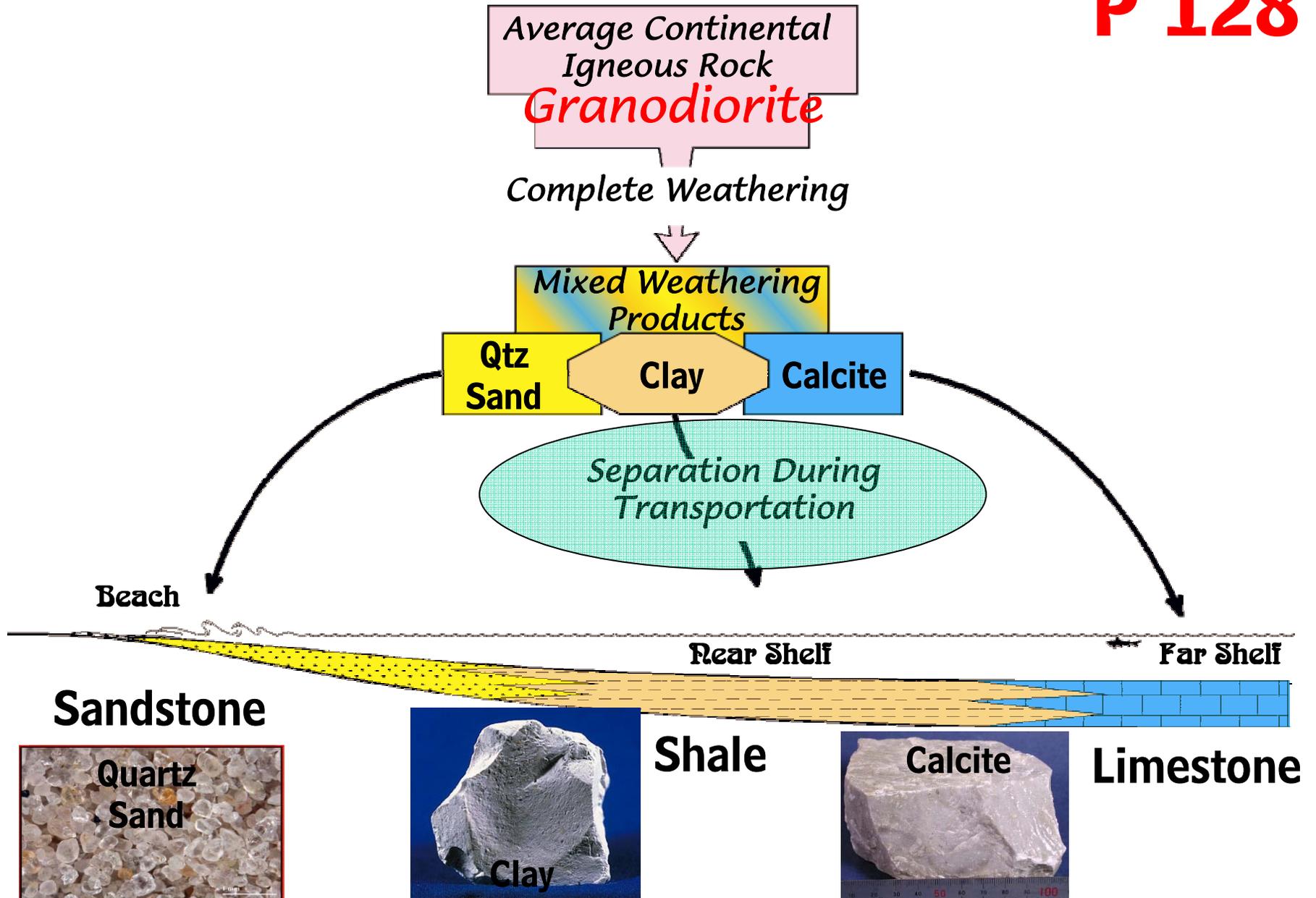


The Simple Ideal Model for the Evolution of Sedimentary Rocks

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Depositional Environments

The Place Where Sediments
Get Deposited

What is a Depositional Environment?

“I am going to the beach”



What is a Depositional Environment?



Tuscarora Sandstone; Seneca Rocks, W.Va.

What is a Depositional Environment?



*Oriskany Sandstone; Chimney Rock
Brocks Gap, Virginia*

What is a Depositional Environment?



Muav Limestone

Bright Angle Shale

Tapeats Qtz ss

***Tapeats Sandstone; Grand Canyon,
Arizona***

What is a Depositional Environment?



*Tapeats Sandstone; Grand Canyon,
Arizona*

Geologically . . .

*A depositional
environment is not
defined as a thing or
a place.*

Depositional environments are defined as processes . . .

By the dissipation of energy

Follow

Gravitational Energy

Things fall

Landslides

Solar Energy

Water flows downhill

Biological Energy

Heat causes things to move

Chemical Energy

Drives the winds that makes the waves, and causes the rain



the Energy

Which leads to the following concepts

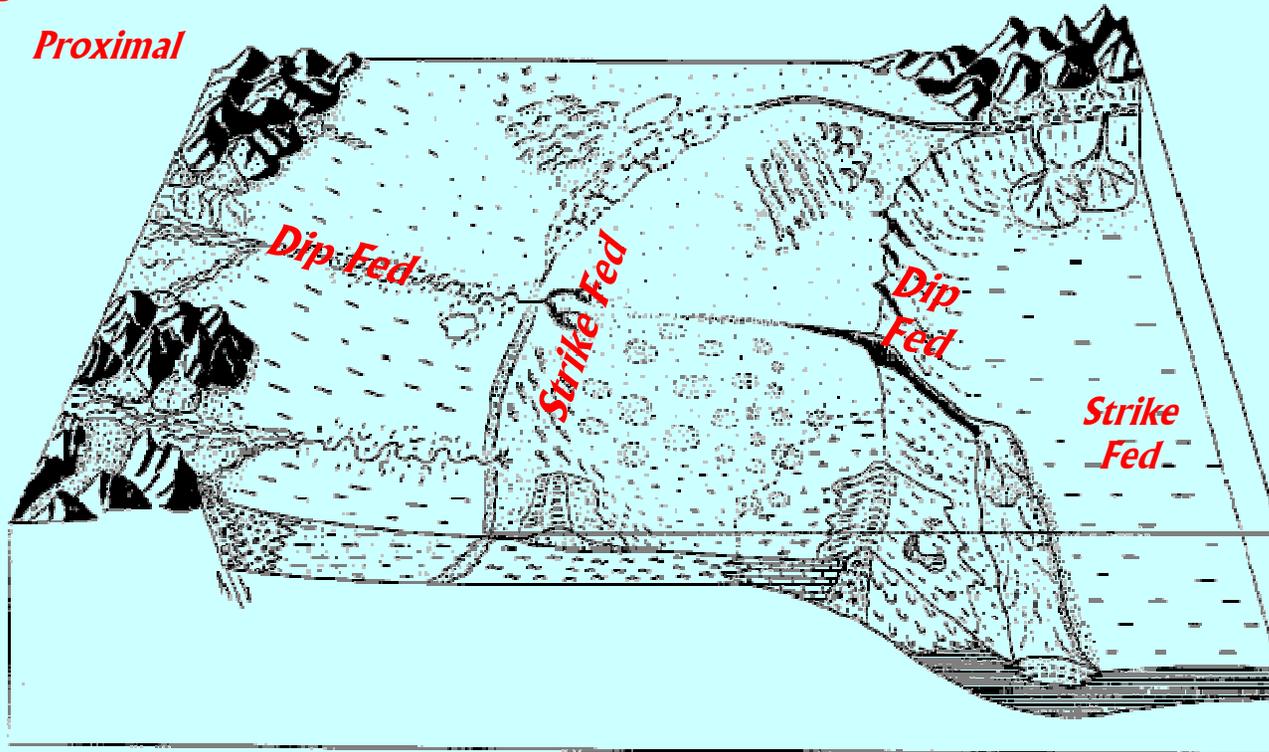
Dip-Fed Systems - gravity dominates

Strike-Fed Systems - Solar energy dominates

Depositional Environments

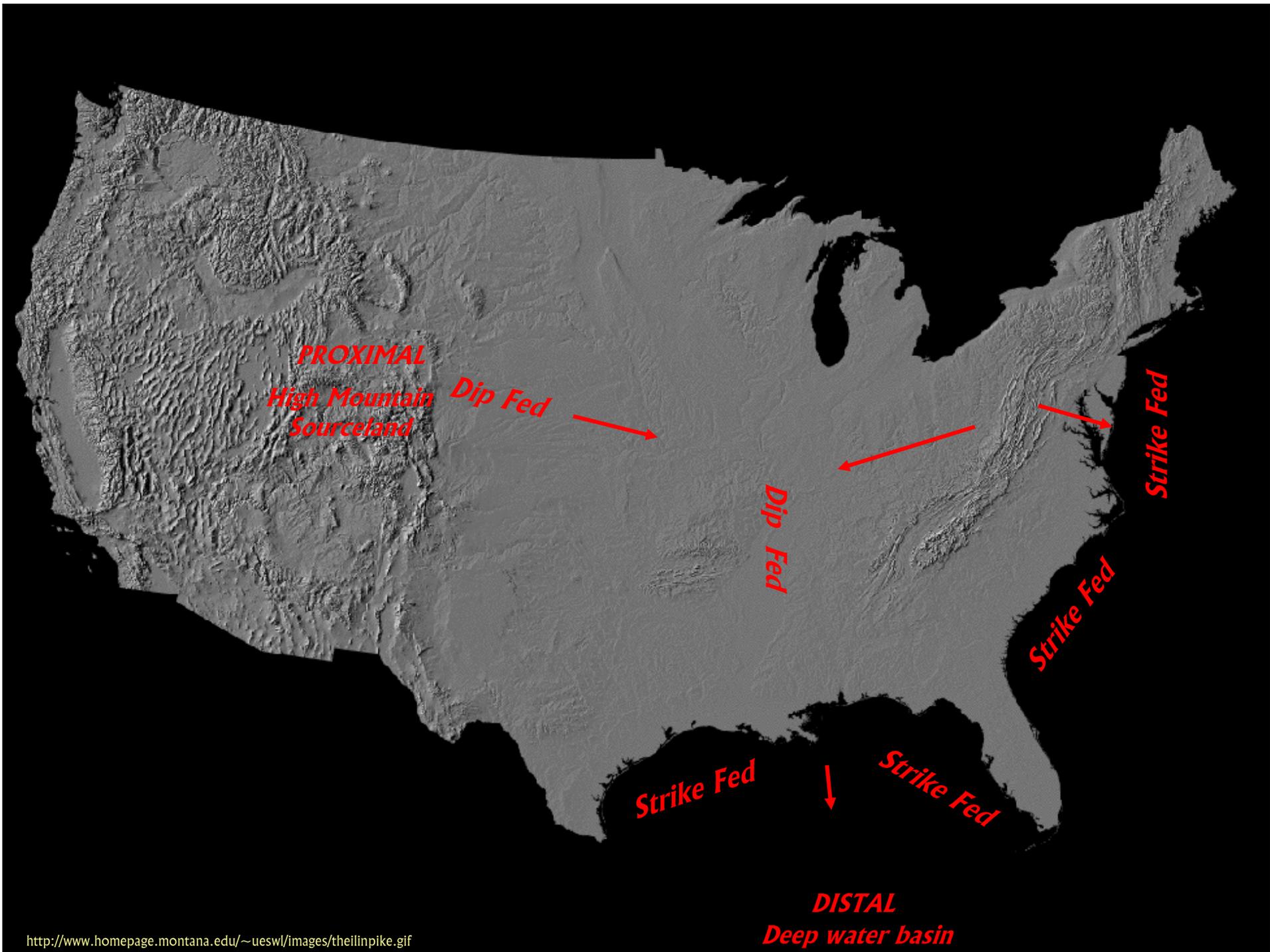
High Mountain Sourceland

Proximal



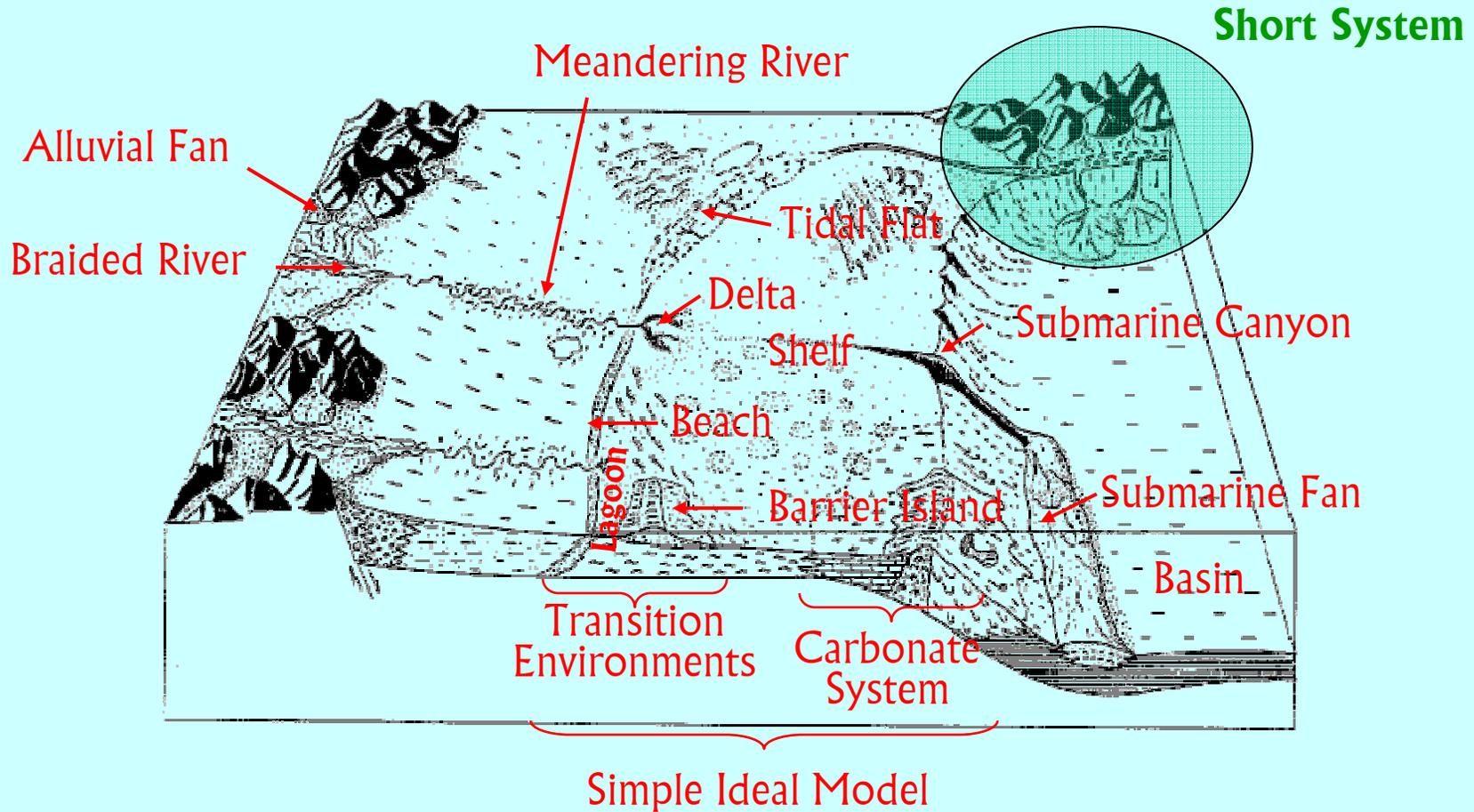
Deep water basin

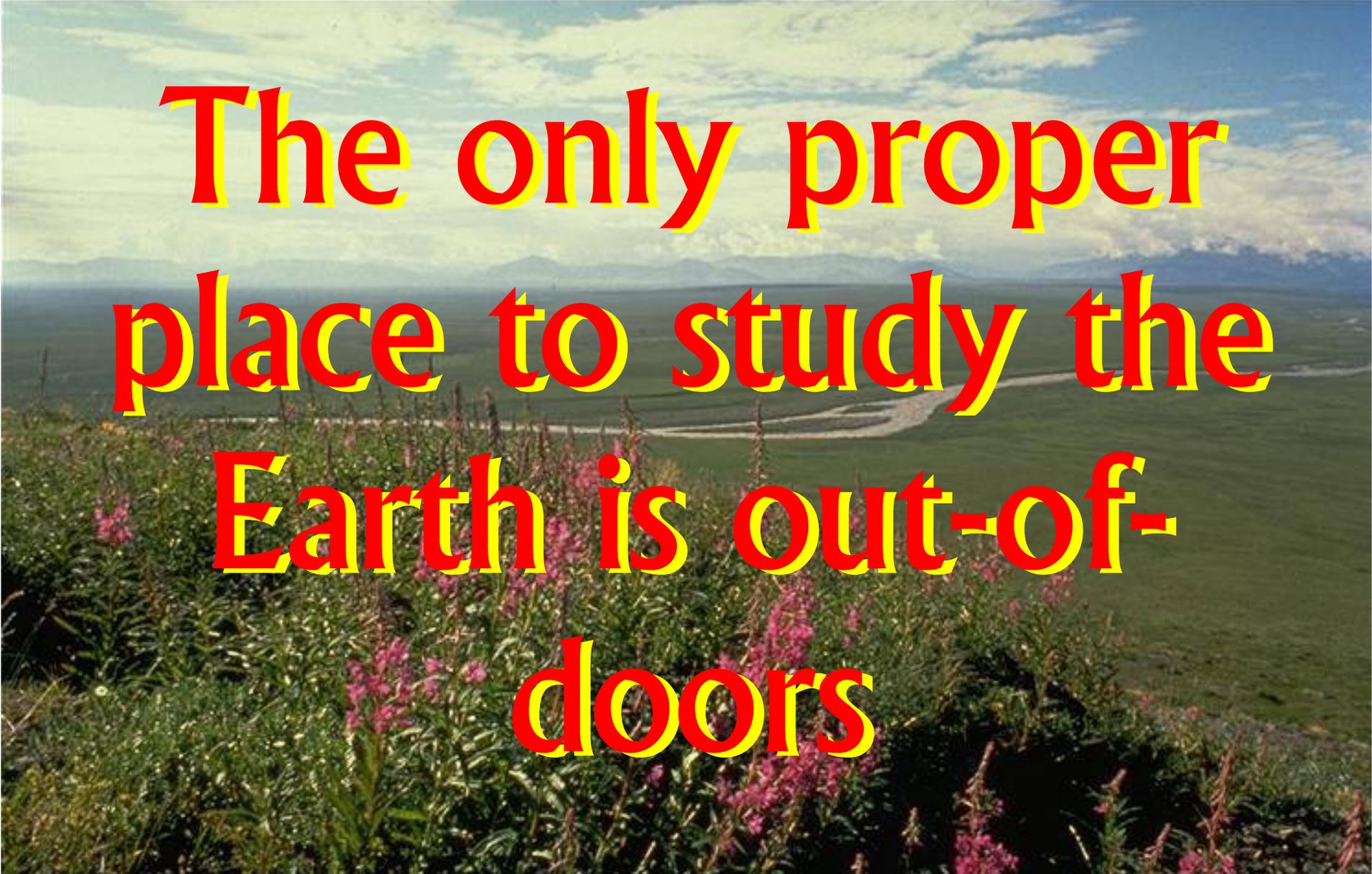
Distal



Depositional Environments

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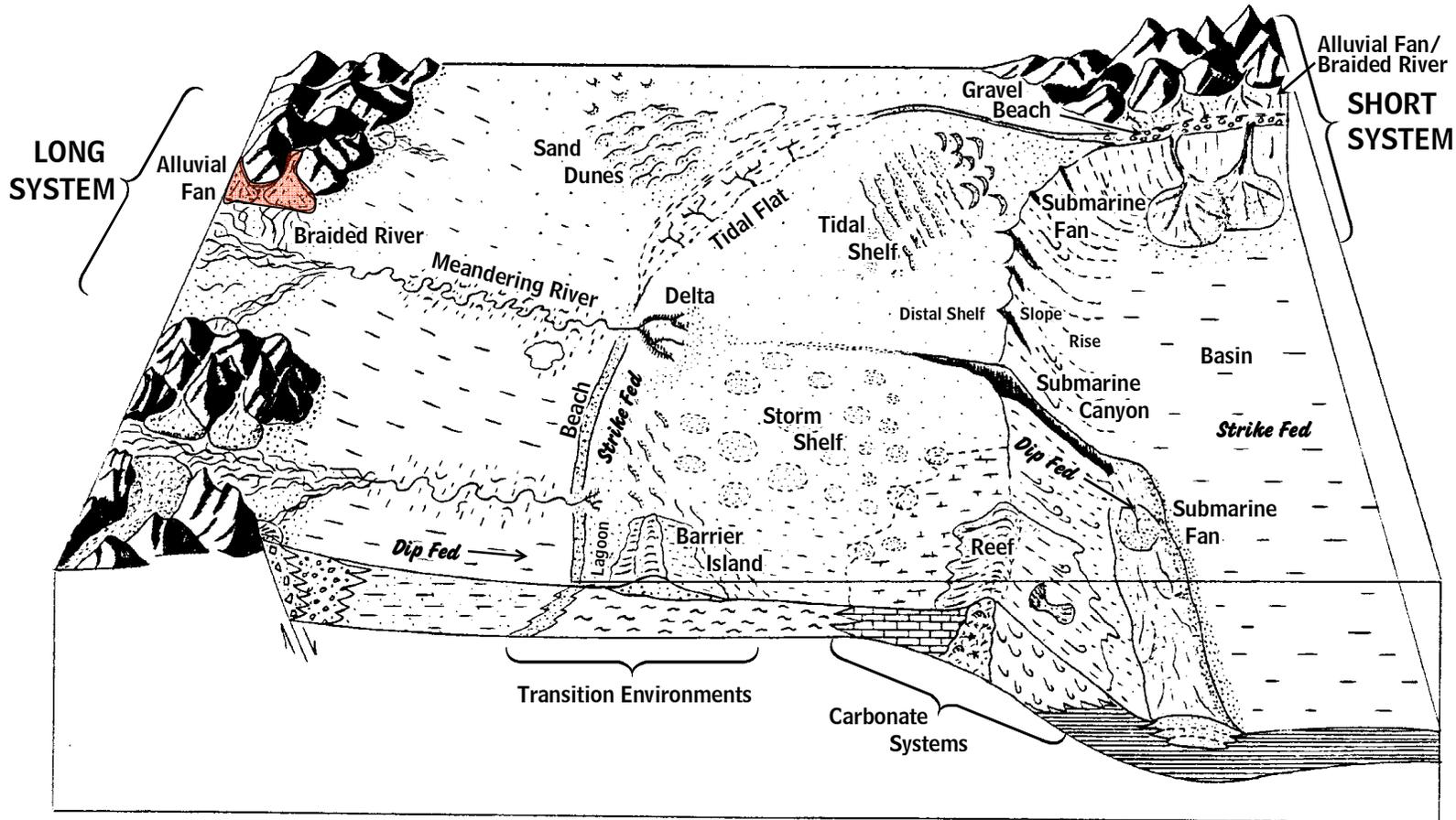


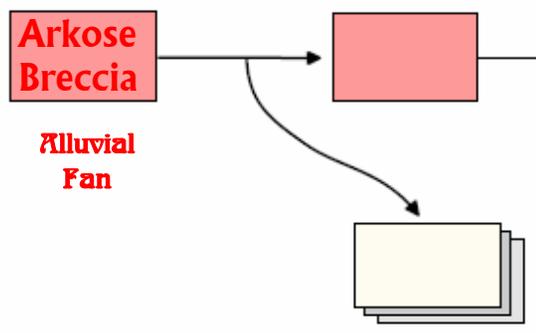
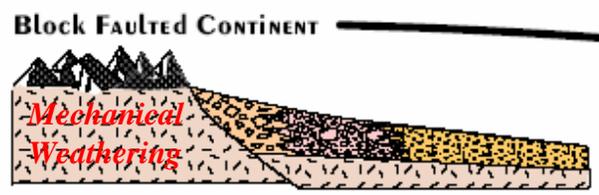
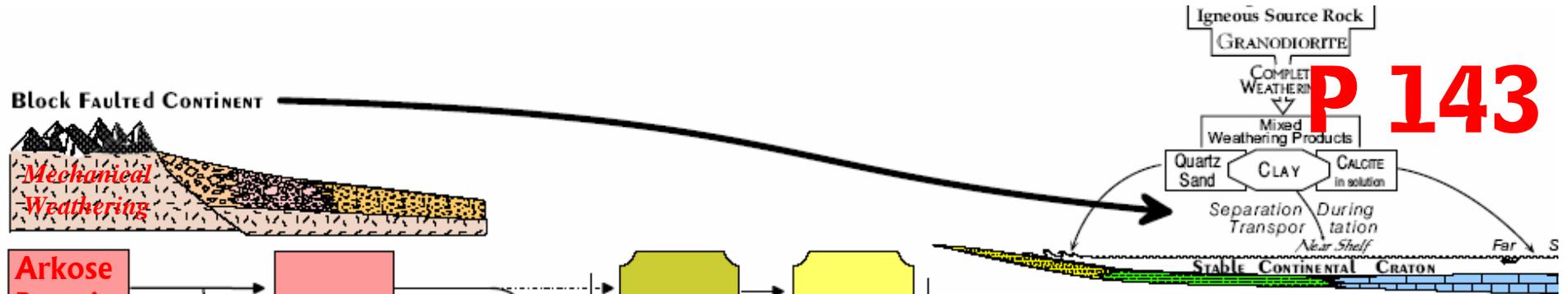
A scenic landscape photograph showing a wide river winding through a valley. In the foreground, there are lush green plants with tall, pinkish-purple flower stalks. The background features rolling green hills and mountains under a blue sky with scattered white clouds. The text is overlaid on the center of the image.

**The only proper
place to study the
Earth is out-of-
doors**

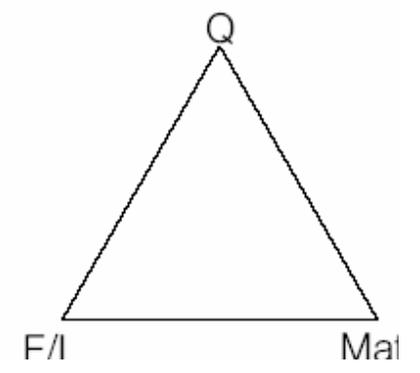
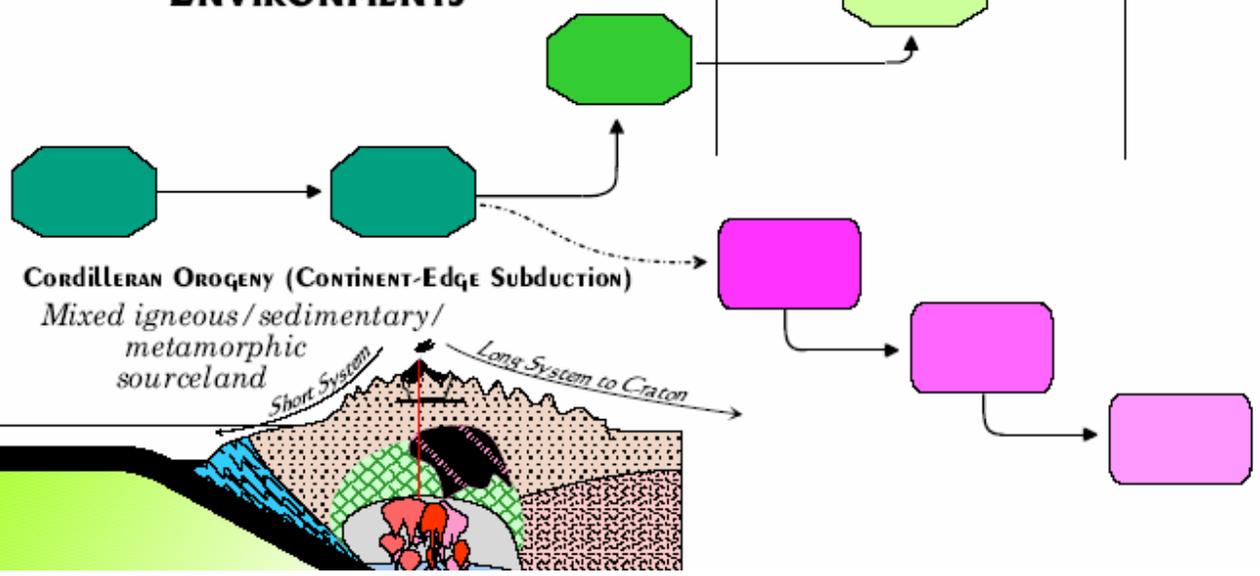
Alluvial Fan

An alluvial fan is a fan-shaped mass of loose rock material deposited where a stream's velocity decreases suddenly or where a valley widens abruptly.





THE EVOLUTION OF SEDIMENTARY ROCKS AND DEPOSITIONAL ENVIRONMENTS



Colorado Front Range



Pikes Peak







<http://3dparks.wr.usgs.gov/landslide/images/dantesview3.jpg>

Proximal in the alluvial fan the sediment is a coarse breccia or conglomerate.



Alluvial fans and bajadas are usually composed of coarse gravel. Near the top the gravel may be deposited as debris flows, and be an unsorted, unstratified jumbled mess of material. Further down the slope the gravel becomes sorted and deposited in layers, often with scoured bottoms.



Venezuela Floods and Landslides 5-16 December 1999



Aerial view of Los Corales sector of Caraballeda. Sediment-laden flash floods destroyed or damaged most structures on this alluvial fan.

Fans are often subject to catastrophic flood and depositional events. It is just the nature of the system. Some idea of the power of these systems is seen in this picture. Notice the size of the boulders transported into this community.

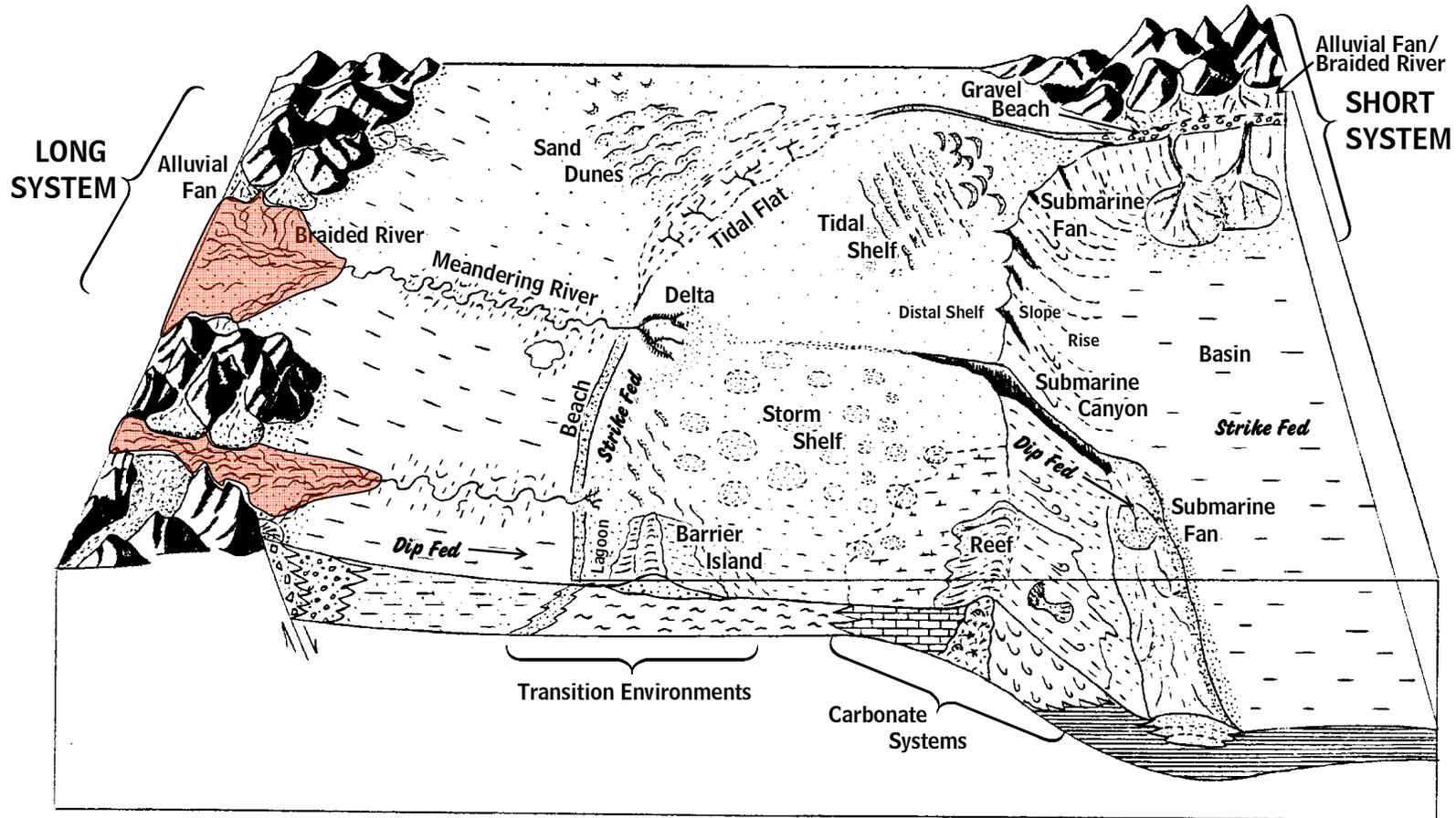
Transition to the Braided River System

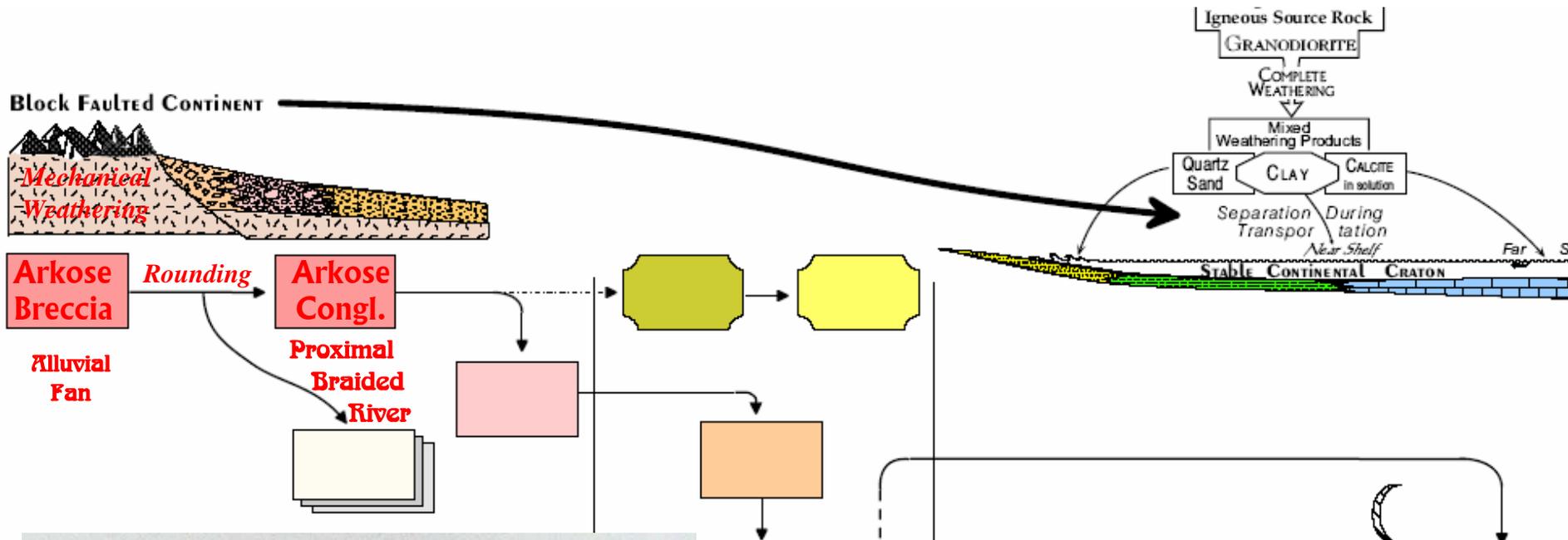
As a transition example we have a small alluvial fan forming at the end of a valley draining an upland area, but notice the river flowing along the outer edge. That braided river is the next system downstream in our ideal system.



Braided Rivers

A braided river contains a network of smaller channels separated by small islands called braid bars.



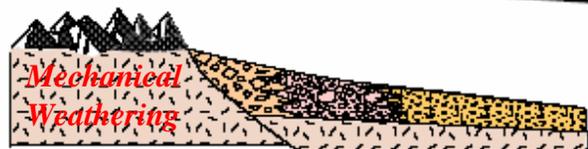


Proximal Braided River – Gravel Dominated

Braid channels and channel bars from a ground view. Notice the abundant gravel, typical of braided rivers proximal to (near the) sourceland. During high water (a flood) this entire system would be under water.



Block Faulted Continent



Long System

Arkose Breccia

Rounding

Arkose Congl.

Sorting

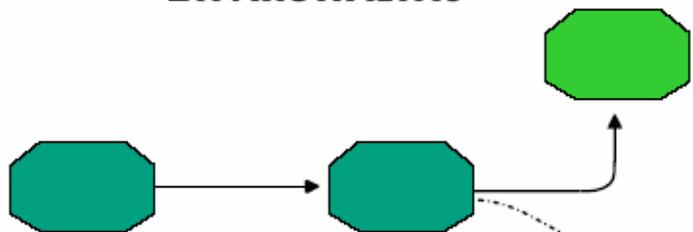
Alluvial Fan

Proximal Braided River

Arkose SS

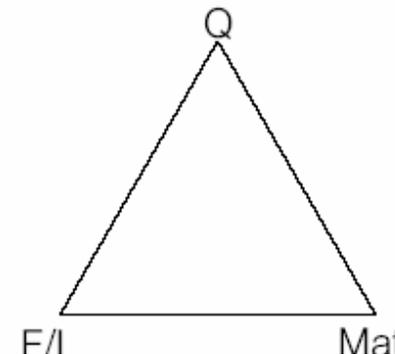
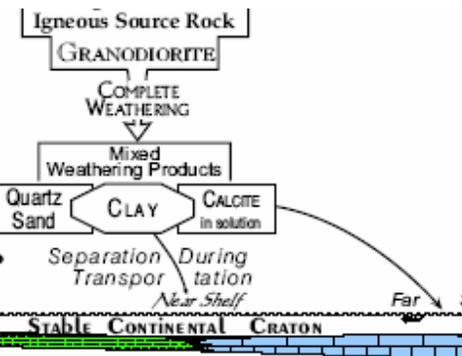
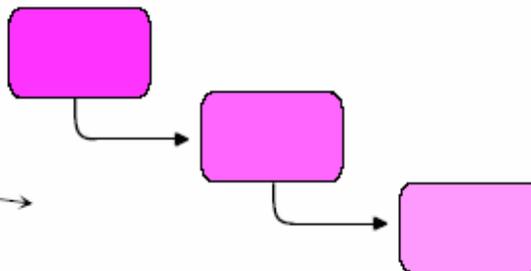
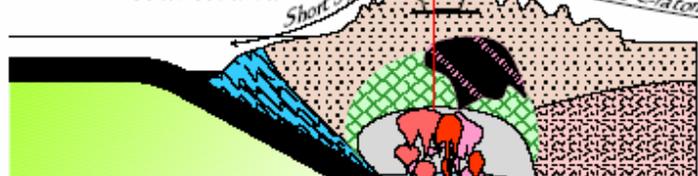
Distal Braided River

THE EVOLUTION OF SEDIMENTARY ROCKS AND DEPOSITIONAL ENVIRONMENTS



Cordilleran Orogeny (Continent-Edge Subduction)

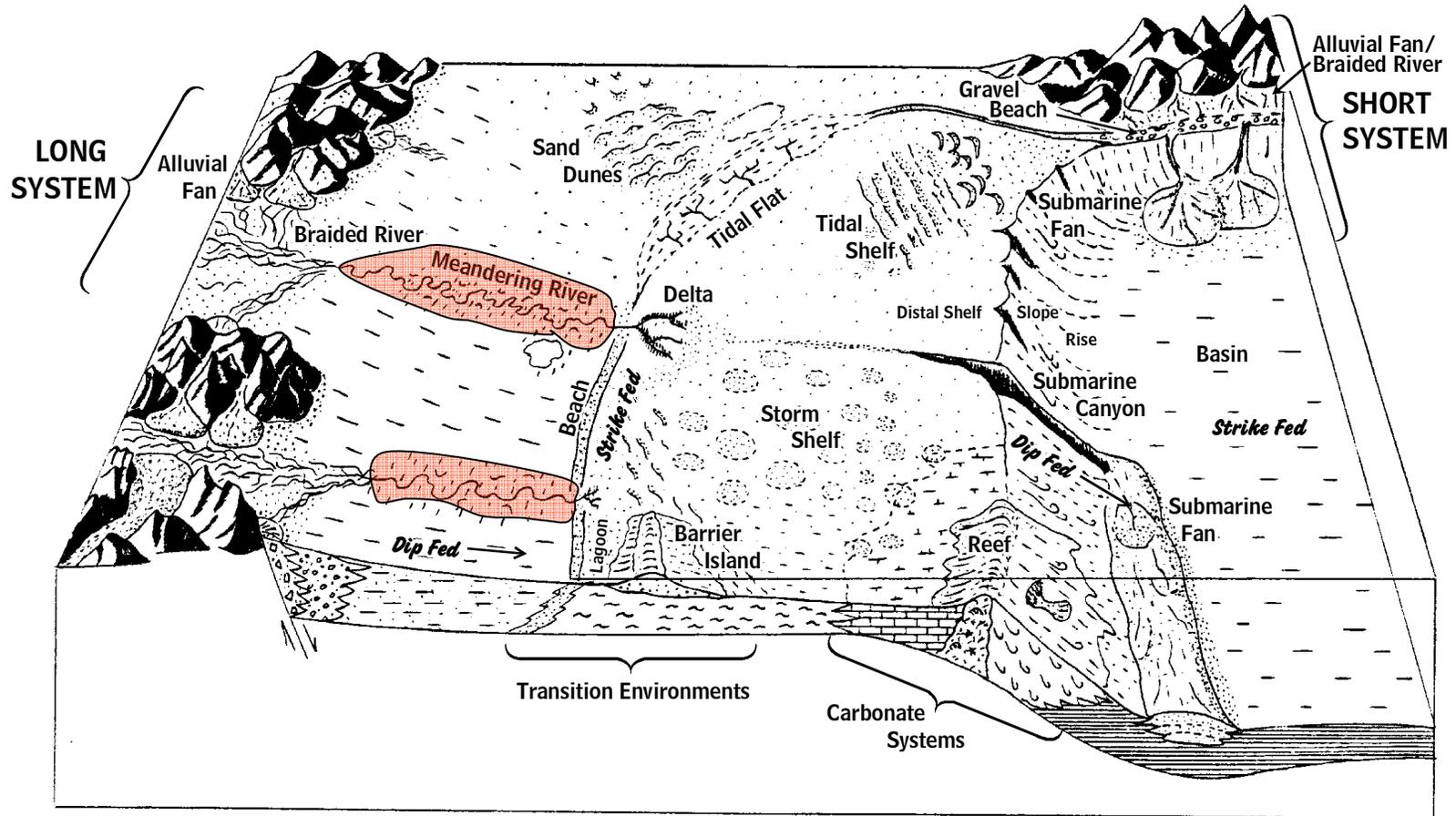
Mixed igneous/sedimentary/metamorphic sourceland



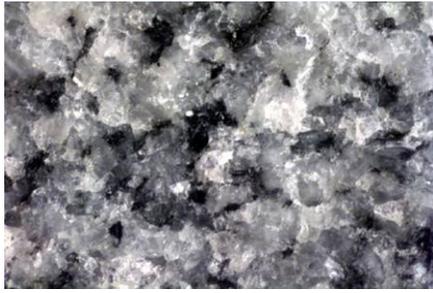
DISTAL BRAIDED RIVER - SAND DOMINATED



Meandering River



Sediment Evolution on a Ternary Diagram Igneous Rock Composition



Plagiogranite



Q = 30%
F = 65%
L = 05%

Granite

F & L chemically
Weathering to clay

Sediment evolving from sandstone
to wacke

Gabbro &
Syenite

Feldspar/
Lithics

Clay (matrix)
(shale)



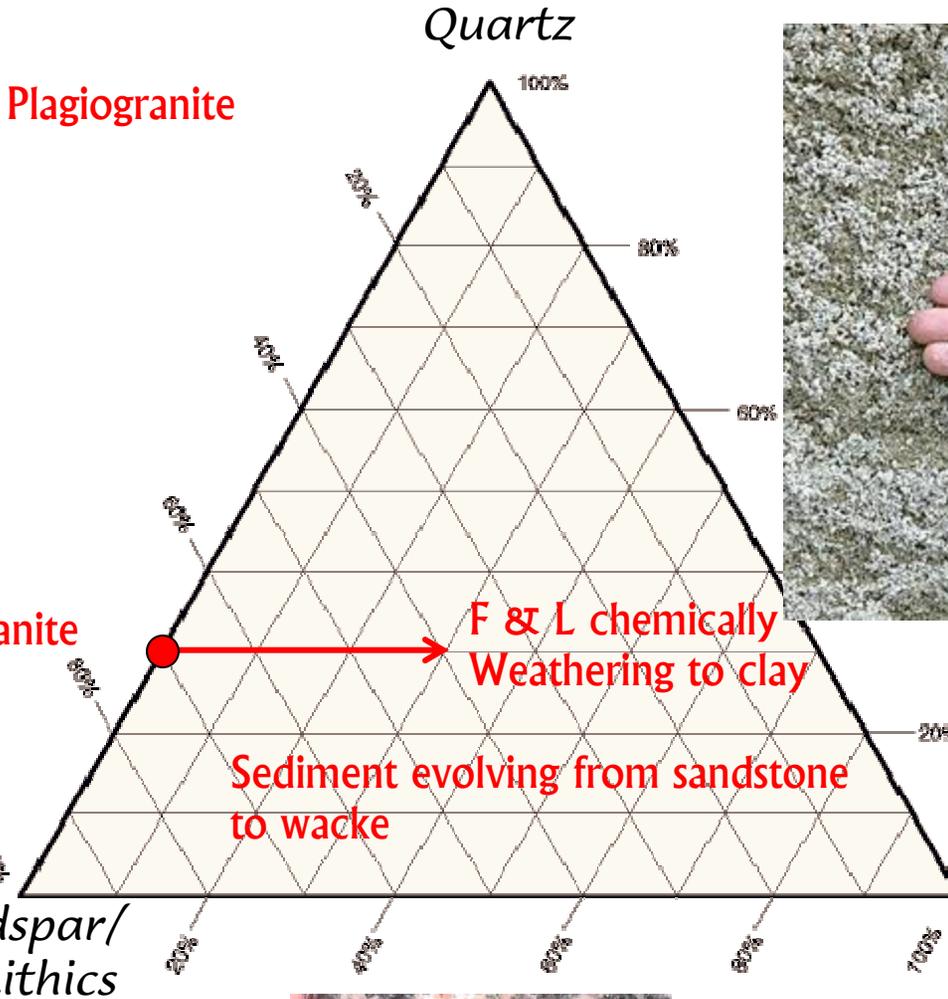
Gabbro

Q = 00%
F = 45%
L = 55%

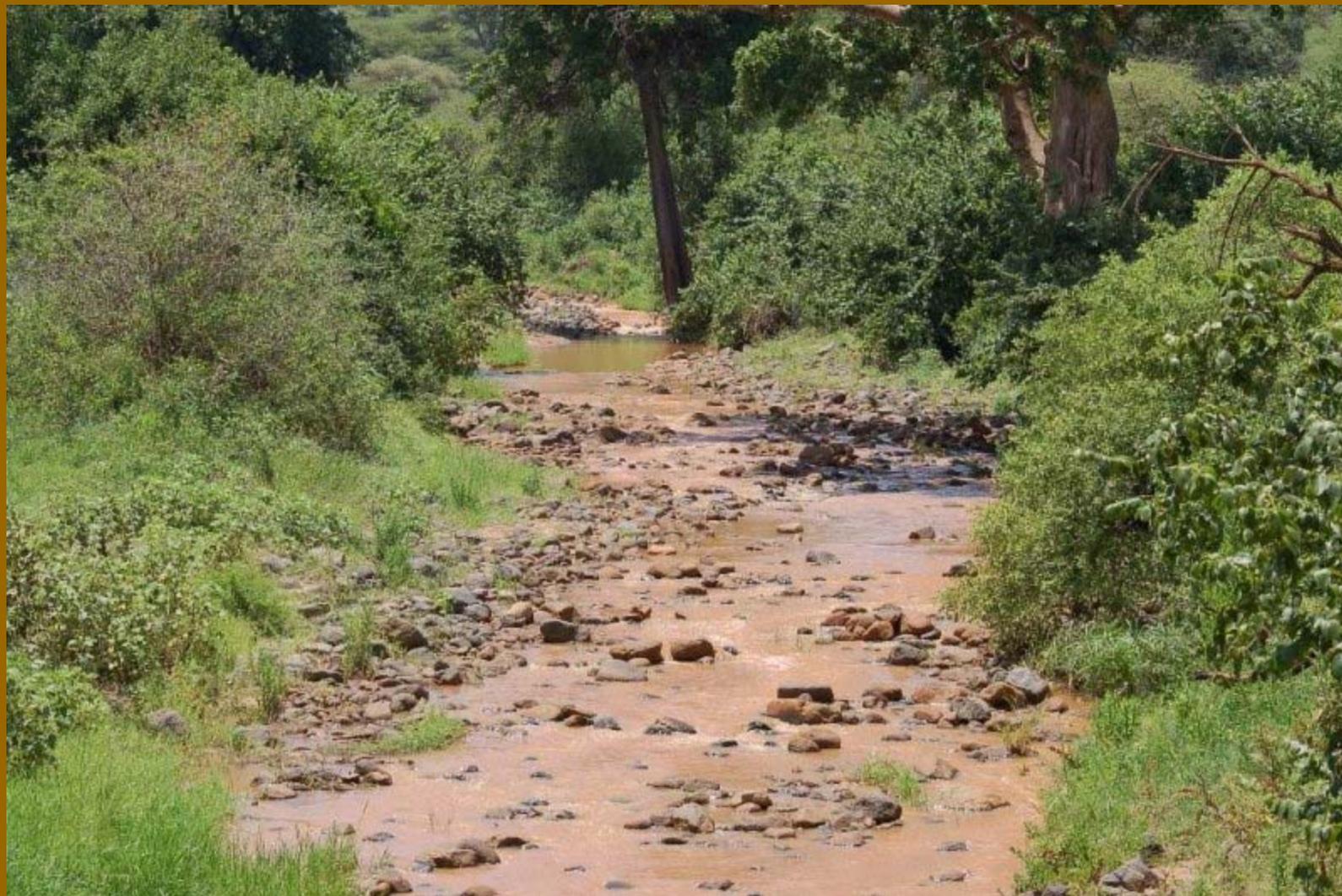


Syenite

Q = 00%
F = 80%
L = 20%

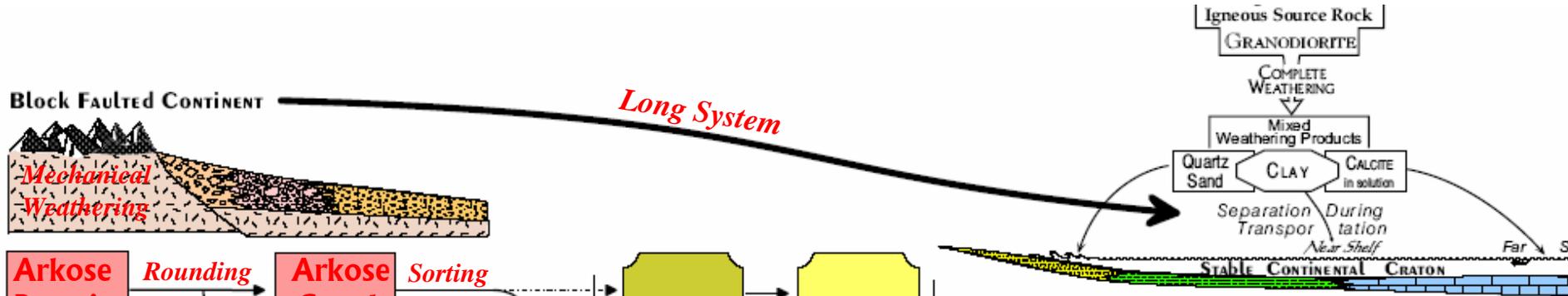


Muddy River

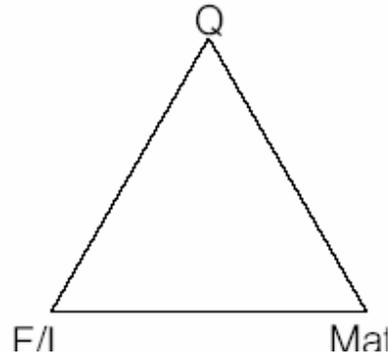
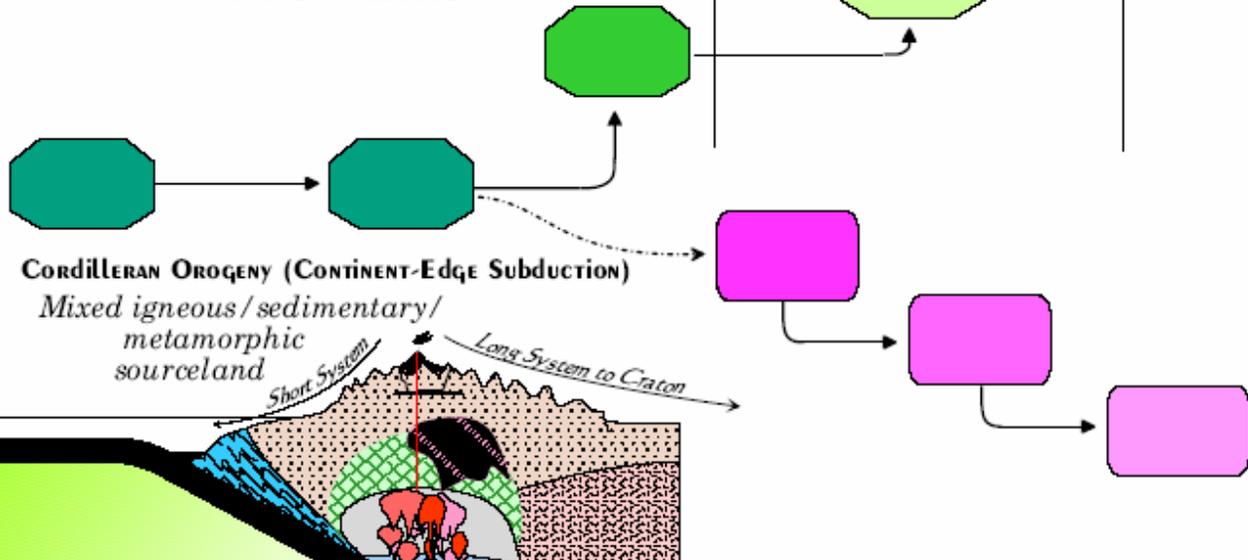


Muddy River



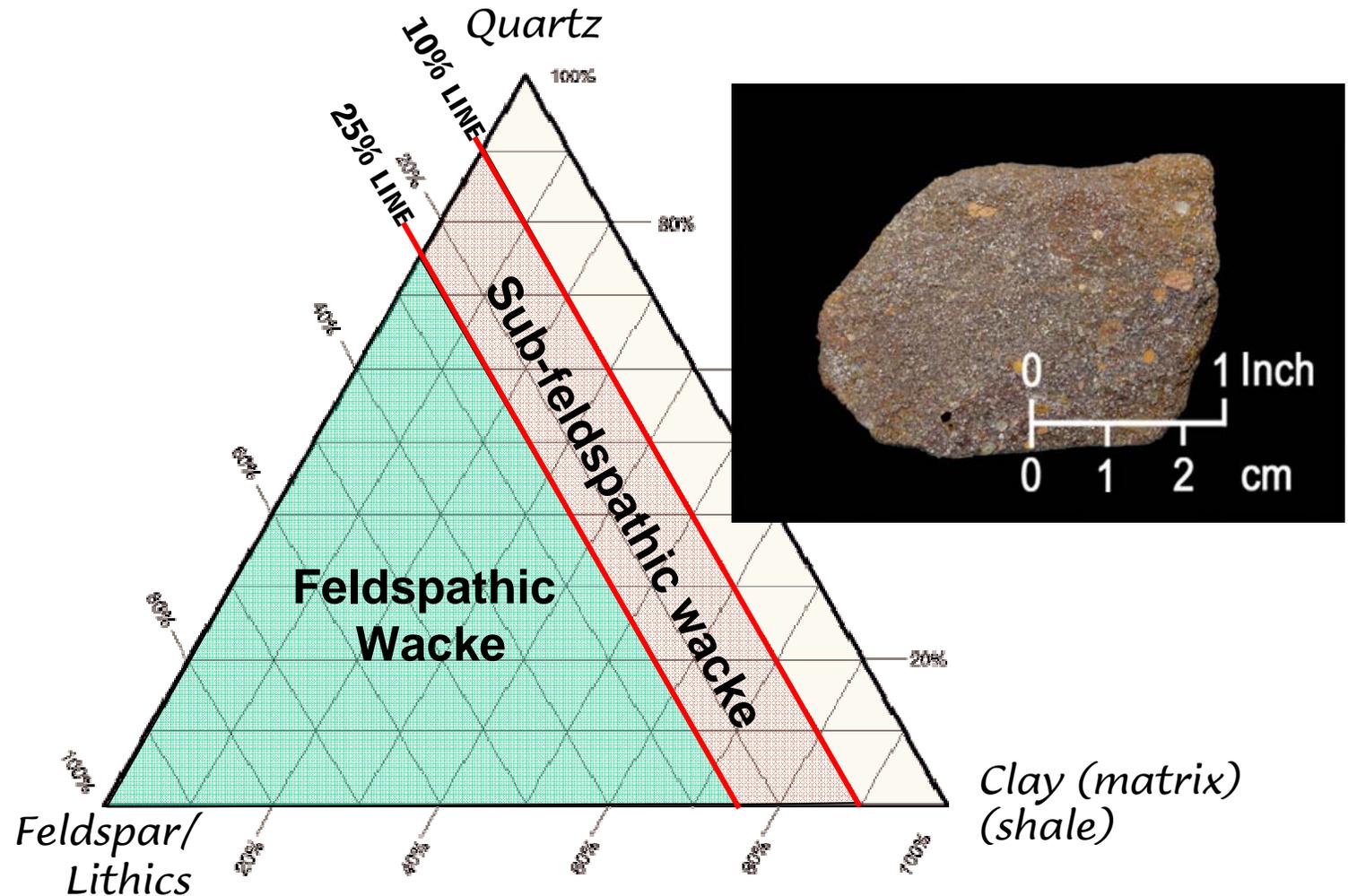


THE EVOLUTION OF SEDIMENTARY ROCKS AND DEPOSITIONAL ENVIRONMENTS



Sediment Evolution on a Ternary Diagram

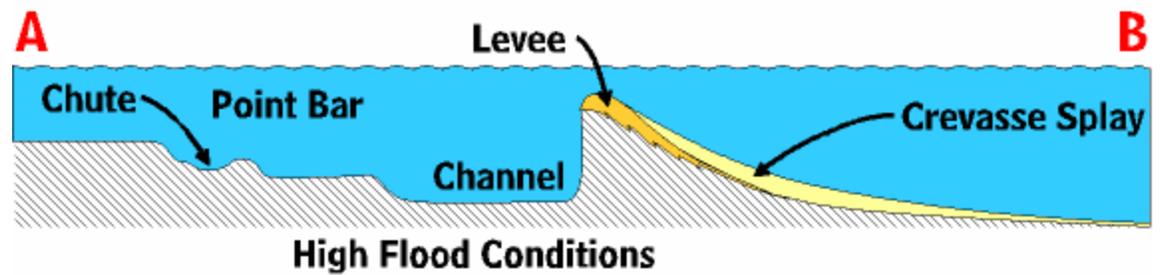
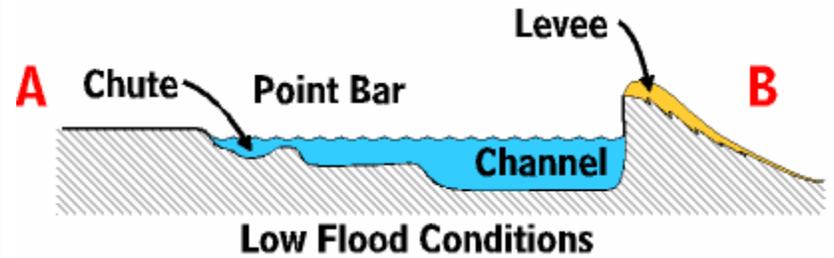
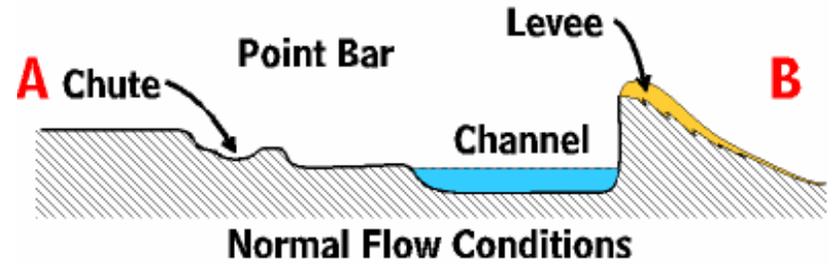
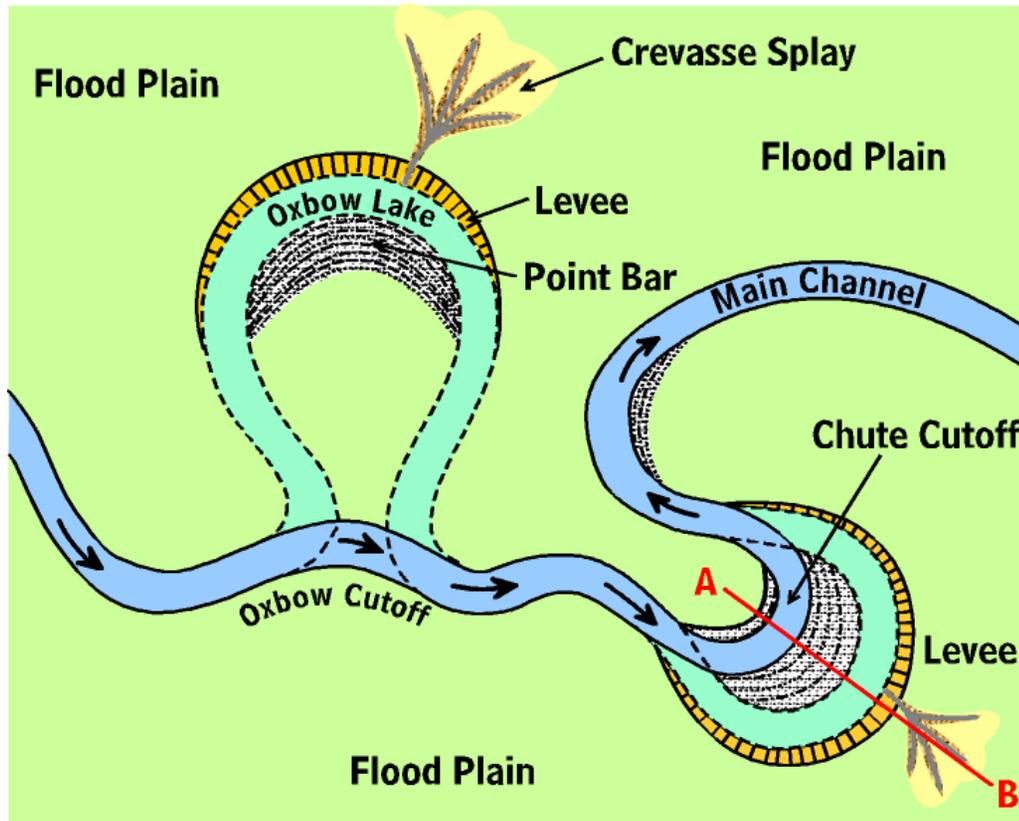
Naming the Rocks



Meandering rivers



Meandering River – flood stages



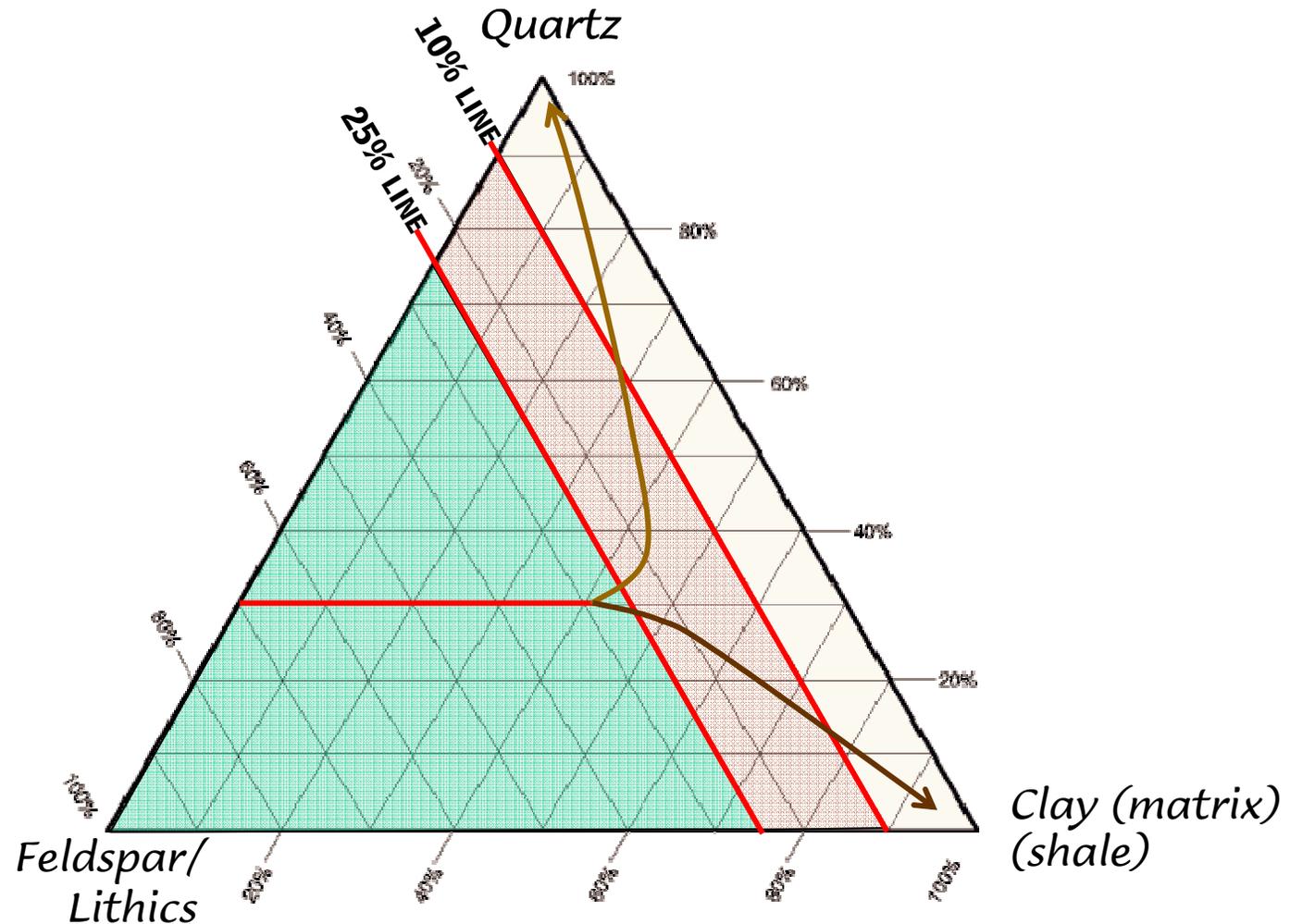
Little Pudding River, Oregon – in flood





Sediment Evolution on a Ternary Diagram

Naming the Rocks



The Simple Ideal Model for the Evolution of Sedimentary Rocks

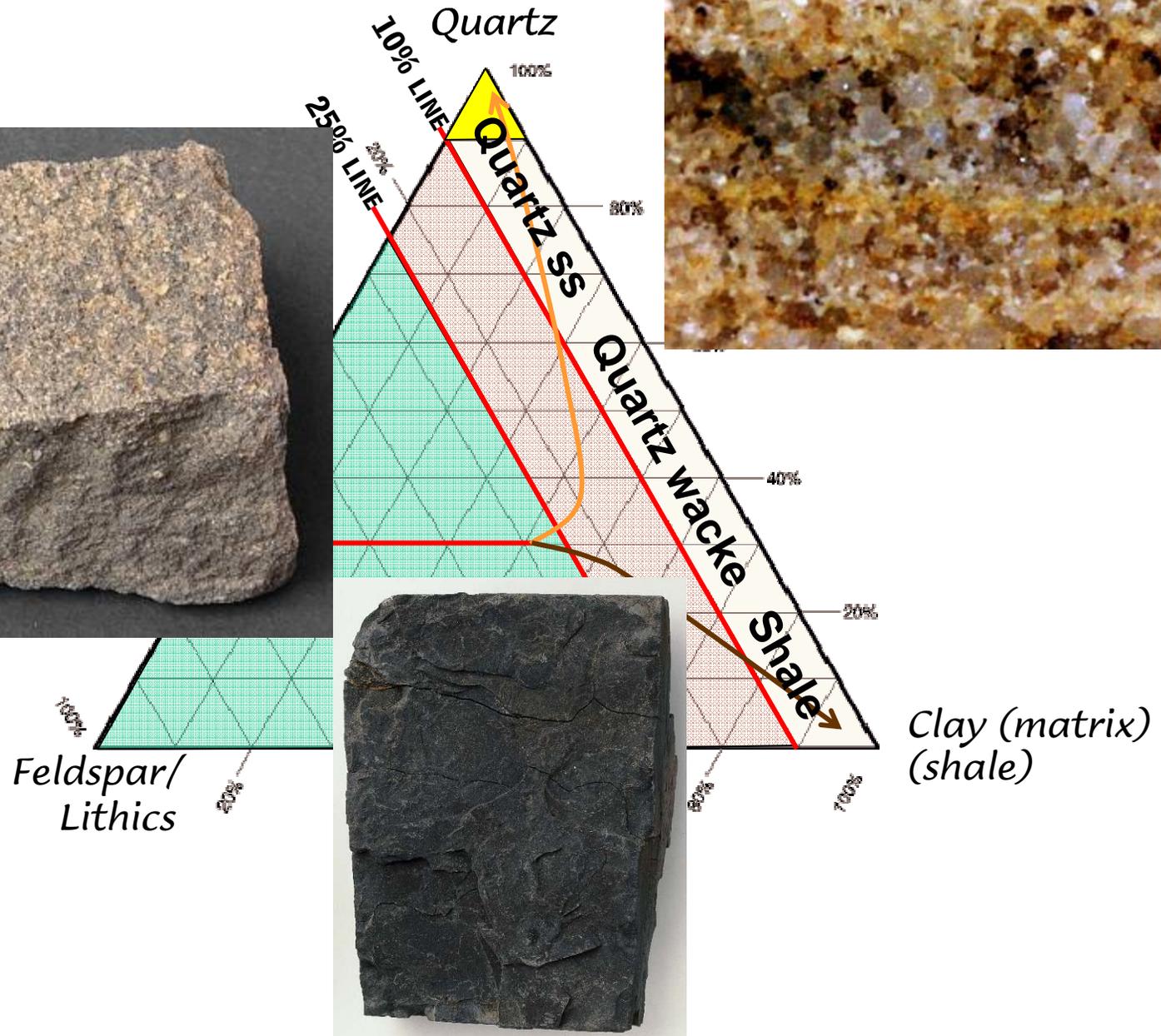


photos/elwhamouth.htm

7

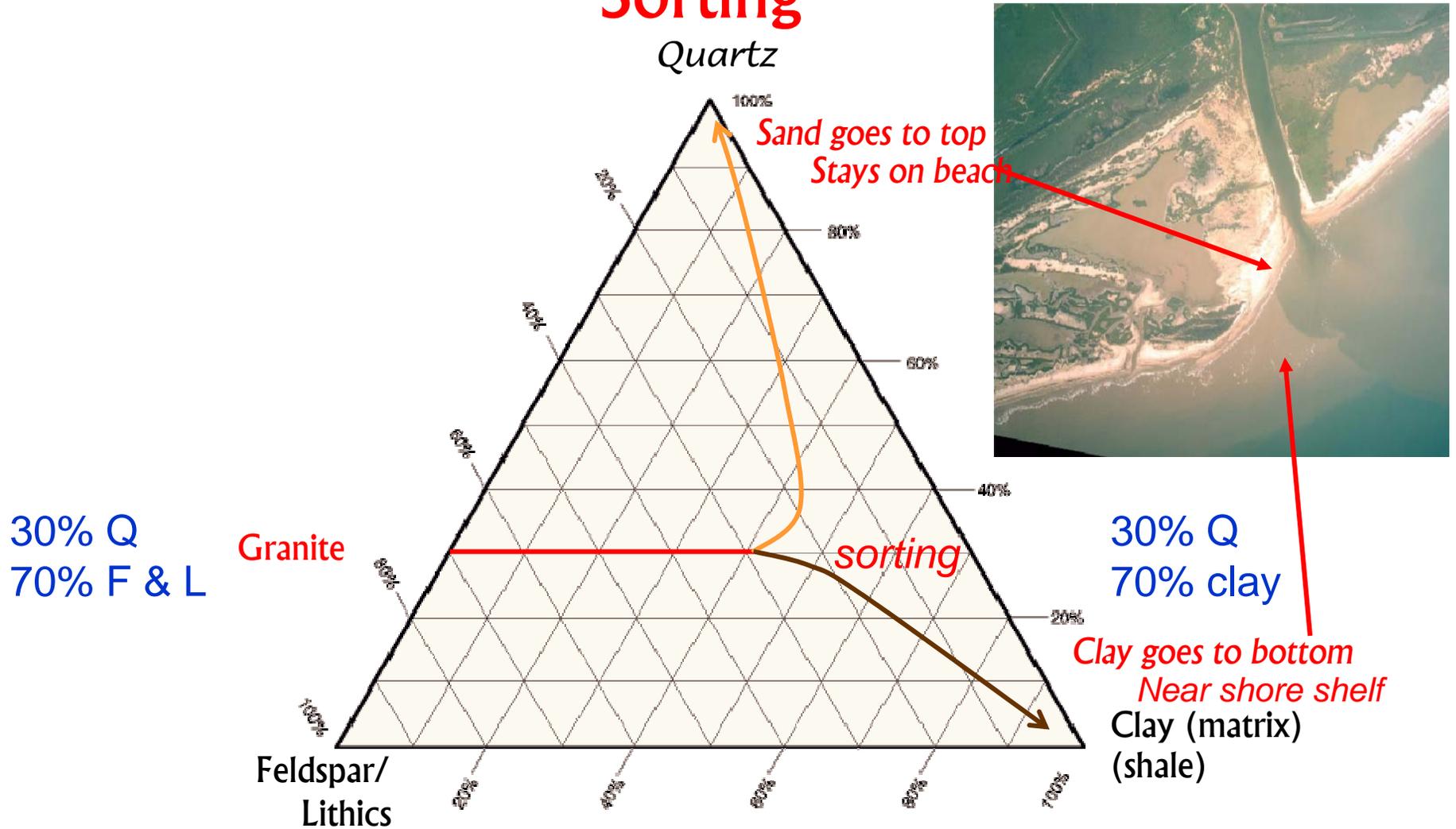
Sediment Evolution on a Ternary Diagram

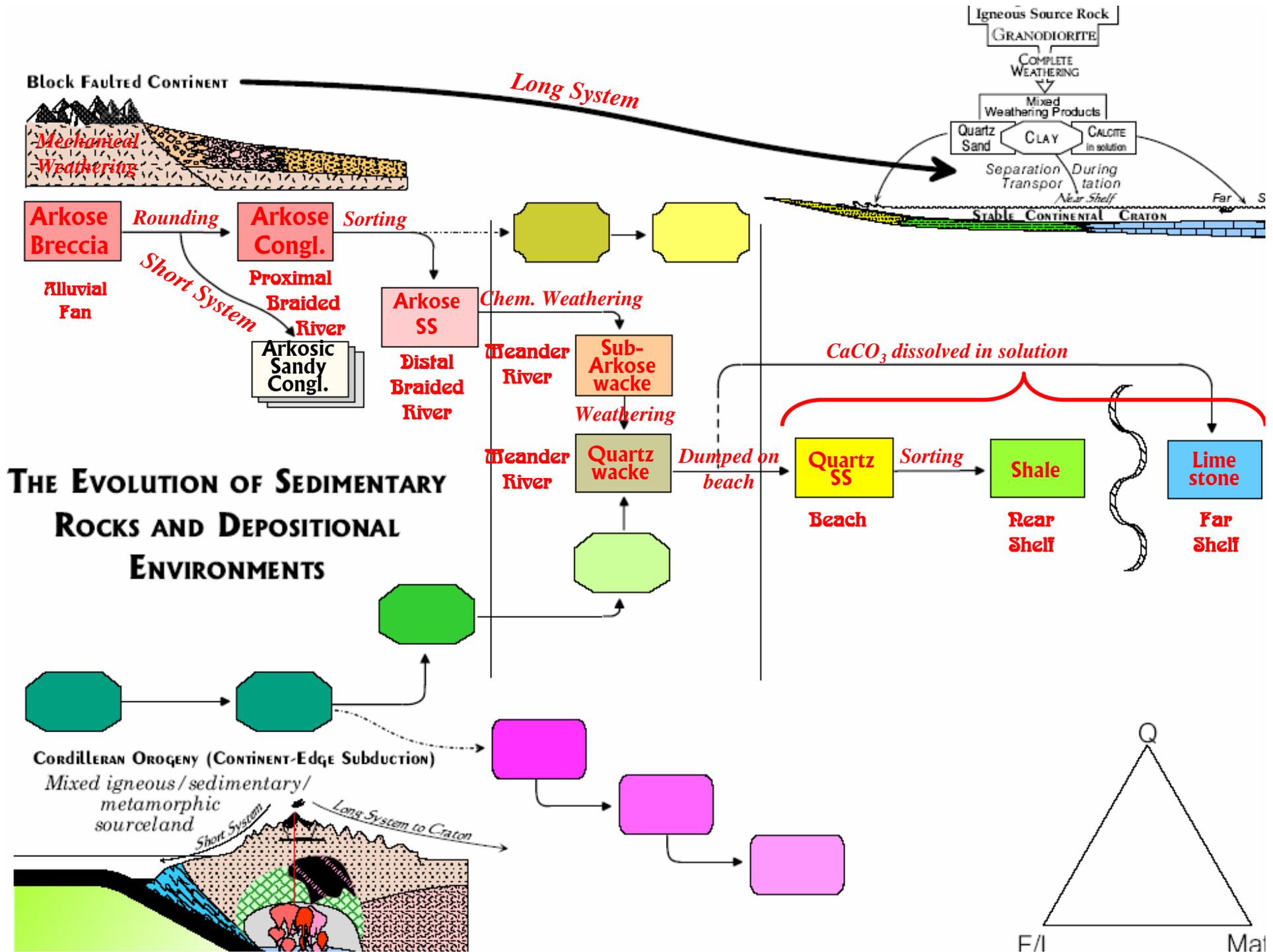
Naming the Rocks



Sediment Evolution on a Ternary Diagram

Sorting

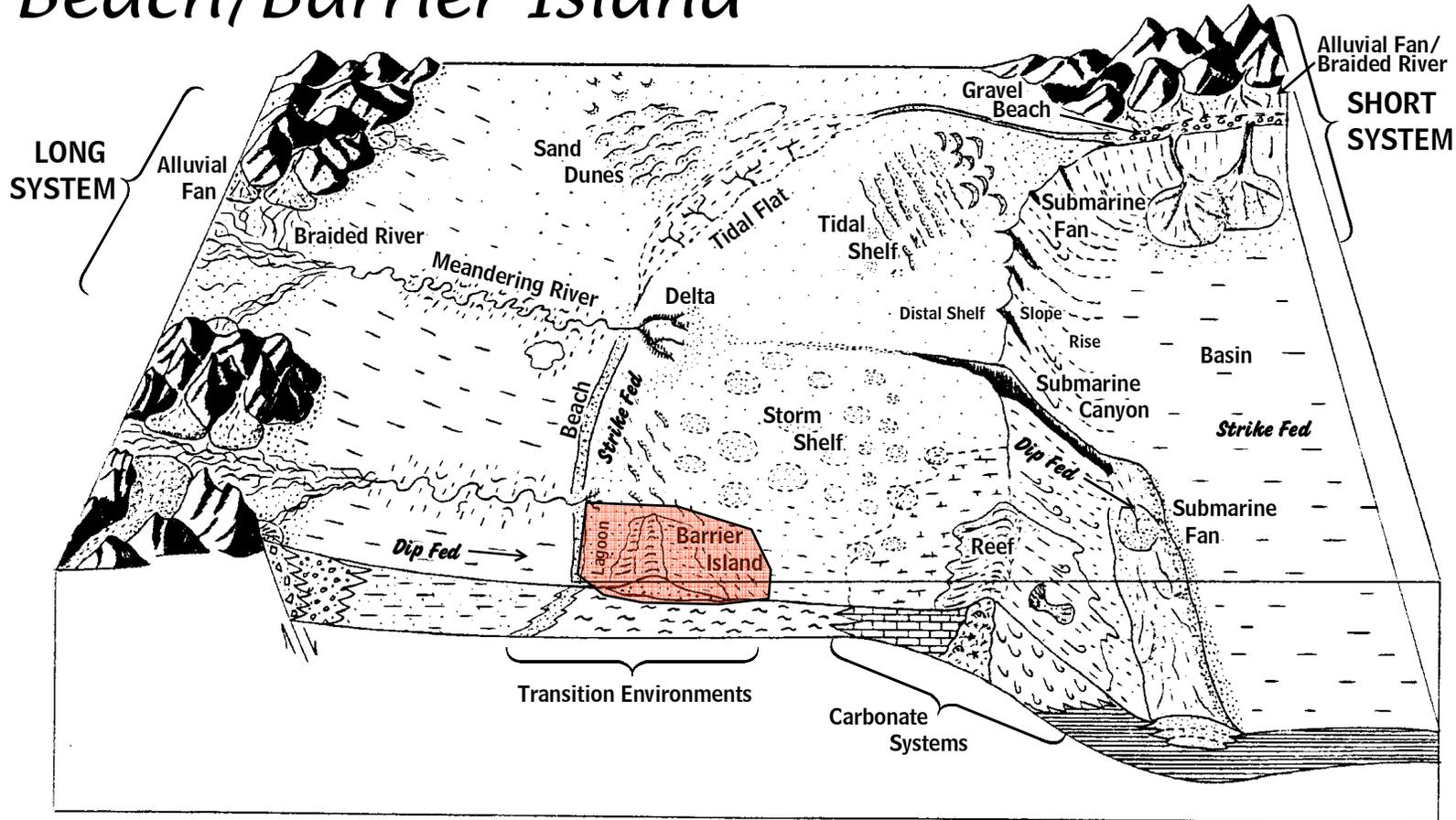




Transition Environments

Transition environments are transitional between the land (subareal) and the ocean (subaqueous). Several environments appear at this transition, and can vary a lot within themselves.

Beach/Barrier Island



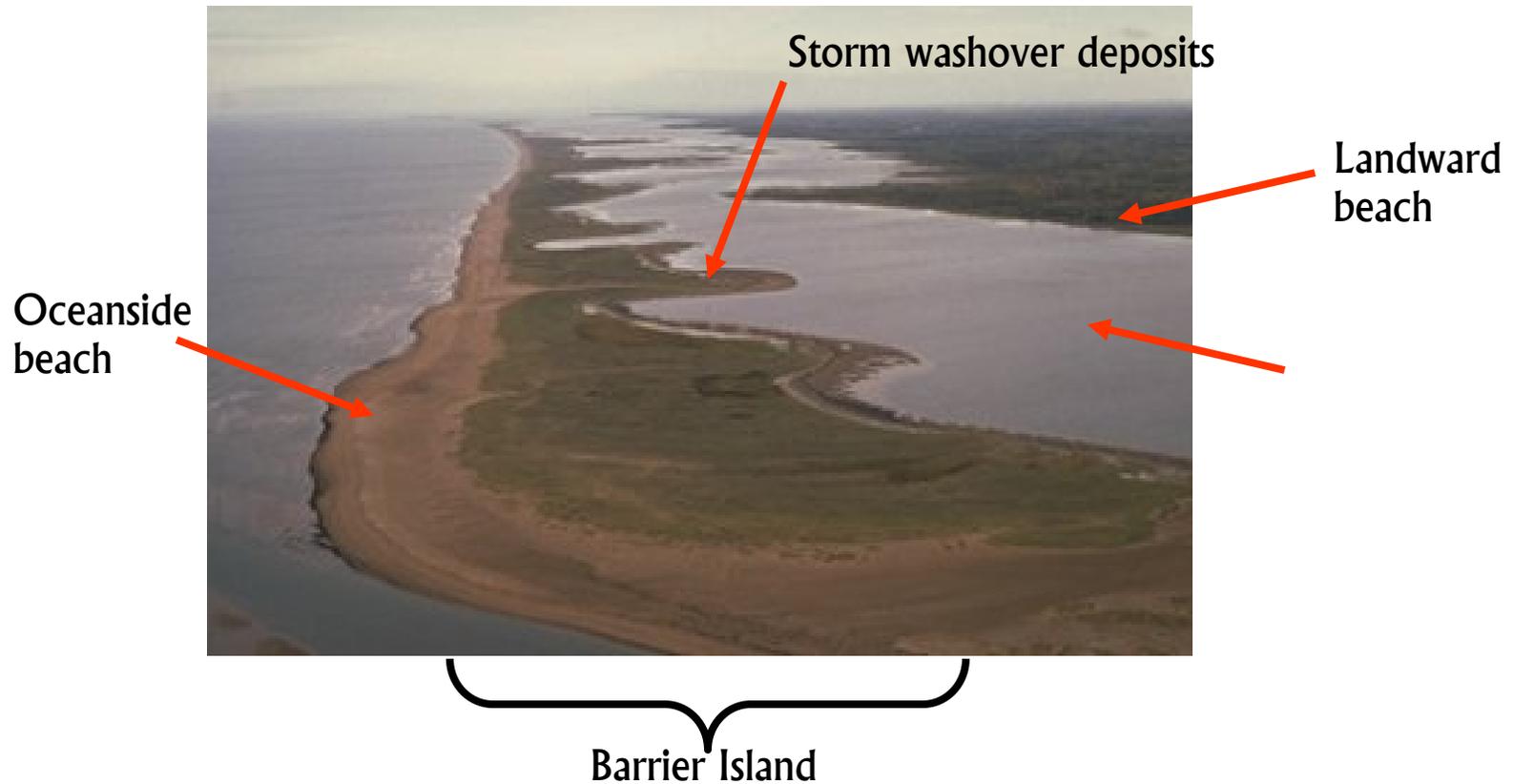
BEACHES



TRANSITION ENVIRONMENTS

Beaches and Barrier Islands

When sea level rises it sometimes floods the land faster than the beach can move inland, resulting in ponded water (the lagoon) behind the beach (now barrier island). As a result there are two beaches, one on the ocean side and one on the lagoon side.

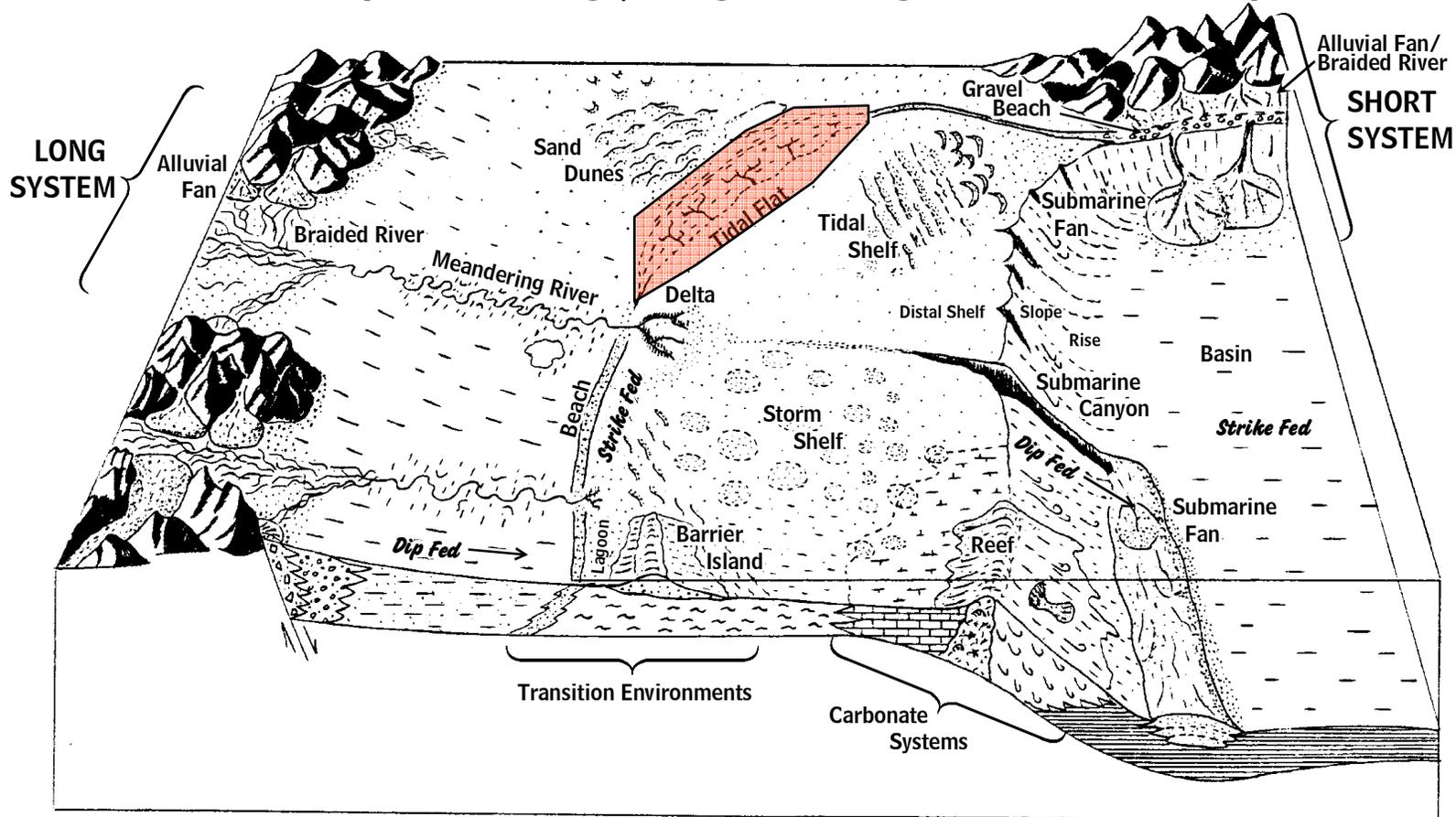




TRANSITION ENVIRONMENTS

Tidal Flat

Because of the gravitational pull of the Moon and Sun on the Earth a bulge of ocean water moves around the Earth as it rotates. This tidal current washes up onto the world's coastlines creating tidal flats. Sometimes the tidal range (difference between high and low tide) are small, such as along the coast of Virginia and the Carolinas, but other places it is large, rising and falling tens of feet each day.



SOME FAMOUS TIDAL FLATS

Mont-Saint-Michel is a 3-acre rocky islet topped by a famous Gothic abbey 1 mi off the coast of Normandy in northwest France along the English Channel. During the Middle Ages it was located 3 mi from the shore, allowing it to withstand repeated English assaults during the Hundred Years' War, but sedimentation has built the tidal flat up so that it is now surrounded by water only during the two highest tides each month.

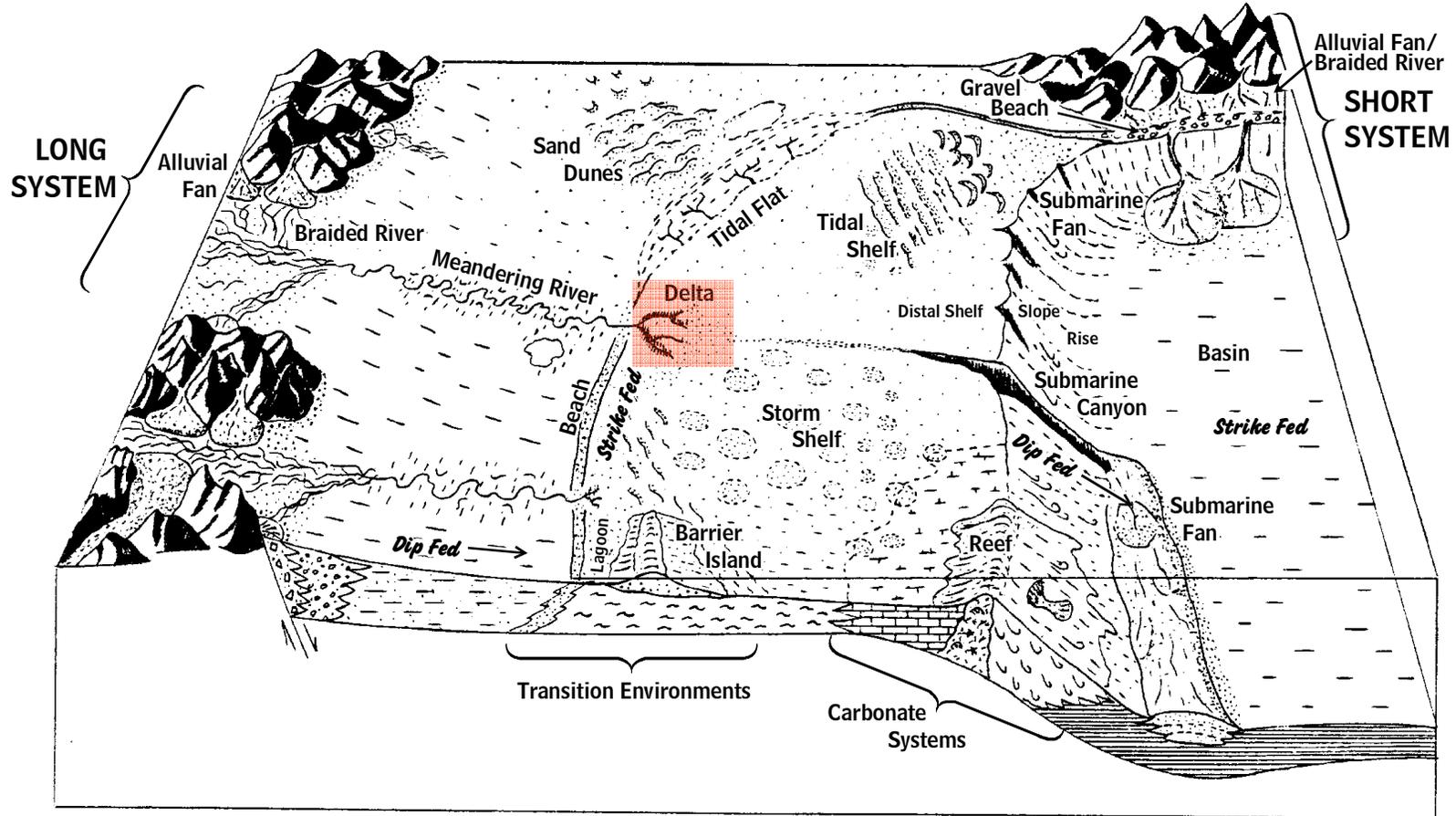


Mont-Saint-Michel during low tide when it is accessible not only by the causeway build in the mid 19th century, but also across the flats.



TRANSITION ENVIRONMENTS

Delta





Gulf of



Mississippi R
Gulf of S

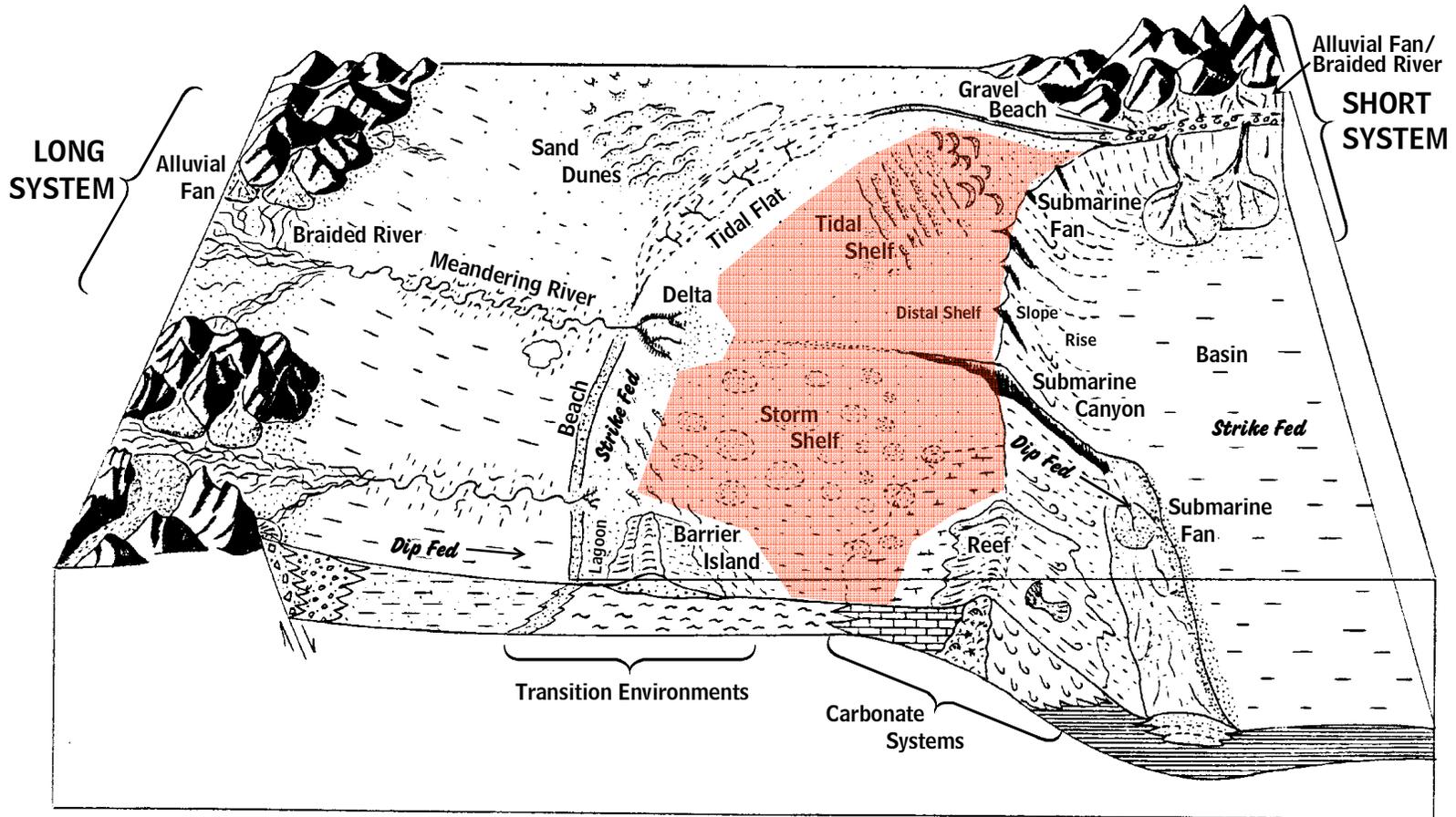


Mississippi River Delta

Wave Delta - The Nile



Shelves

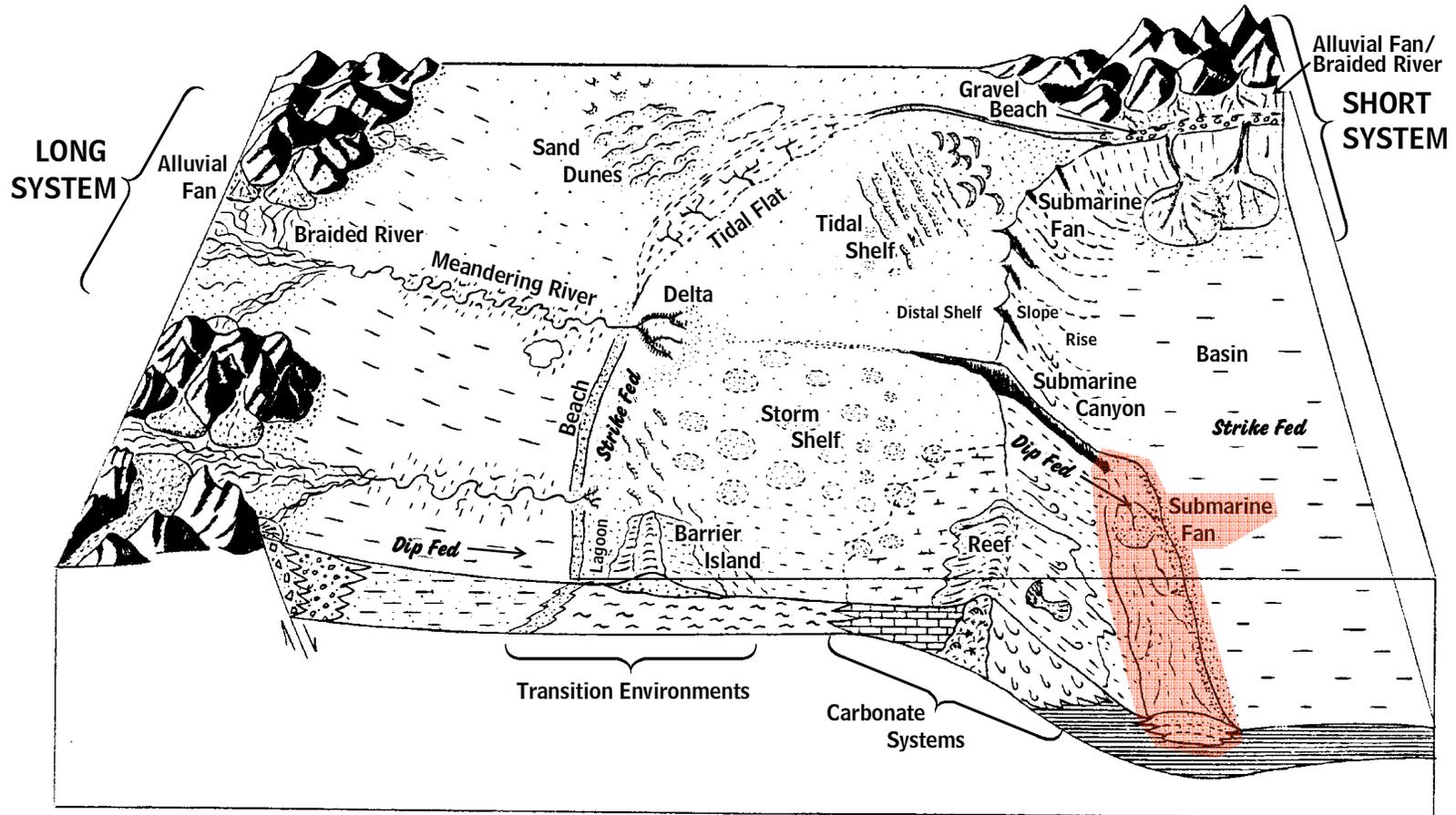


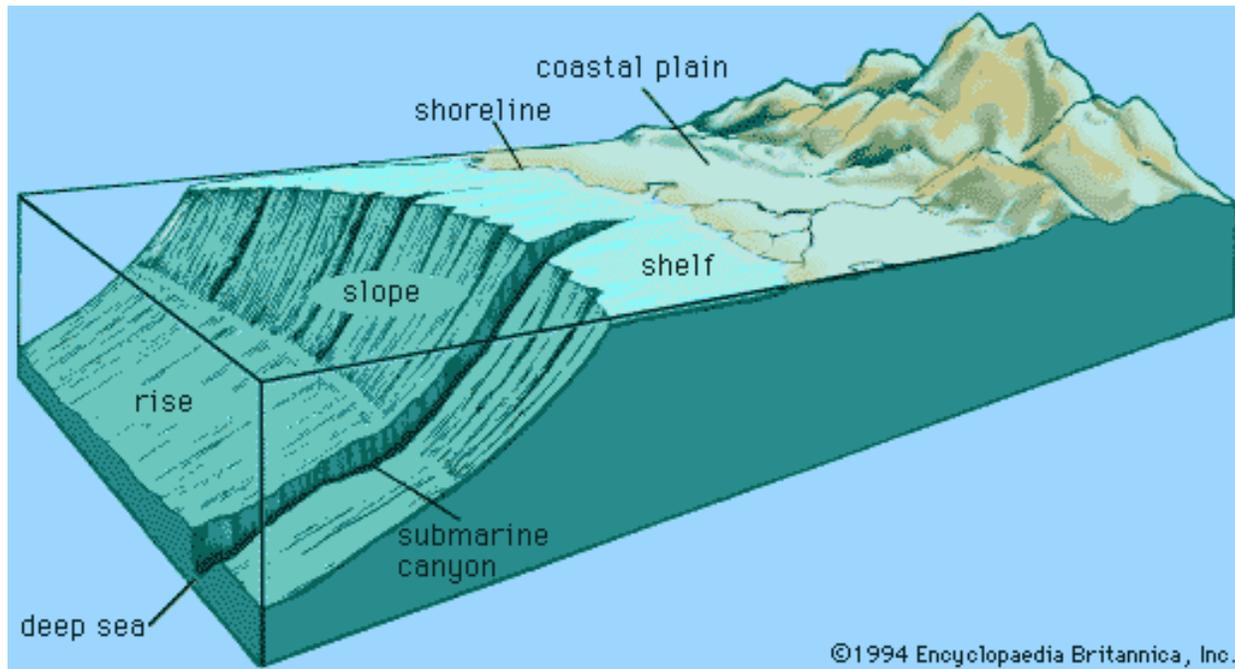


Shelves, and other submarine environments are hard to study because they are under water. The waves in the distance tell us we are relatively near shore, and that the environment under the water is probably a shelf.

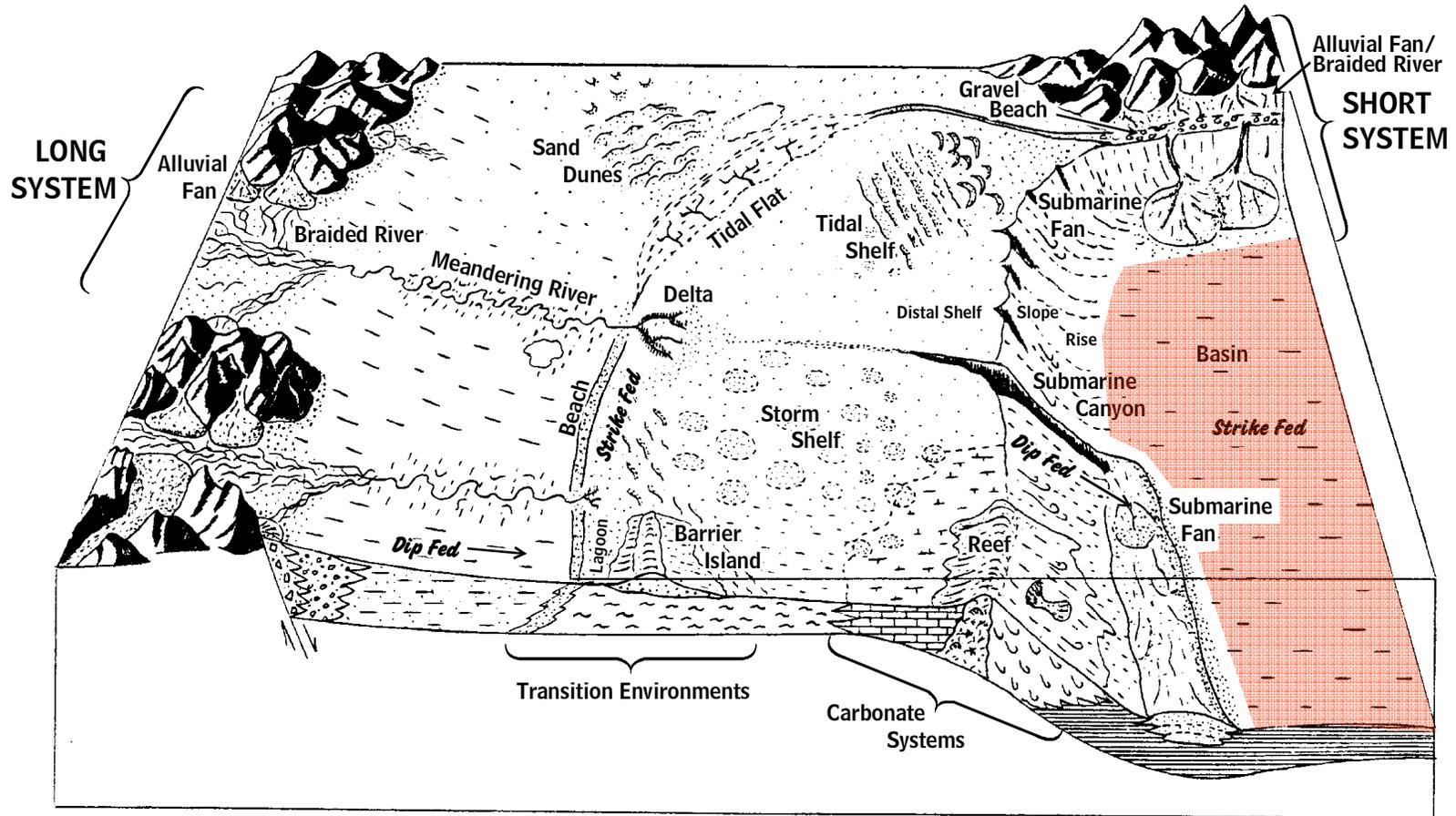


Submarine Fan

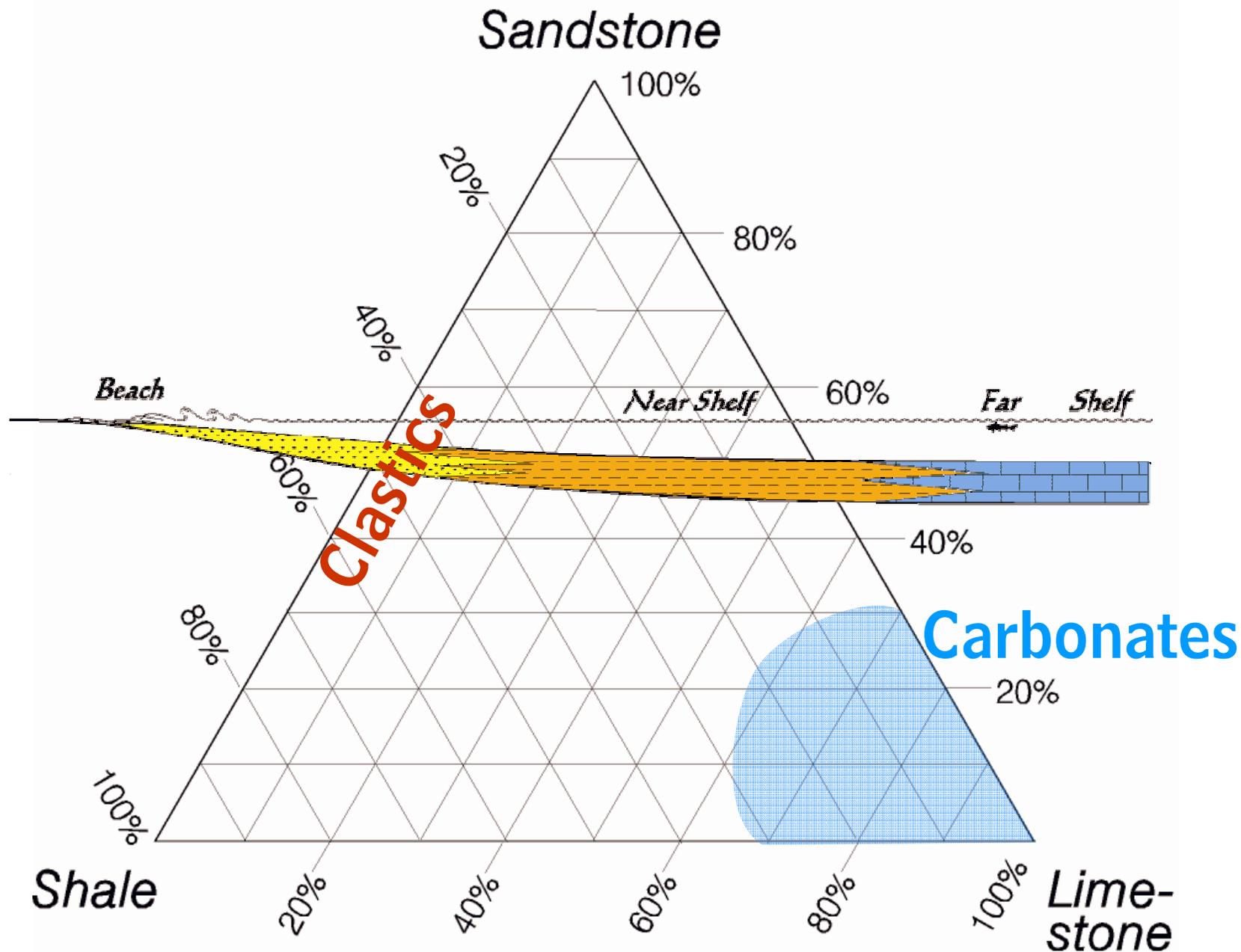




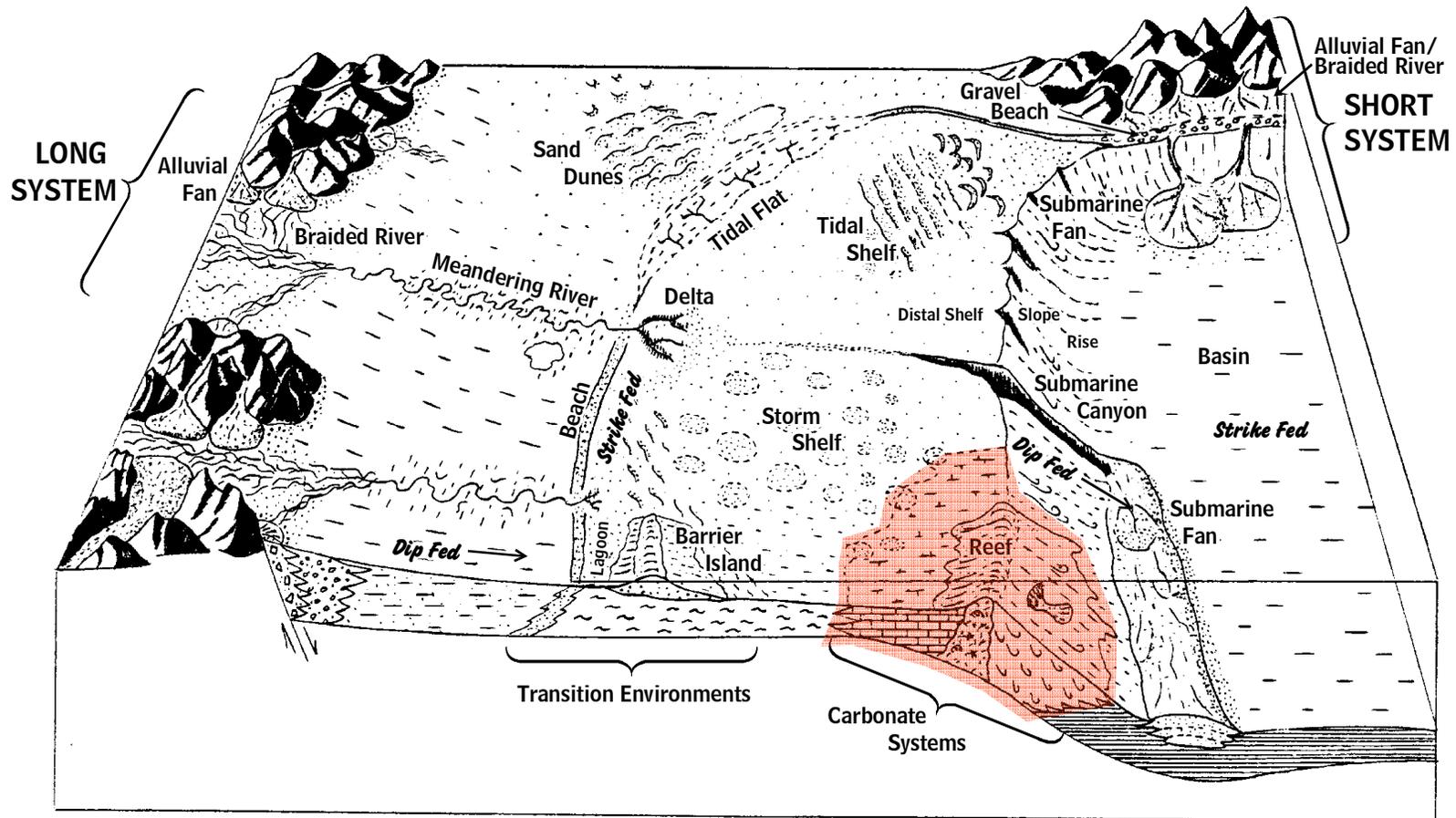
Basin



Sedimentary Rock Classification



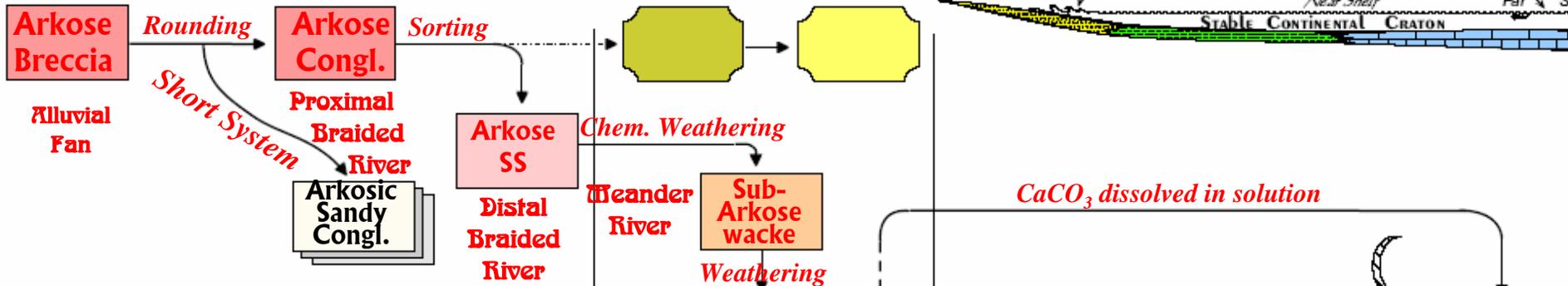
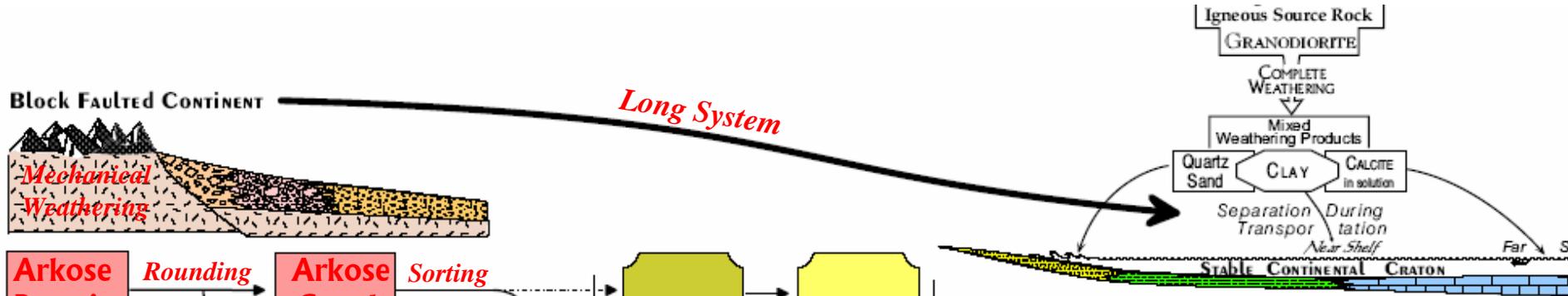
Carbonate System – Reef, Lagoon



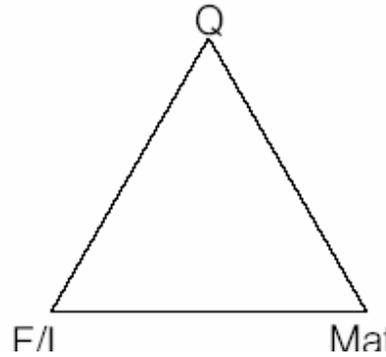
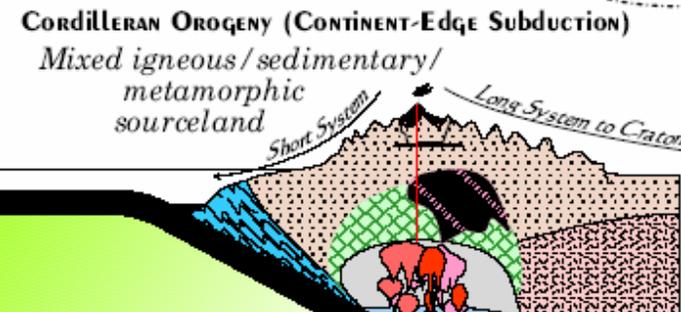
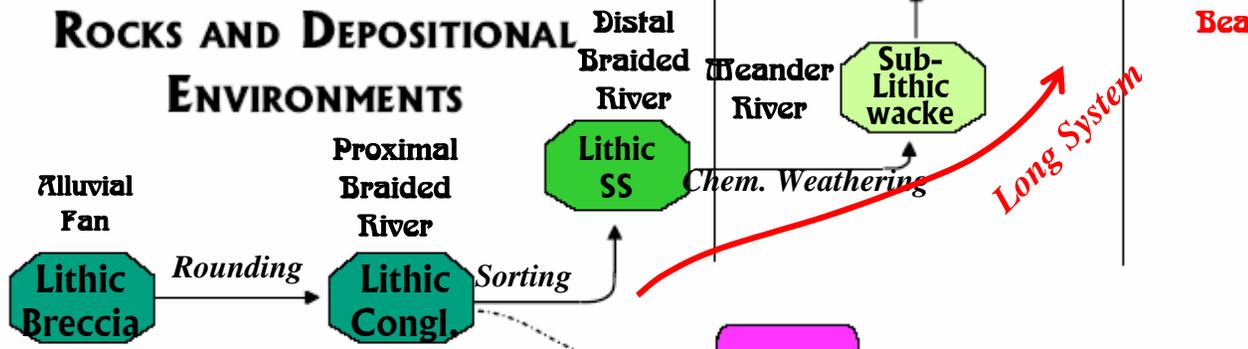




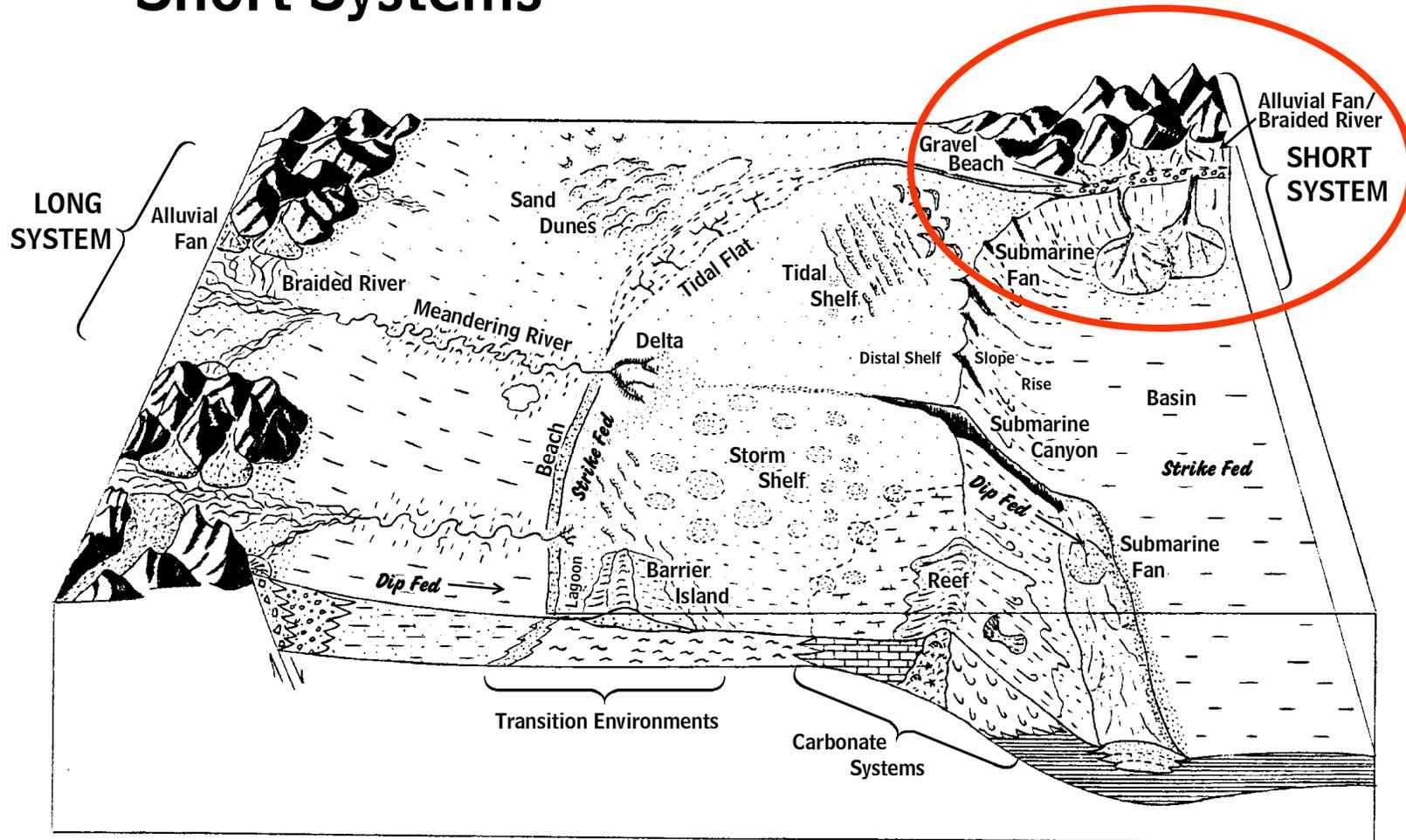


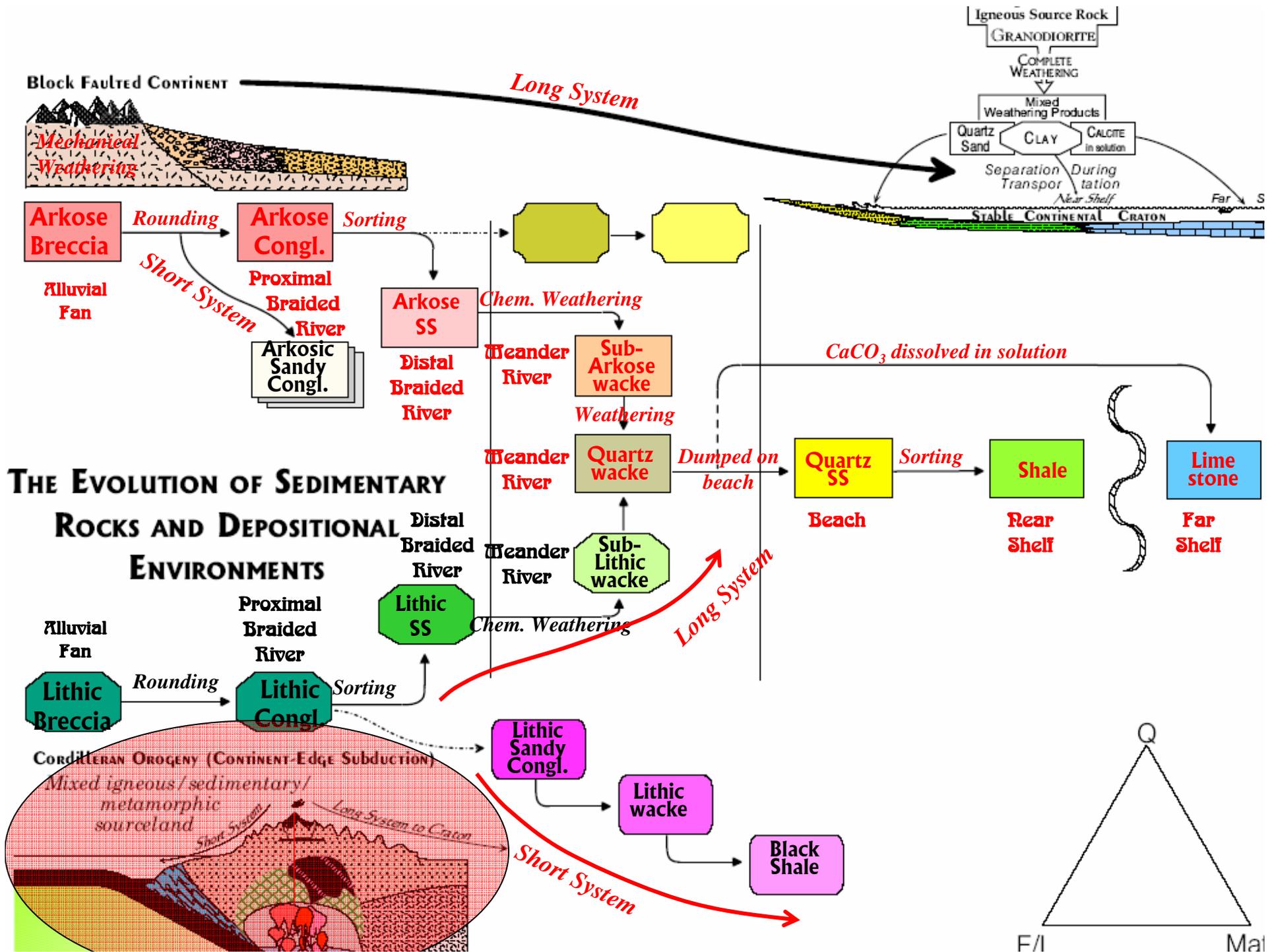


THE EVOLUTION OF SEDIMENTARY ROCKS AND DEPOSITIONAL ENVIRONMENTS



Short Systems







Gravel on the short system beach is not unusual.



Gravel on the short system beach is not unusual.





http://commons.wikimedia.org/wiki/Image:Gravel_on_a_beach_in_Thirasia,_Santorini,_Greece.jpg

