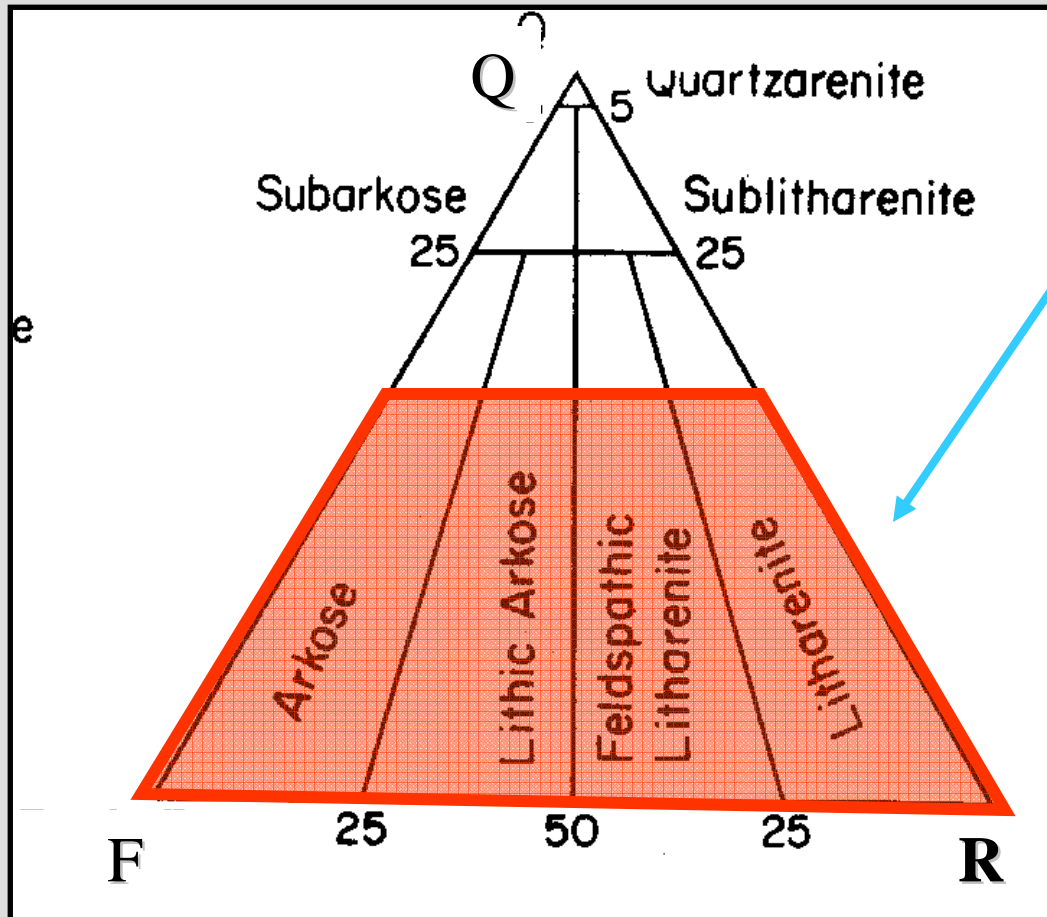
Alluvial Fans, Braided Streams

Last Time

Immature siliciclastic sediment and sedimentary rocks

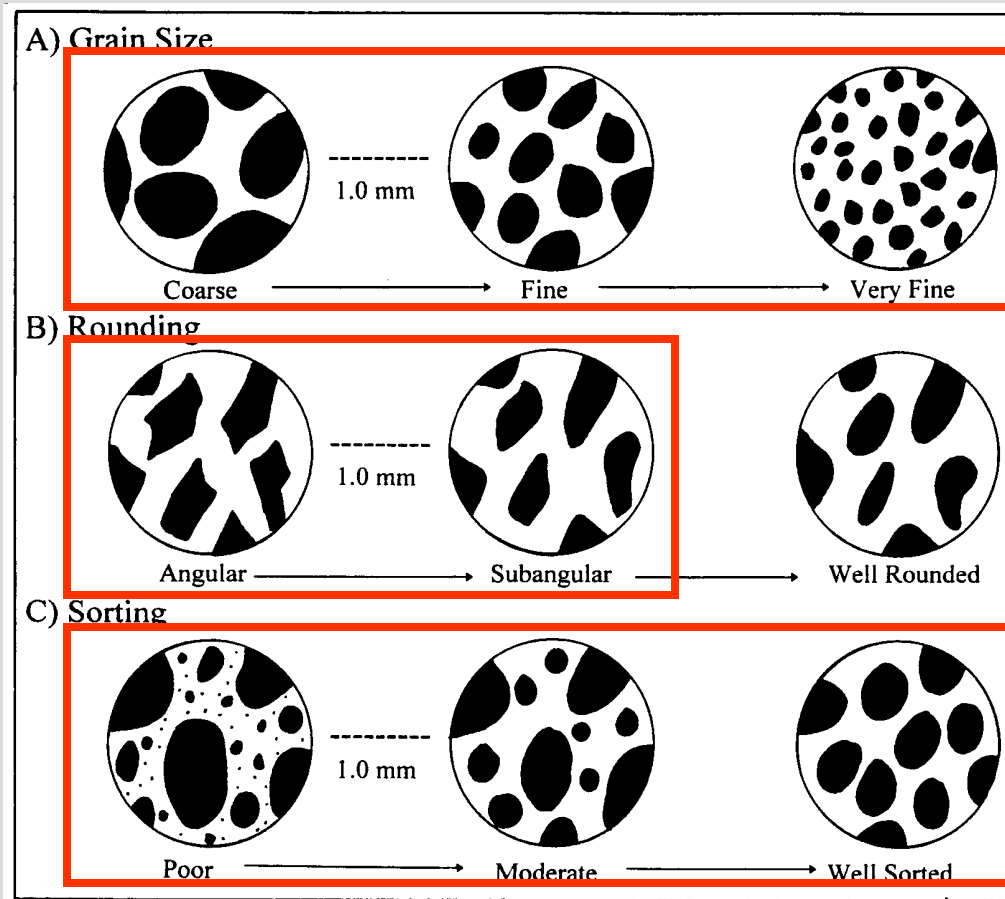
1. Immature siliciclastic sediment
2. Immature siliciclastic sedimentary rocks
3. Point counting (for this or the next lab assignment)

Siliciclastic Sedimentary Rocks



“Immature” rocks
(mineralogically unstable)
Enriched in feldspars and
unstable rock fragments

Important Grain Parameters



Grain Size

(energy of deposition)

Rounding

(degree of wear)

Sorting

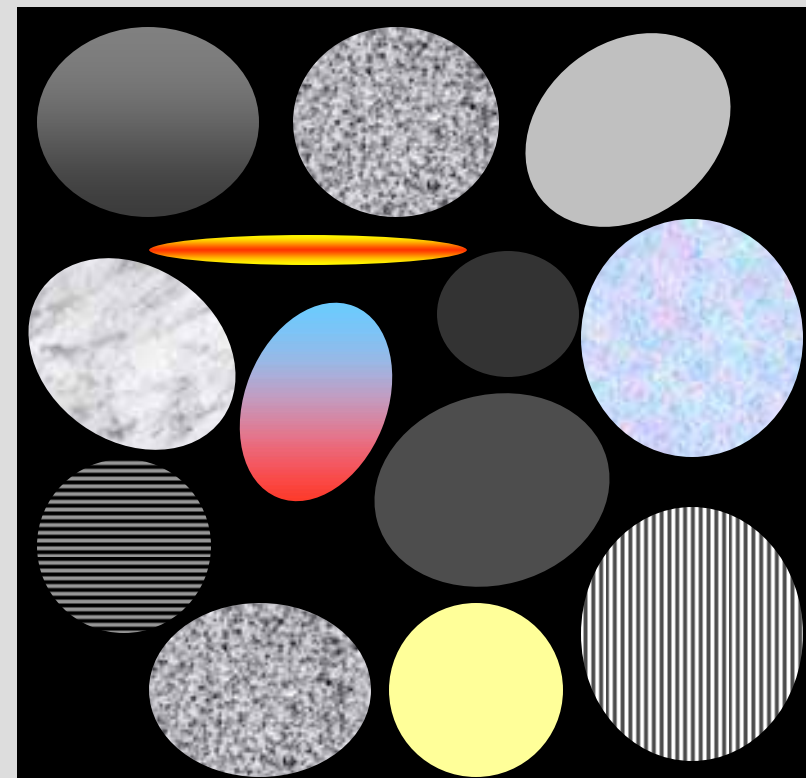
(energy of deposition)

Immature Siliciclastic Sediment

Is usually more diverse
(mineralogy-wise) than
mature sediment.

Grains include:

- ❖ Plagioclase feldspar
- ❖ Orthoclase
- ❖ Microcline
- ❖ Micas
- ❖ Lithics
- ❖ Quartz

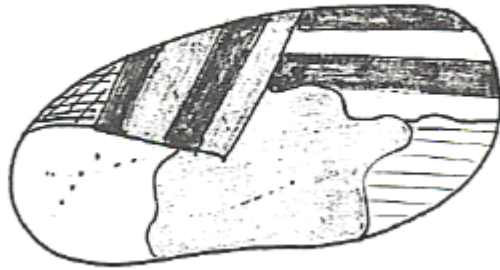


XN

250 μm

Lithic Fragments

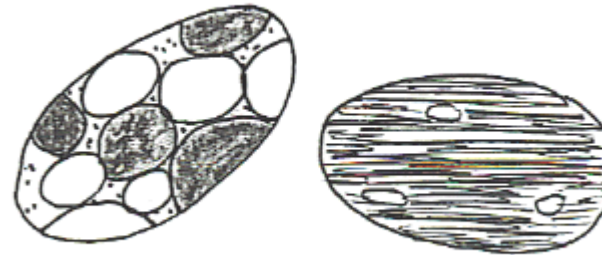
Plutonic Fragments



1.5mm

- 1) contain large, anhedral, intergrown crystals of common igneous minerals (i.e. quartz, feldspar, biotite [granite]; plagioclase, pyroxene, amphibole [gabbro])
- 2) some feldspars display zonation; some quartz crystals display vacuoles or inclusions.

Sedimentary Fragments

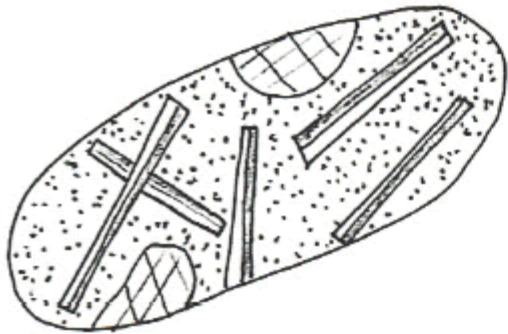


1.5mm

- 1) contain smaller, frequently rounded, grains of variable mineralogy depending upon origin (i.e. quartz, chert, feldspar [siliciclastic]; carbonate ± fossil fragments [limestone]).
- 2) siltstone fragments commonly grain-free, but laminated.

Lithic Fragments

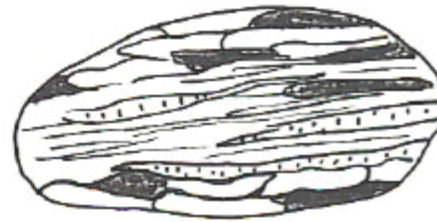
Volcanic Fragments



1.5mm

- 1) contain euhedral crystals (esp. plagioclase) in fine grained or glassy matrix.
- 2) may contain virtually inclusion-free, hexagonal-bipyramidal quartz crystals.

Metamorphic Fragments



1.5mm

- 1) contain elongated, and/or foliated minerals such as biotite and muscovite.
- 2) Quartz displays strong, undulose extinction and common inclusions of mica.

Hand specimens

Immature siliciclastic sandstones

(arkose - litharenite)

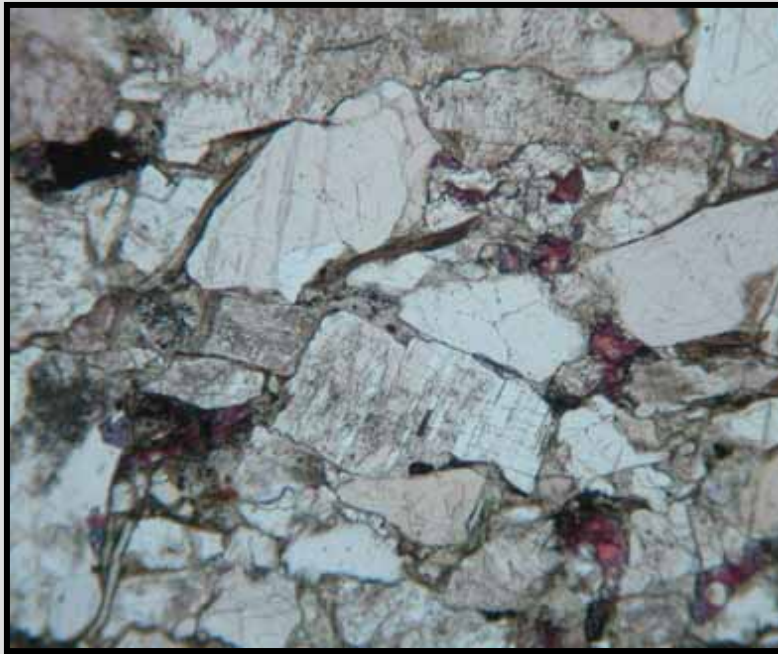


5 cm

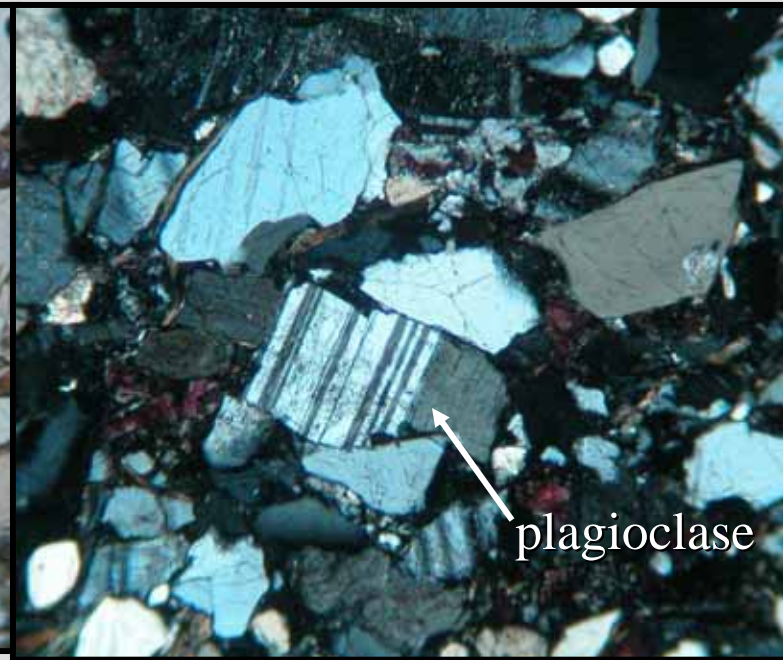


Thin-section Photomicrographs

Arkose



ppl



xn

750 m

Today's Agenda

Immature siliciclastic sediment and sedimentary rocks

- ❖ Pictorial overview
- ❖ Alluvial fans
- ❖ Braided rivers

Alluvial Fans



Alluvial Fans



Alluvial Fans



Alluvial Fans



Alluvial Fans



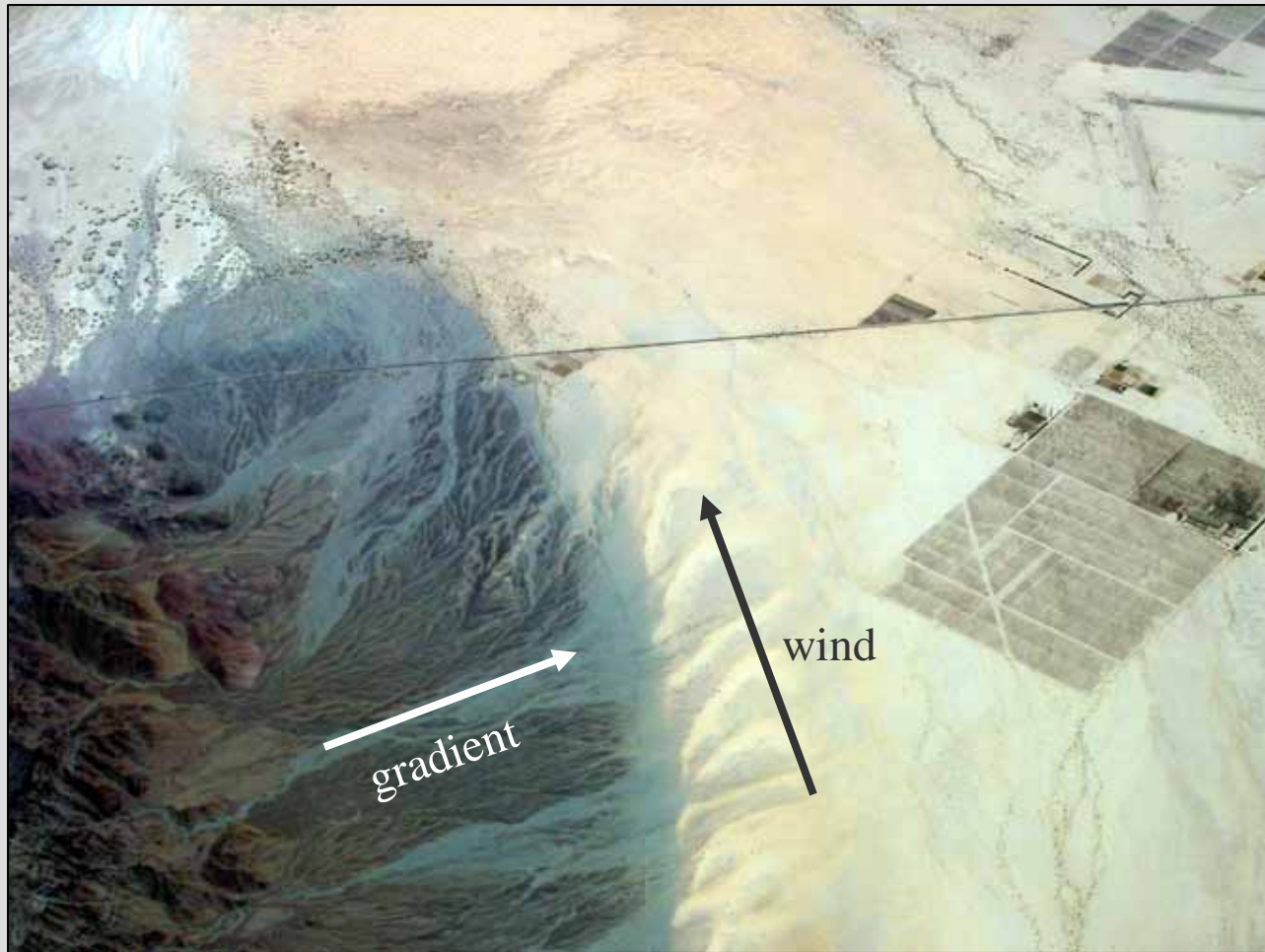
Alluvial Fans



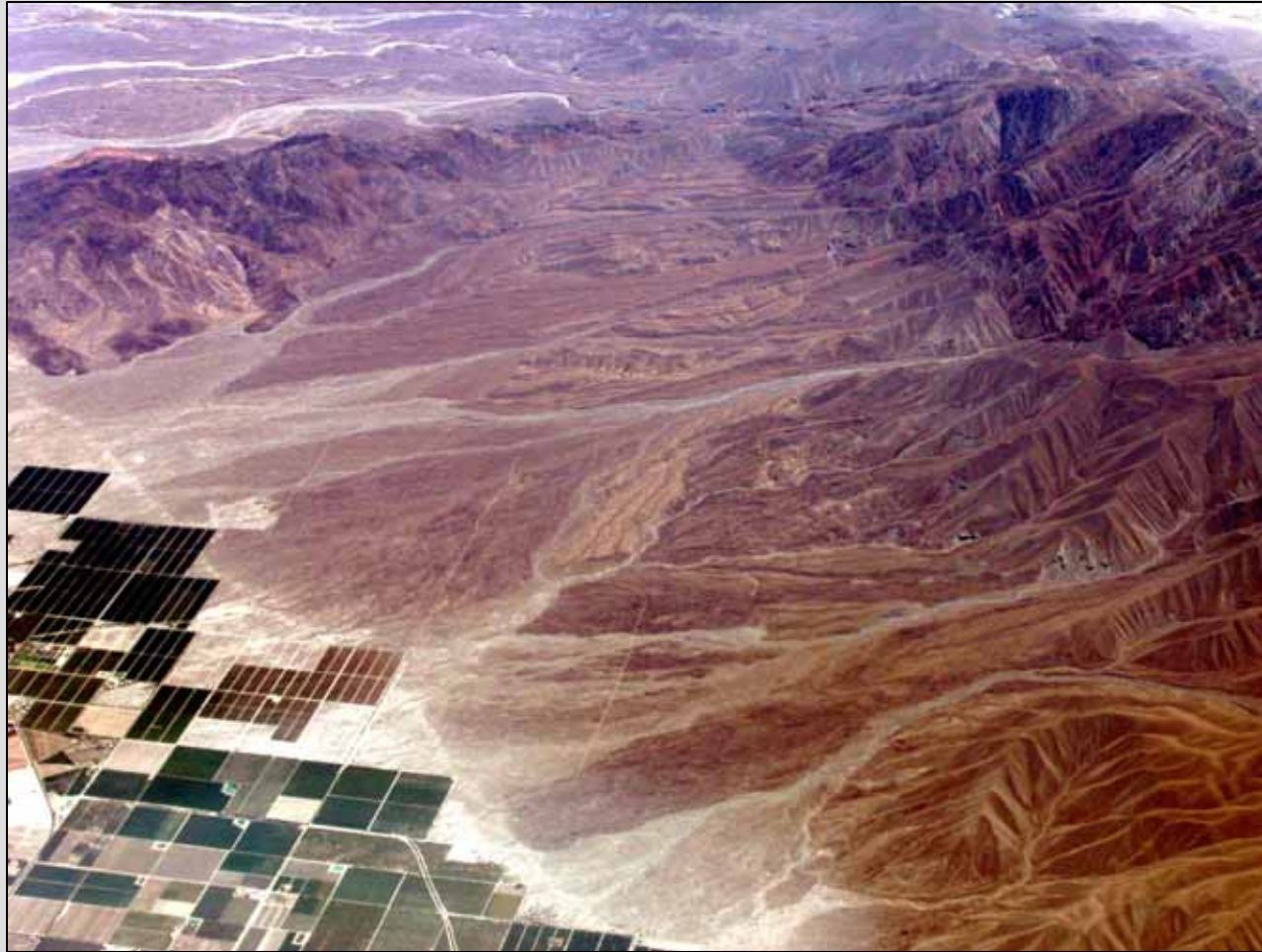
Alluvial Fans



Alluvial Fans



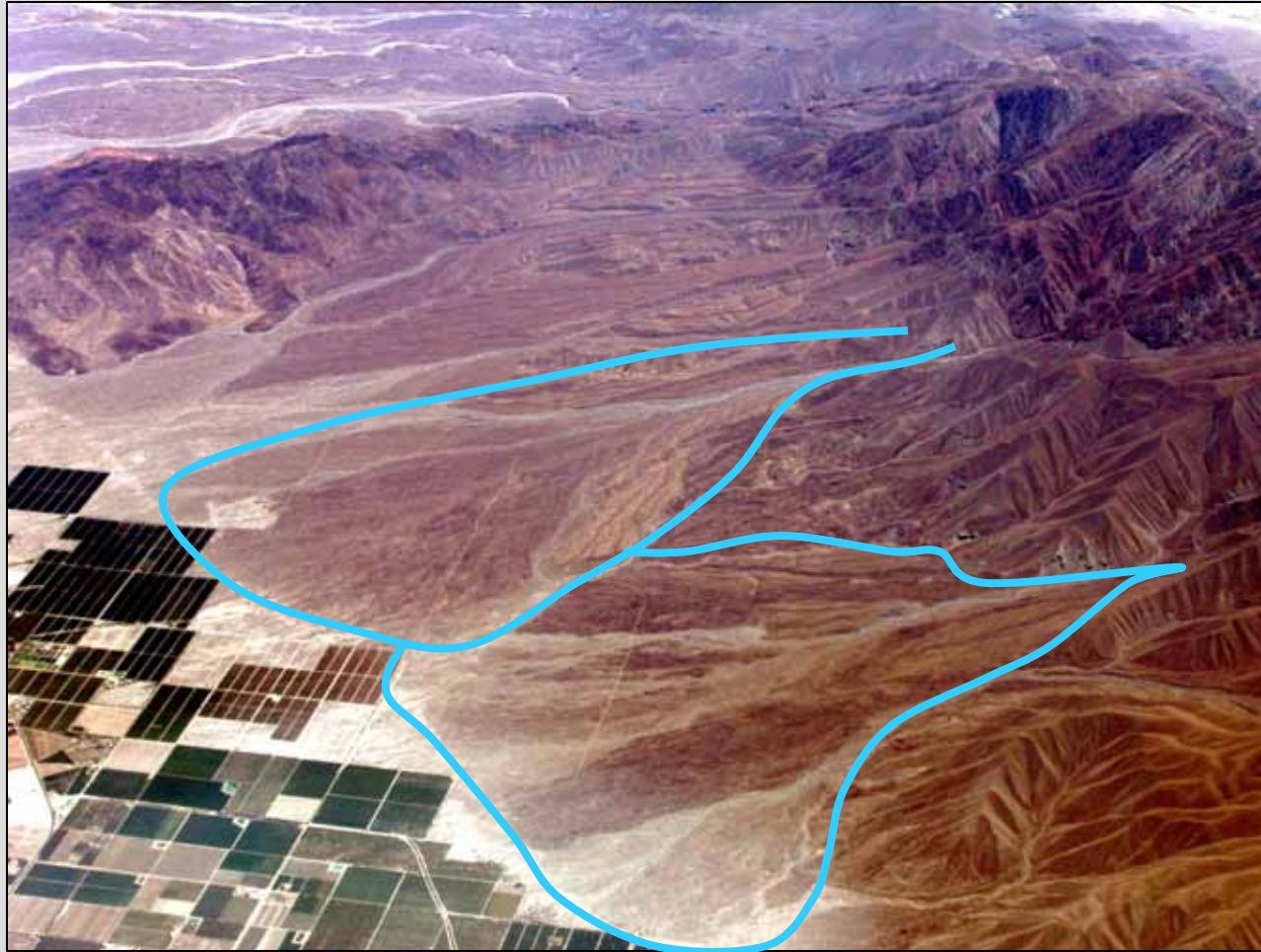
Alluvial Fans



Alluvial Fans



Alluvial Fans



Alluvial Fans



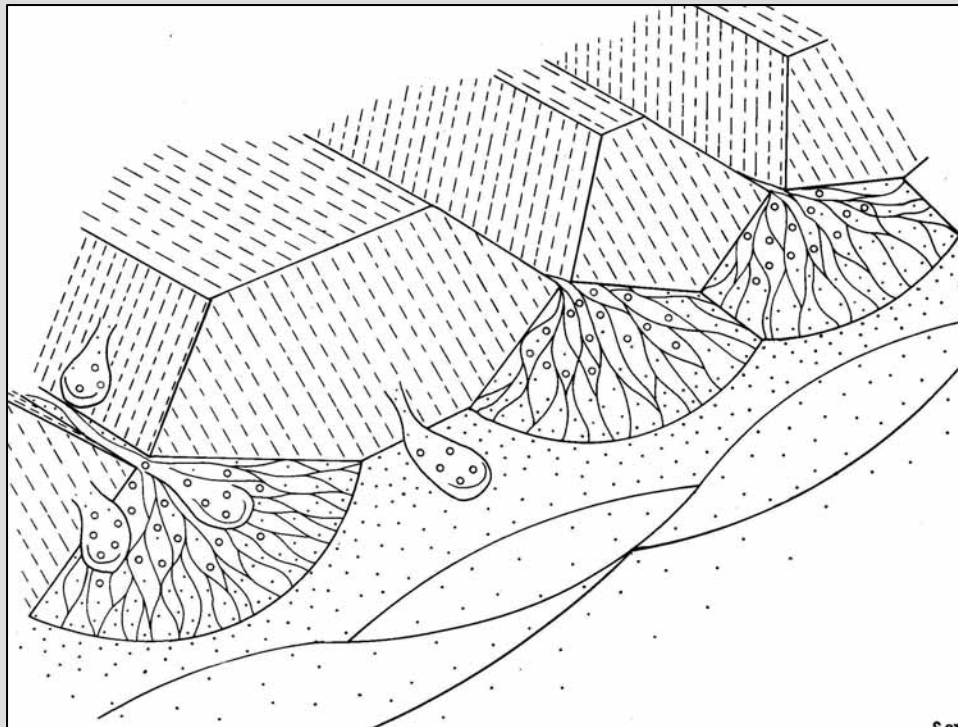
Alluvial Fans



Alluvial Fans - view from the top



Alluvial Fans



Fan-shaped deposits
of siliciclastic
sediment deposited
at the base of
mountains

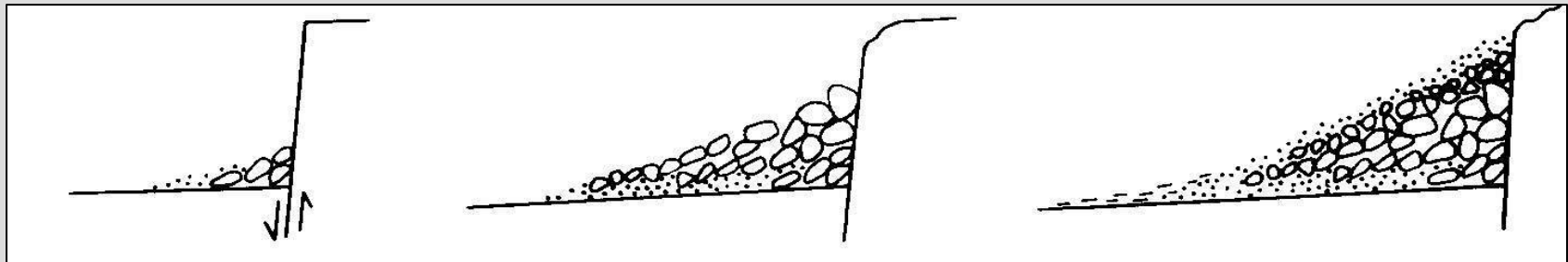
- ❖ Gravel to clay sized
- ❖ Angular to sub rounded
- ❖ immature

Alluvial Fans

- ❖ Best developed in arid regions

Alluvial Fans

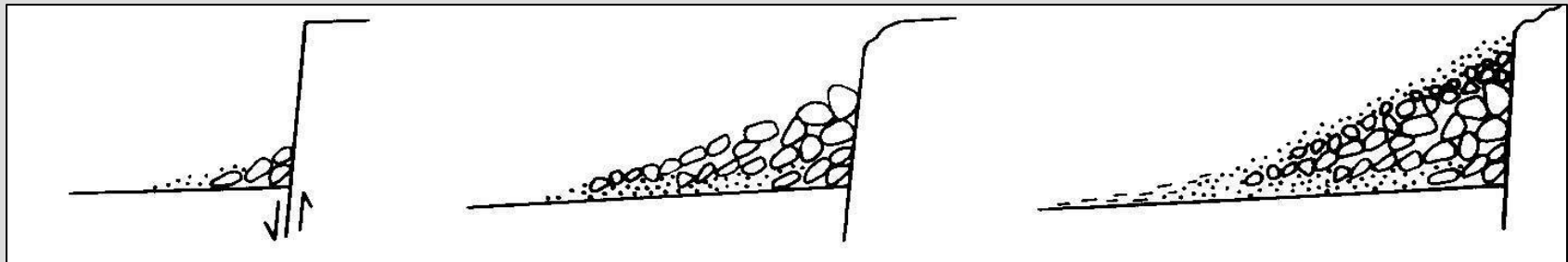
- ❖ Best developed in arid regions
- ❖ Best developed in tectonically active areas



From Walker, R.G. 1980. Facies Models. *Geological Association of Canada*

Alluvial Fans

- ❖ Best developed in arid regions
- ❖ Best developed in tectonically active areas



From Walker, R.G. 1980. Facies Models. *Geological Association of Canada*

← **Lateral fining**

Alluvial Fans

- ❖ Best developed in arid regions
- ❖ Best developed in tectonically active areas
- ❖ Formed primarily through the action of water flow, but there are also mass flow deposits

Alluvial Fans

- ❖ Best developed in arid regions
- ❖ Best developed in tectonically active areas
- ❖ Formed primarily through the action of water flow, but there are also mass flow deposits
- ❖ Debris flows, fluidized flow and “sieve” deposits

Alluvial Fan Facies

Facies code	Facies	Sedimentary Structures	Interpretation
Gms	massive, matrix supported gravel	grading	debris flow deposits
Gm	massive or crudely bedded gravel	horizontal bedding, imbrication	longitudinal bars, lag deposits, sieve deposits
Gt	gravel, stratified	trough cross beds	minor channel fills
Gp	gravel, stratified	planer cross beds	longitudinal bars, deltaic growths from older bar remnants
St	sand, medium to very coarse, may be pebbly	solitary or grouped trough cross beds	dunes (lower flow regime)
Sp	sand, medium to very coarse, may be pebbly	solitary or grouped planer cross beds	linguoid, transverse bars, sand waves (lower flow regime)
Sr	sand, very fine to coarse	ripple cross lamination	ripples (lower flow regime)
Sh	sand, very fine to very coarse may be pebbly	horizontal lamination parting or streaming lineation	planer bed flow (upper flow regime)
Sl	sand, very fine to very coarse may be pebbly	low angle (<10°) cross beds	scour fills, washed-out dunes, antidunes
Se	erosional scours with intraclasts	crude cross bedding	scour fills
Ss	sand, fine to very coarse, may be pebbly	broad, shallow scours	scour fills
Fl	sand, silt, mud deposits	fine lamination, very small ripples	overbank or waning flood
Fsc	silt, mud	laminated to massive	backswamp deposit
Fcf	mud	massive, with freshwater molluscs	backswamp pond deposits
Fm	mud, silt	massive, desiccation cracks	overbank or drape deposits
C	coal, carbonaceous mud	plant, mud films	swamp deposits
P	carbonate	pedogenic features	paleosol

Walker, R.G. and James, N.P., 1992. Facies Models. Response to Sea Level Change. *Geological Association of Canada*, 409p.

Alluvial Fan Facies

gravel

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Alluvial Fan Facies

sand

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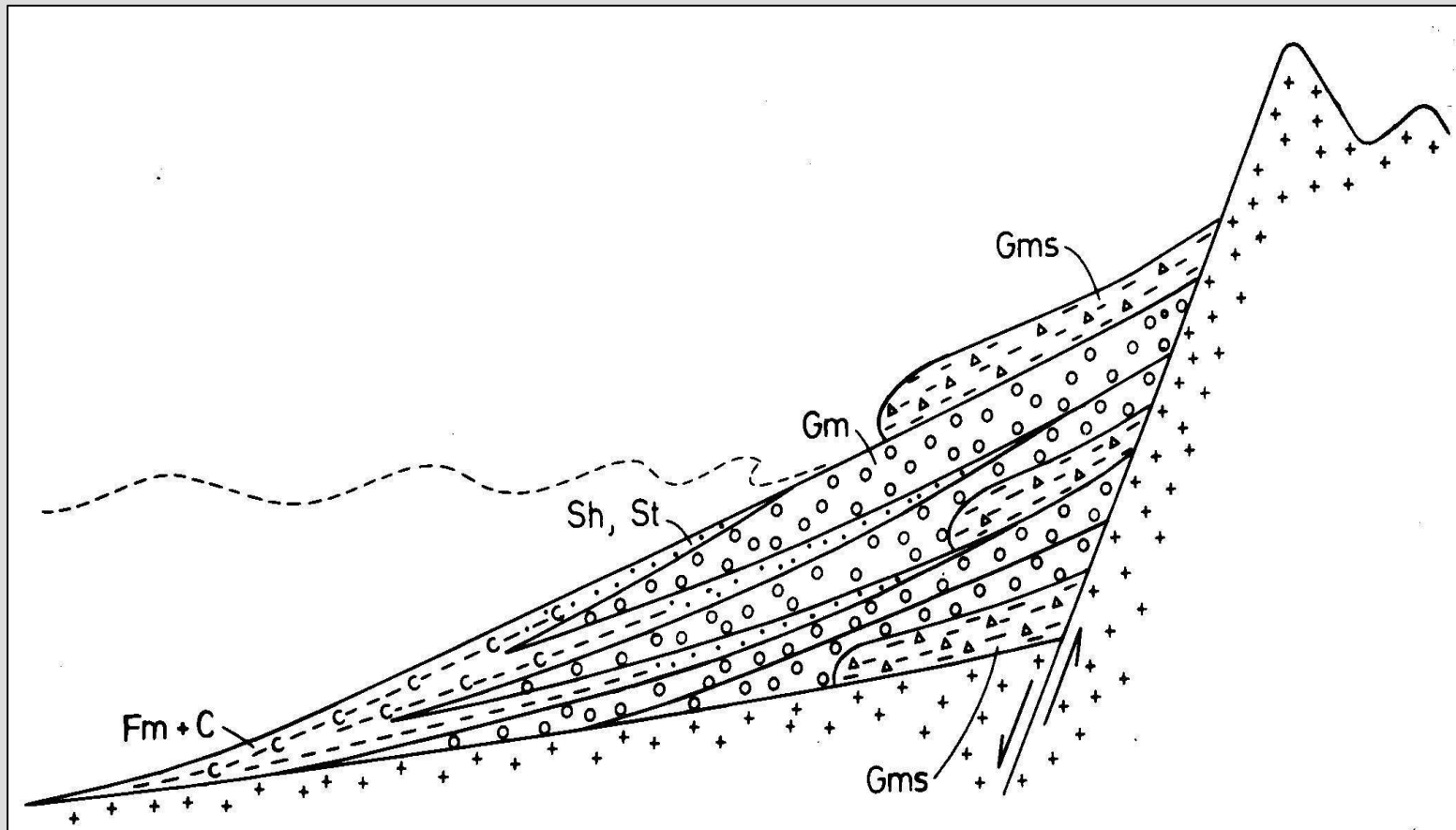
Alluvial Fan Facies

“mud”

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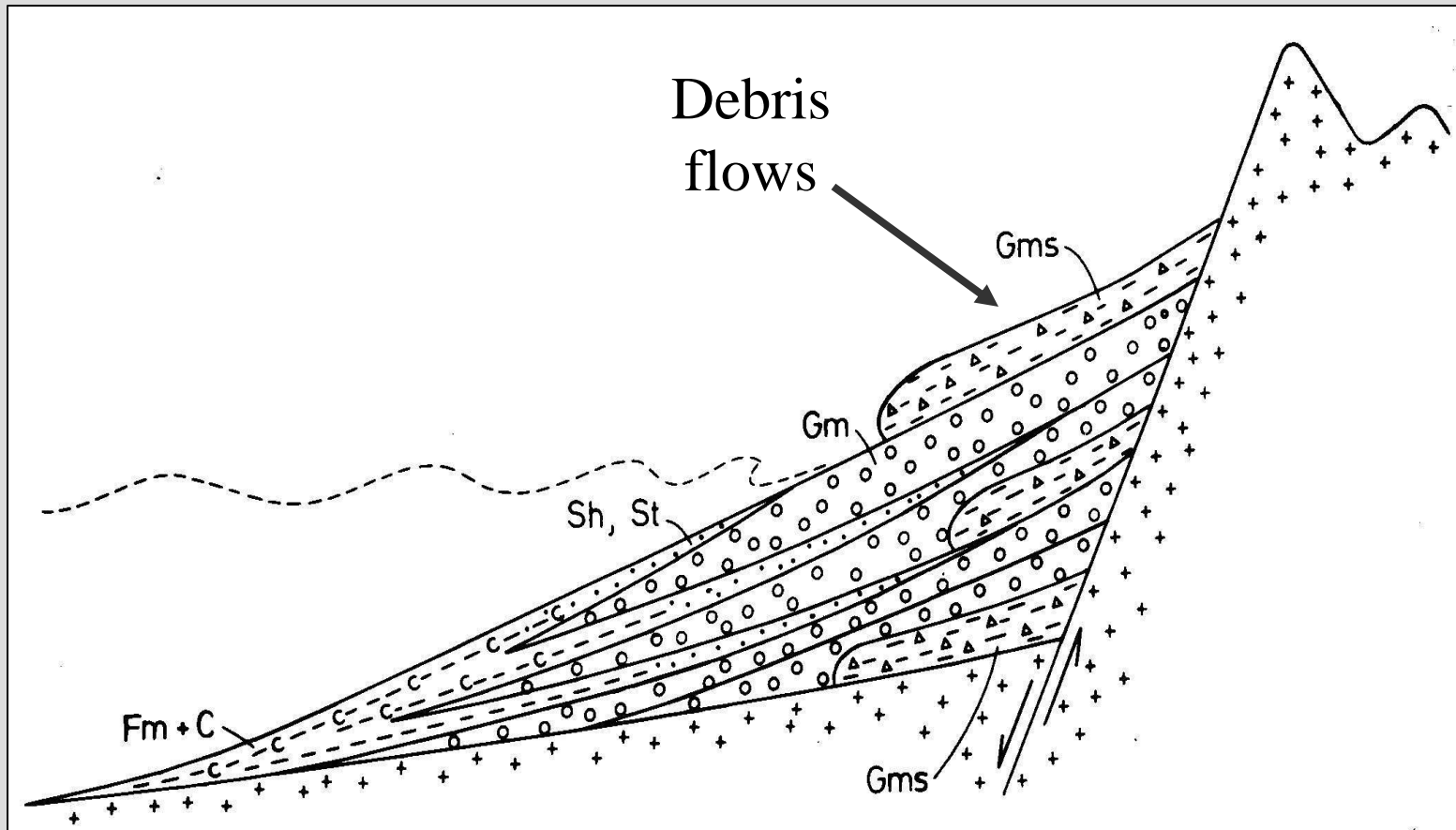
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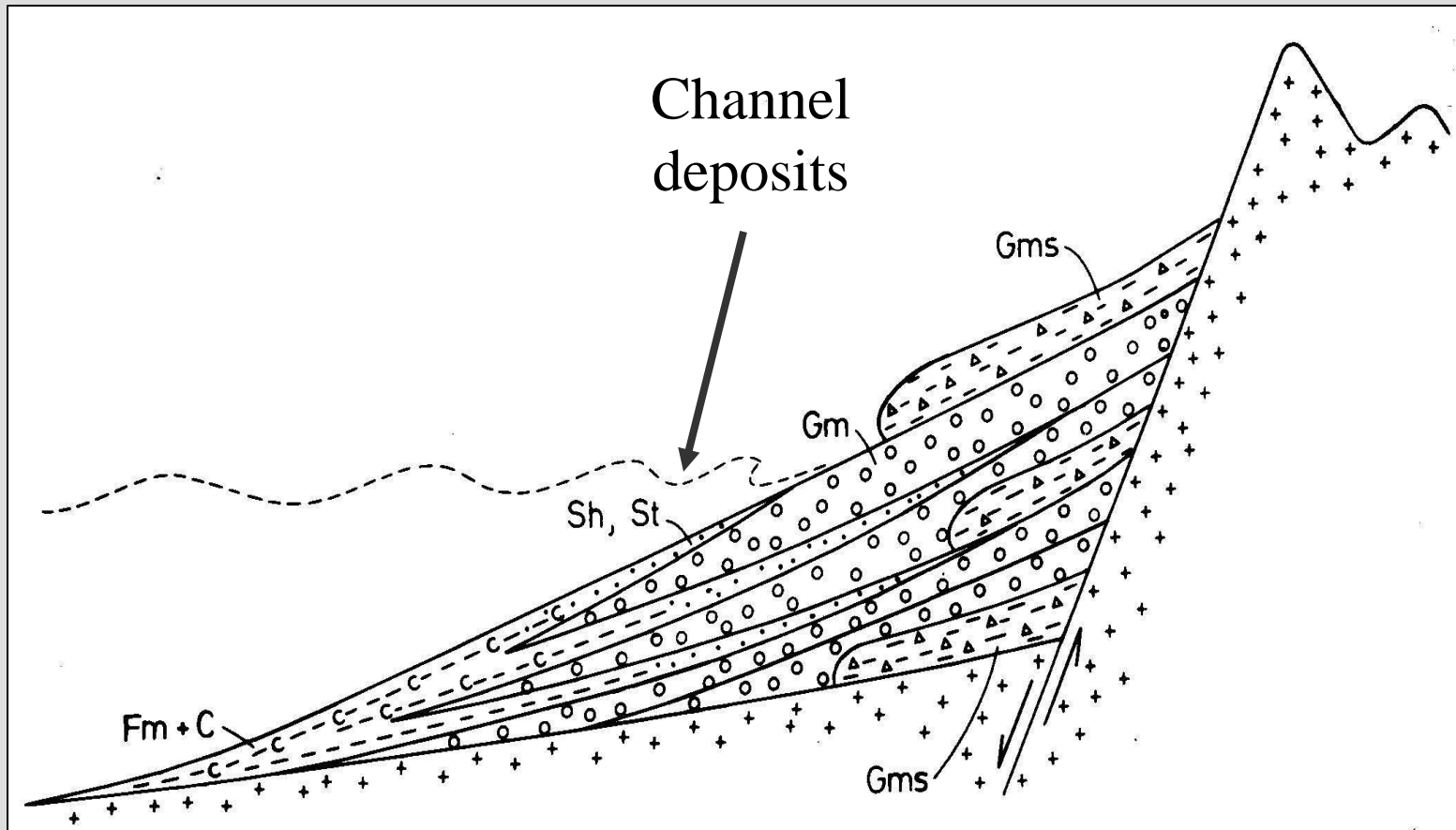
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Alluvial Fan Facies



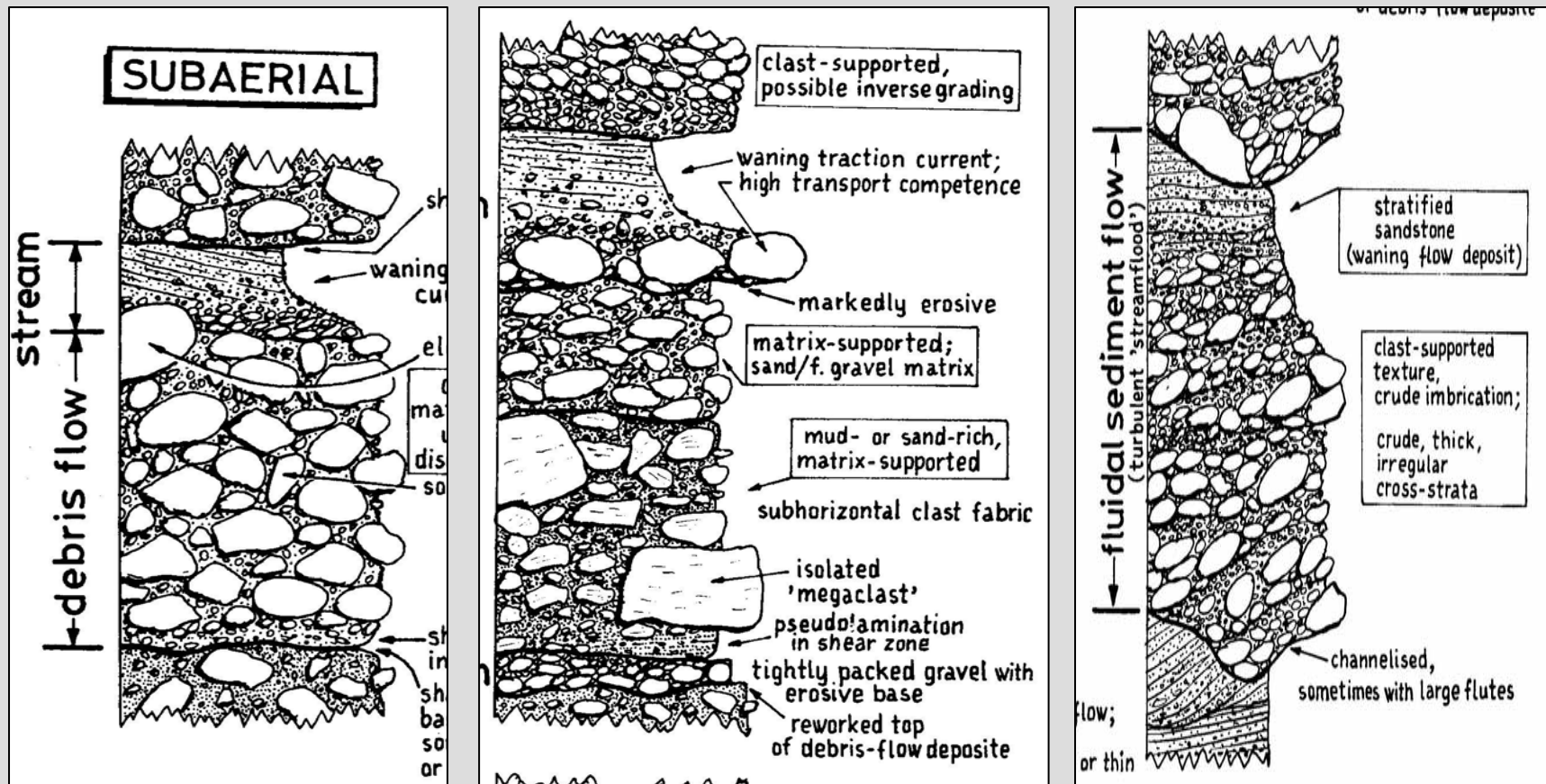
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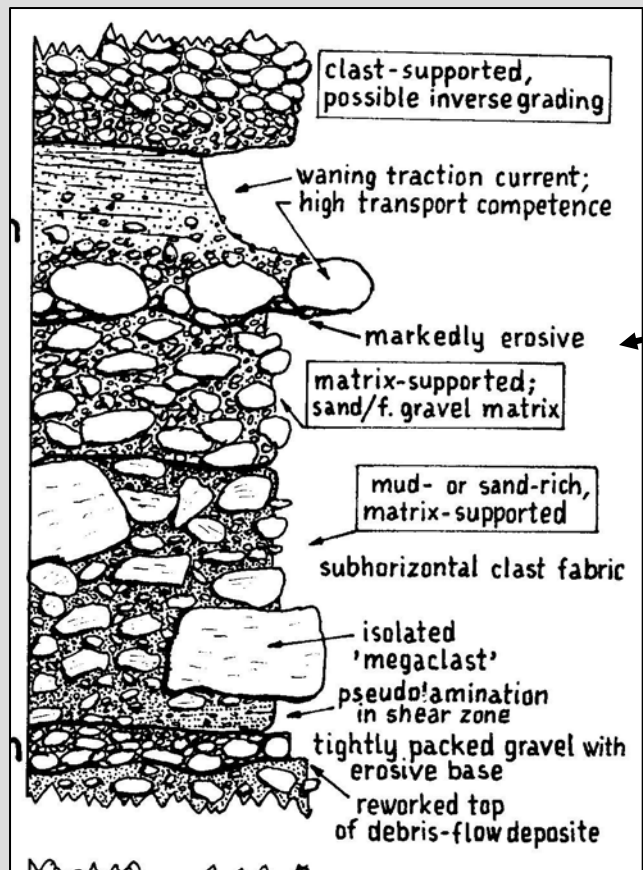
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Alluvial Fans - sed. sections



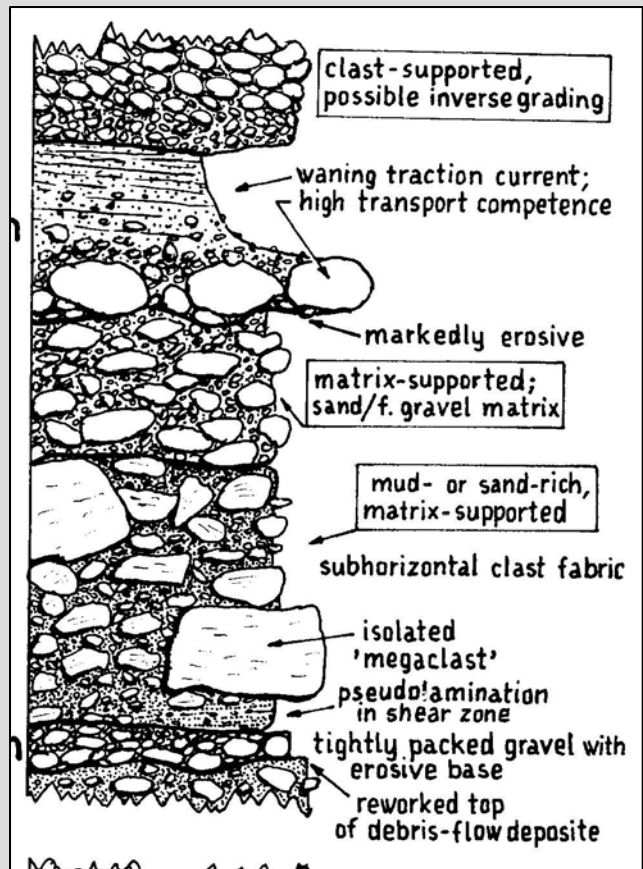
Nemec, W. and Steel, R.J., 1984. Alluvial and coastal conglomerates: their significant features and some comments on gravelly mass-flow deposits. In Koster, E.H. and Steel, R. eds), *Sedimentology of Gravels and Conglomerates*. *Canadian Society of Petroleum Geologists Mem. 10*, 1-31.

Alluvial Fans - sed. sections



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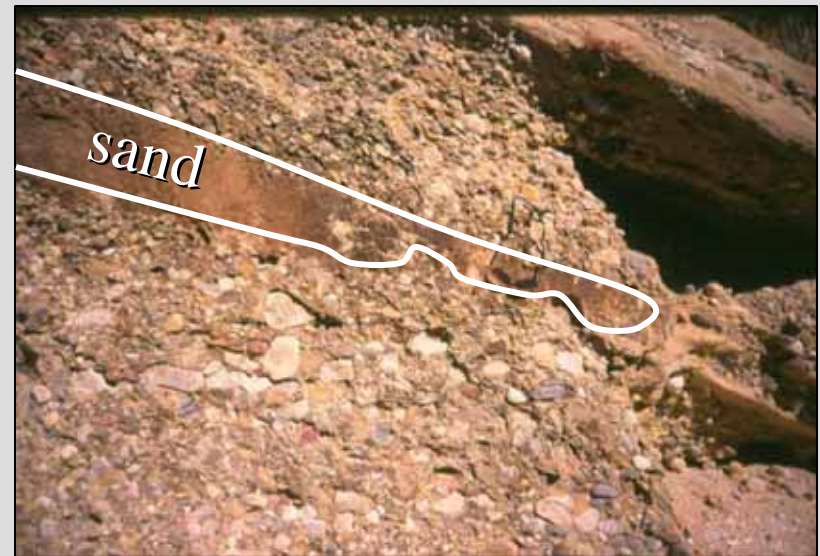
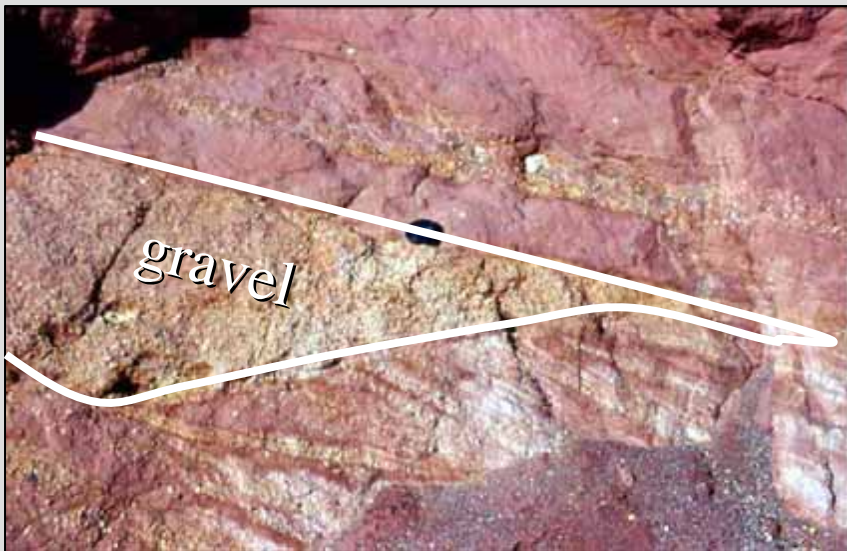
Alluvial Fans - sed. sections



Interbedded
gravel/ sand
beds

Nemec, W. and Steel, R.J., 1984. Alluvial and coastal conglomerates: their significant features and some comments on gravelly mass-flow deposits. In Koster, E.H. and Steel, R. eds), *Sedimentology of Gravels and Conglomerates. Canadian Society of Petroleum Geologists Mem. 10*, 1-31.

Alluvial Fans - sed. sections



Lenticular, scoured sediment bodies

Braided Streams

Braided Streams



↑
Meandering

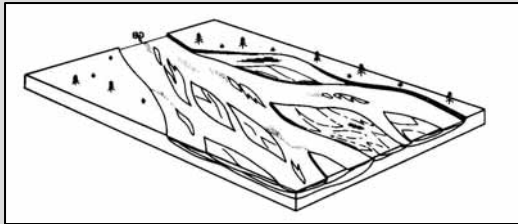
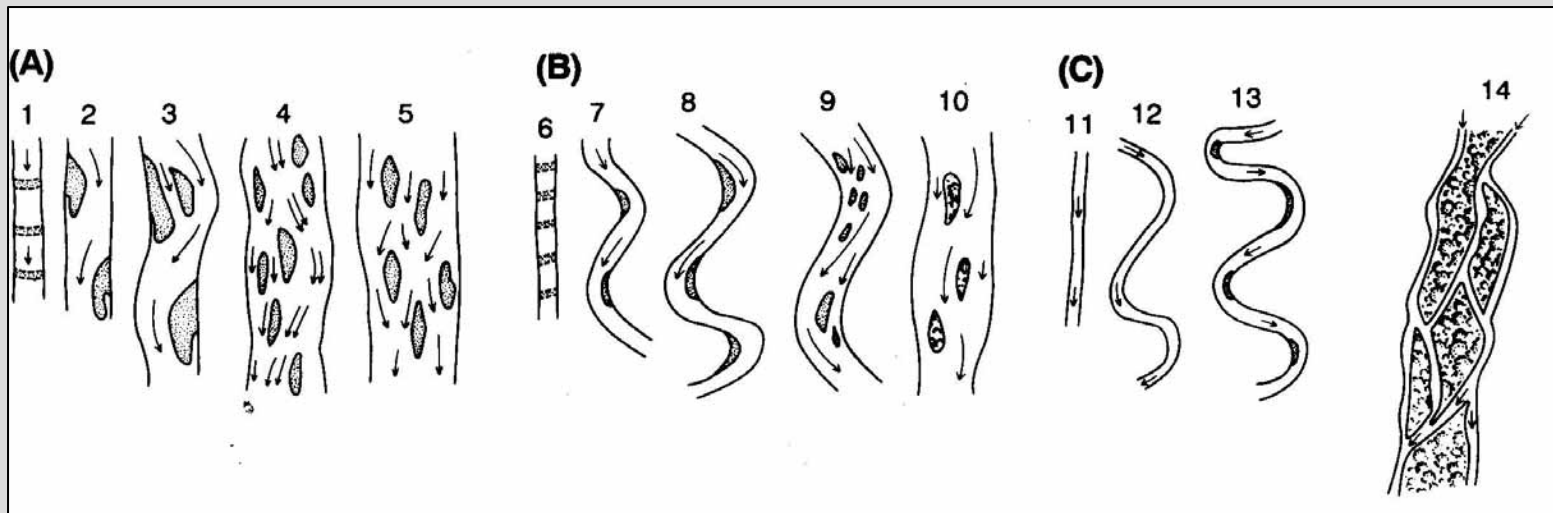
← Braided

Braided Streams

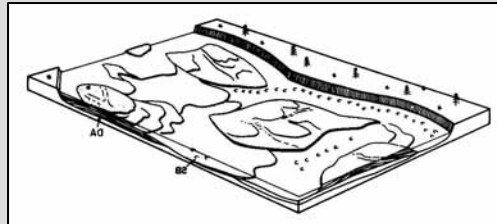
- ❖ Best developed in alluvial plains with “steep gradients” (1 to 3 degrees of slope); frequently in mountainous areas



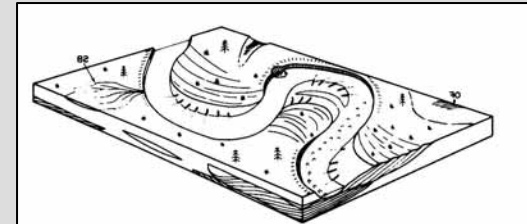
Stream morphology



Braided



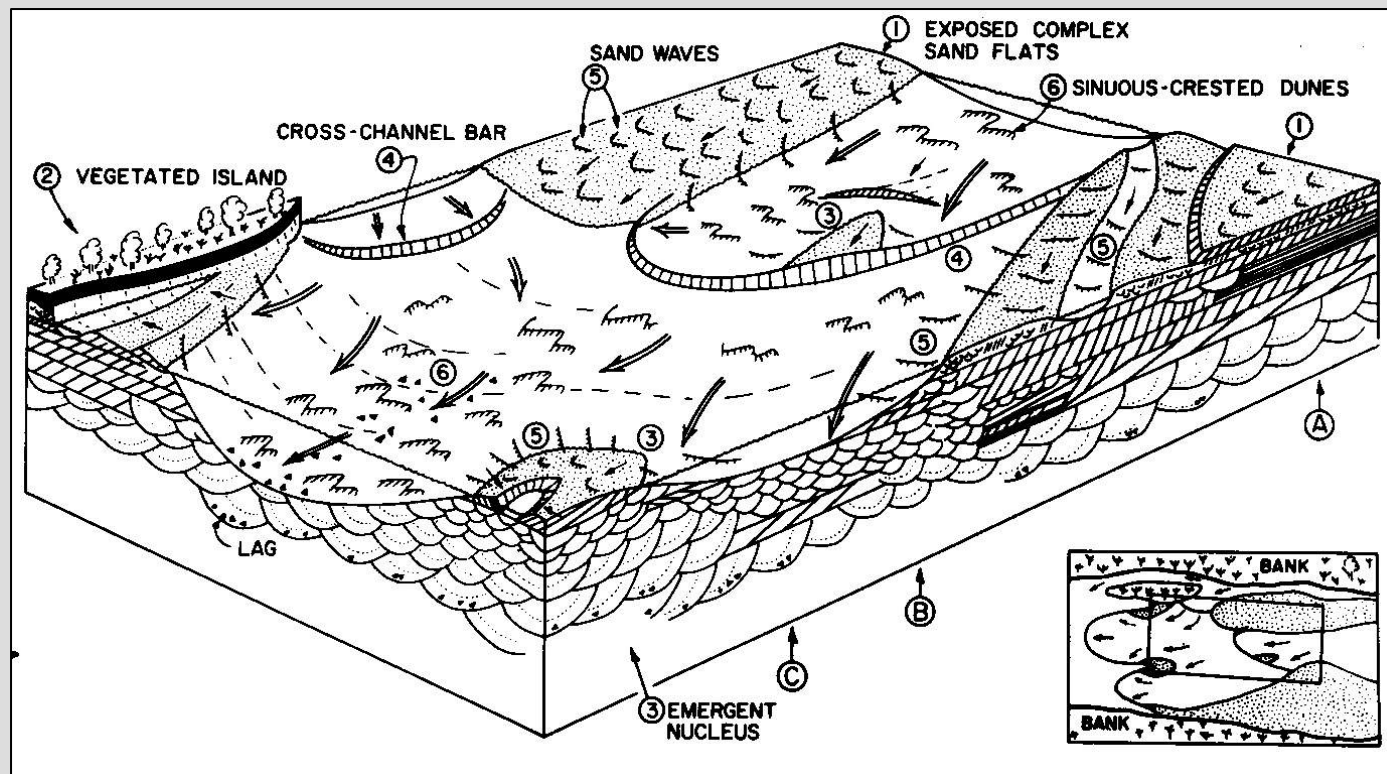
Anastomosing



Meandering

Walker, R.G. and James, N.P., 1992. Facies Models. Response to Sea Level Change. *Geological Association of Canada*, 409p.

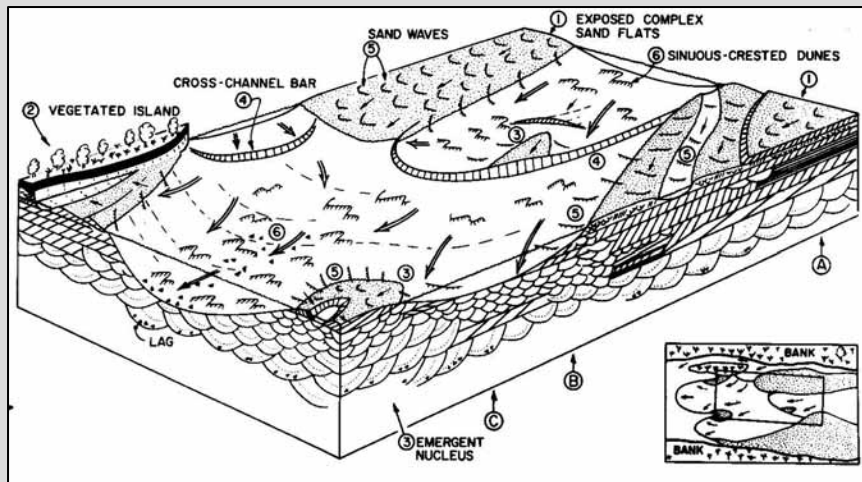
Braided Streams Facies



Walker, R.G. and James, N.P., 1992. Facies Models. Response to Sea Level Change. *Geological Association of Canada*, 409p.

Braided Streams Facies

Gravel beds comprise the majority of channel and bar facies, but sand and mud are also common (flood plain facies)

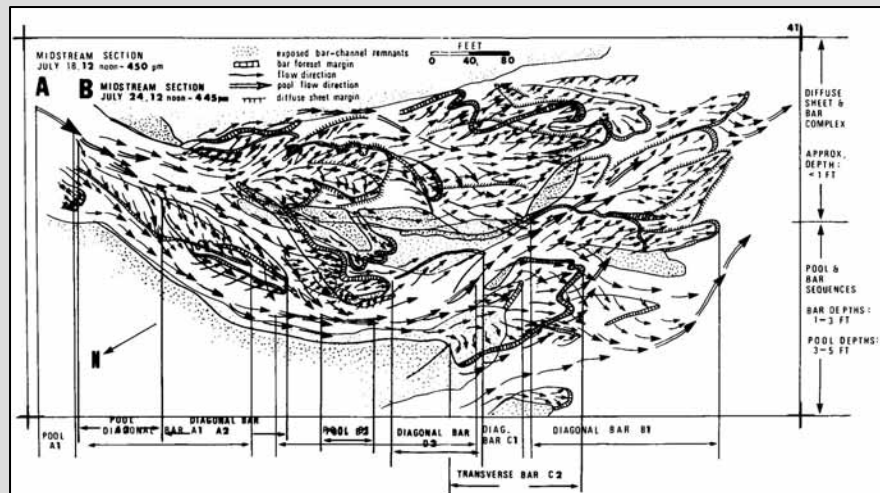
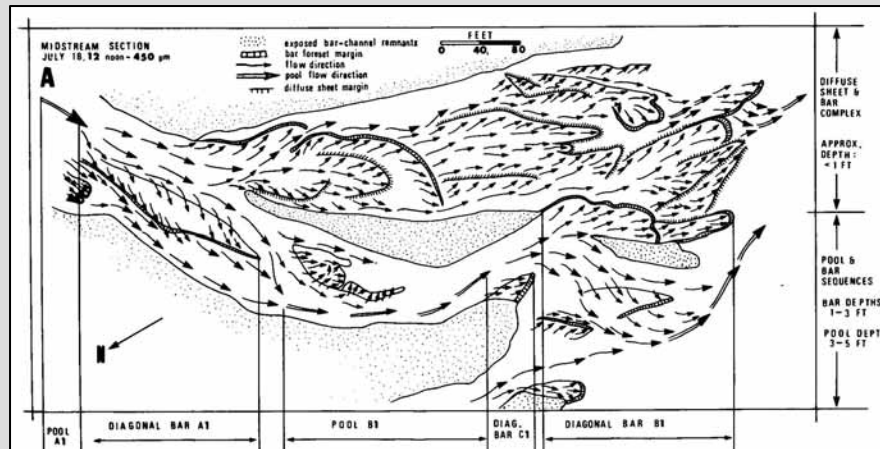


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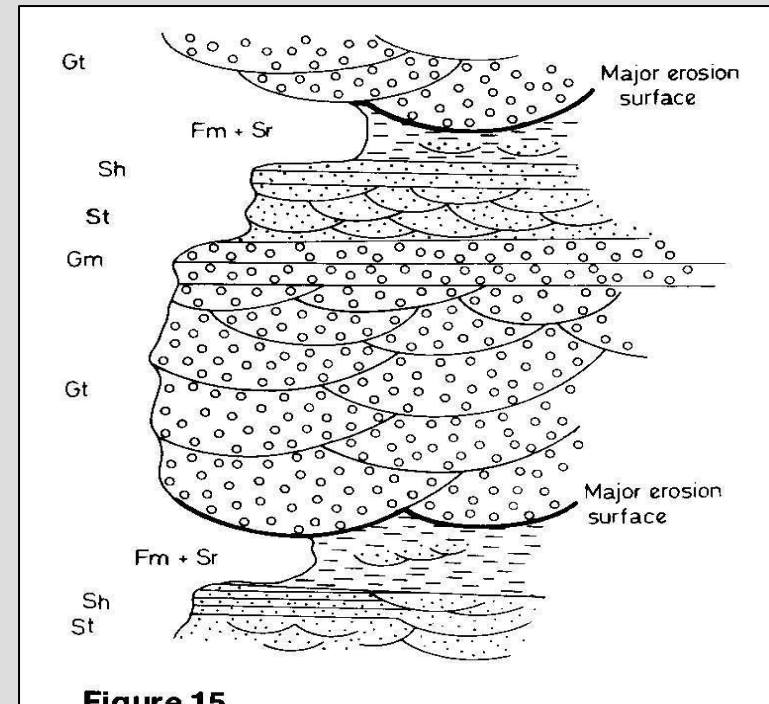
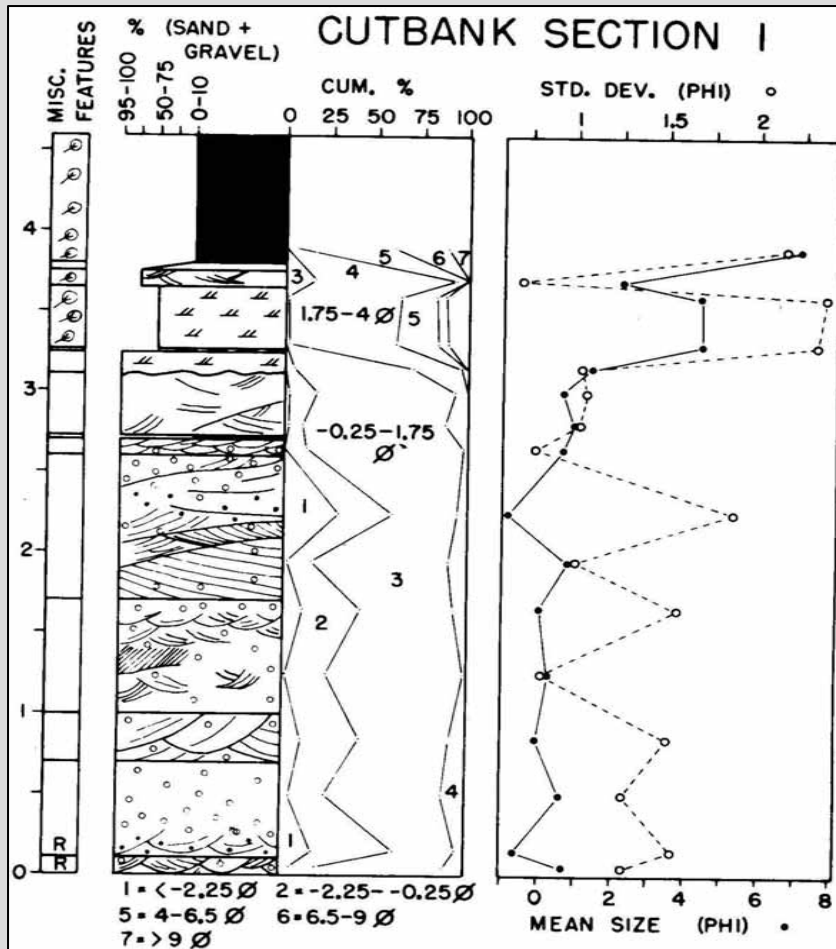


Braided Streams Facies

Hein, F.J. 1984. Deep-sea and fluvial braided channel conglomerates: a comparison of two case studies. In Koster, E.H. and Steel, R. eds), *Sedimentology of Gravels and Conglomerates. Canadian Society of Petroleum Geologists Mem. 10*, 33-49.



Braided Stream –sed sections



Walker, R.G. and James, N.P., 1992. Facies Models. Response to Sea Level Change. *Geological Association of Canada*, 409p.

Upcoming Stuff

Homework

- 1) Mid term exam due Thursday March 10th
- 2) St Stephens Quarry section due Friday March 11th

Lab Today

- 1) Immature Siliciclastic Petrography (due today)
- 2) *Mature thin section discussion redo (due today)*

Next Tuesday:

Mardi Gras Holiday (woo hoo!)

Next Thursday:

Moscow Landing Overview and Library Research Activity