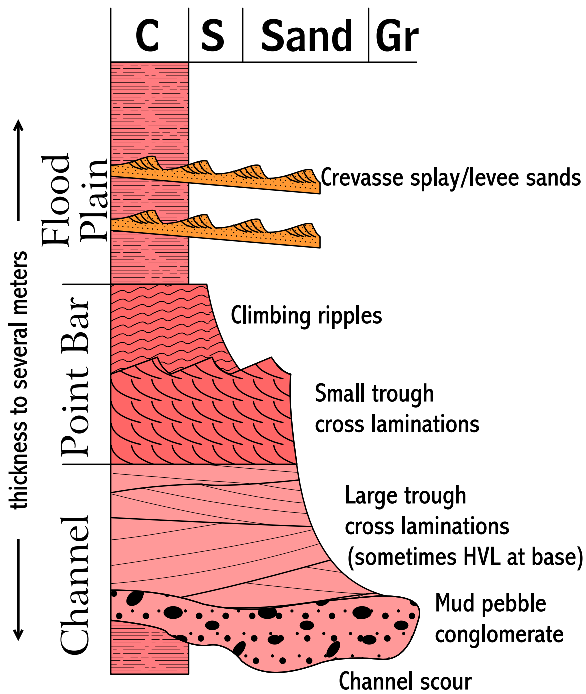
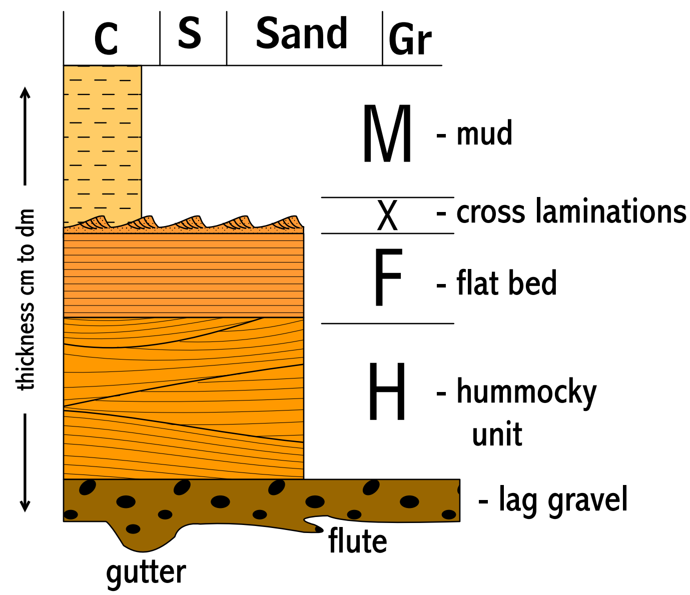
Common Depositional Sequences

Sequences that represent geologically instantaneous events, lasting a few hours to a few days

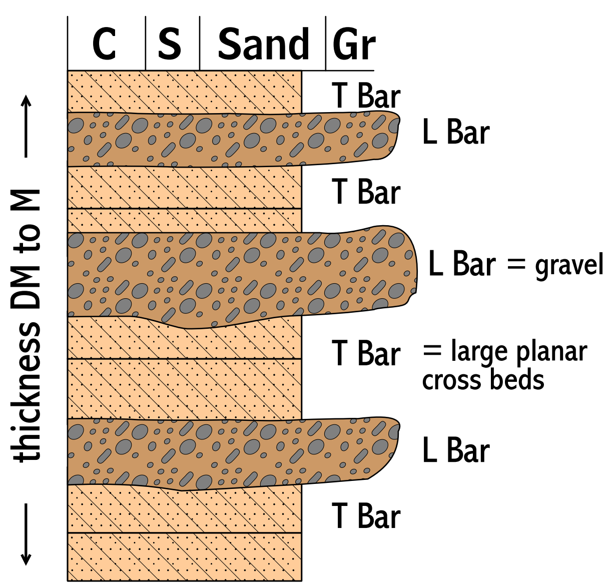
Point Bar
(Meandering River)



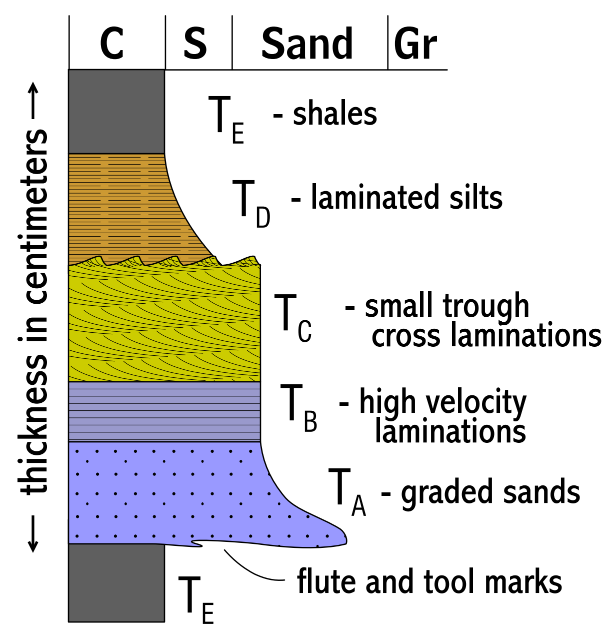
Hummocky
(Sorm Shelf)



L-Bar/T-Bar
(Braided River)

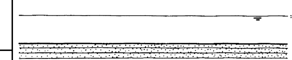
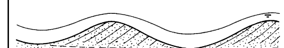
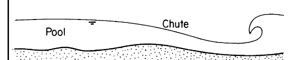
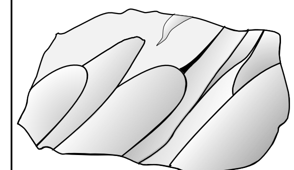
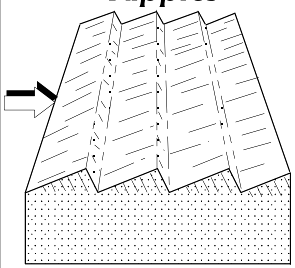
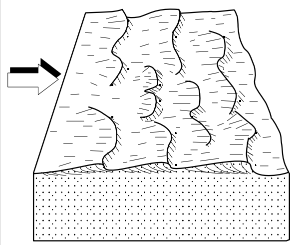
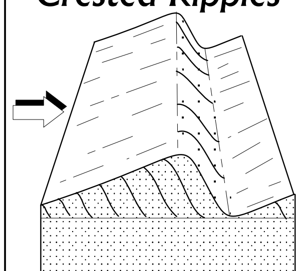
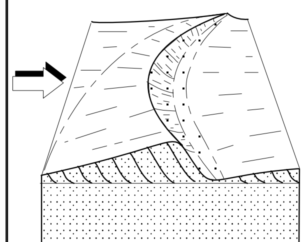
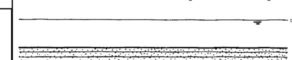
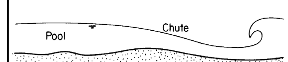
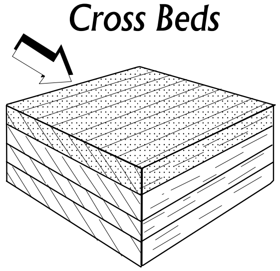
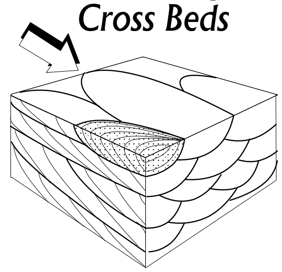
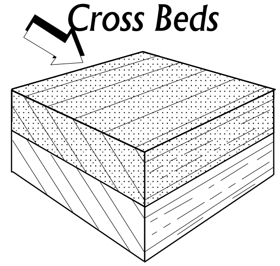
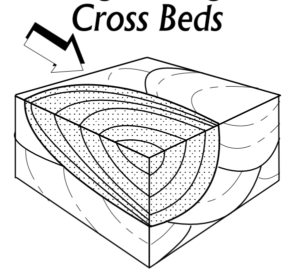


Bouma
(Turbidity Current: Submarine Fan)

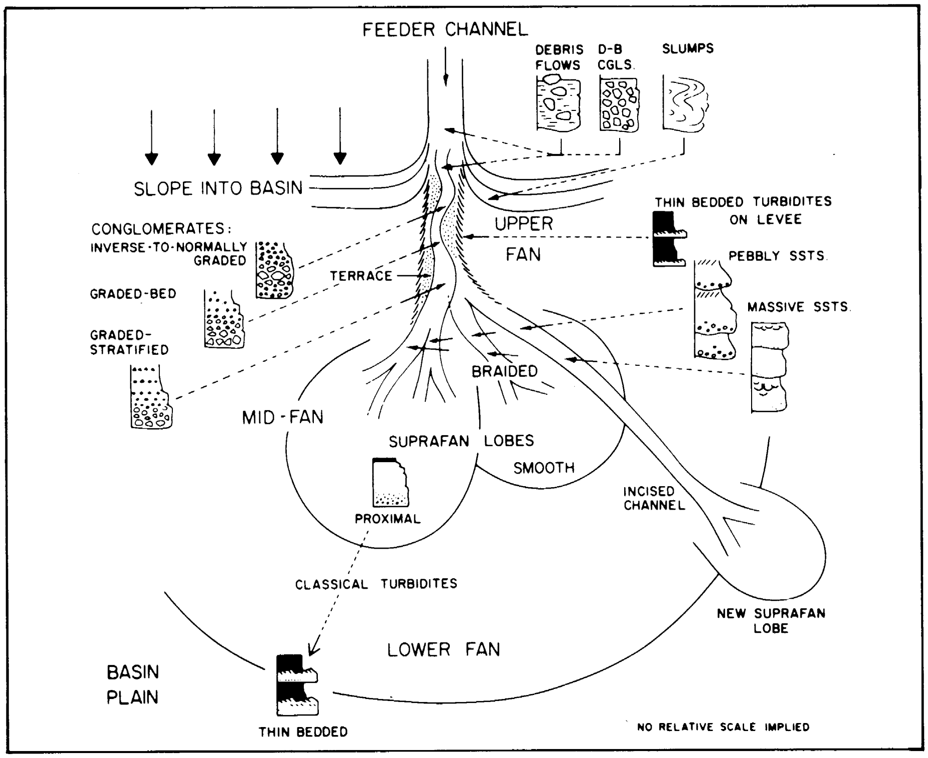


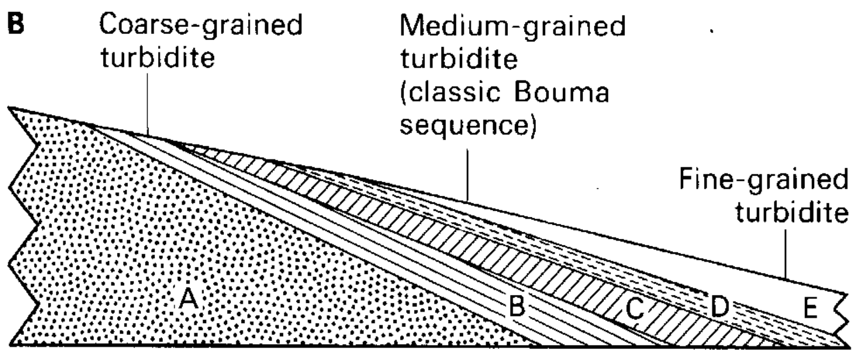
Flow Regime Divisions and Resulting Sedimentary Structures

LOW ENERGY ⟶ increasing water velocity ⟶ HIGH ENERGY

	LOWER FLOW REGIME				UPPER FLOW REGIME	NO DEPOSITION: EROSION *(All particles in motion)*
	Lower-Lower		*Upper-Lower*			
BED FORMS	*Small Ripples* *Wave length < 30 cm; usually less*		*Large Ripples* *Wave length > 1 meter; no upper limit*		*Plane Bed (HVL)*  *Antidunes*  *Chute and Pool* 	***Flute Marks*** ***Scours*** ***Channels*** 
	Small Straight Crested **Ripples** 	Linguloid Ripples 	Large Straight Crested Ripples 	Lunate Ripples 		
INTERNAL STRUCTURES	*The sedimentary structures below result from the above bed forms*				*Plane Bed (HVL)*  *Antidunes*  *Chute and Pool* 	***Sediment Channel Fill*** *(For example, a point bar sequence*
	Small Cross Beds *< 5 cm high; usually much less*		*Large Cross Beds* *> 5 cm high; no upper limit*			
	Small Planar Cross Beds 	Small Trough Cross Beds 	Large Planar Cross Beds 	Large Trough Cross Beds 		

Submarine Fan Depositional Models





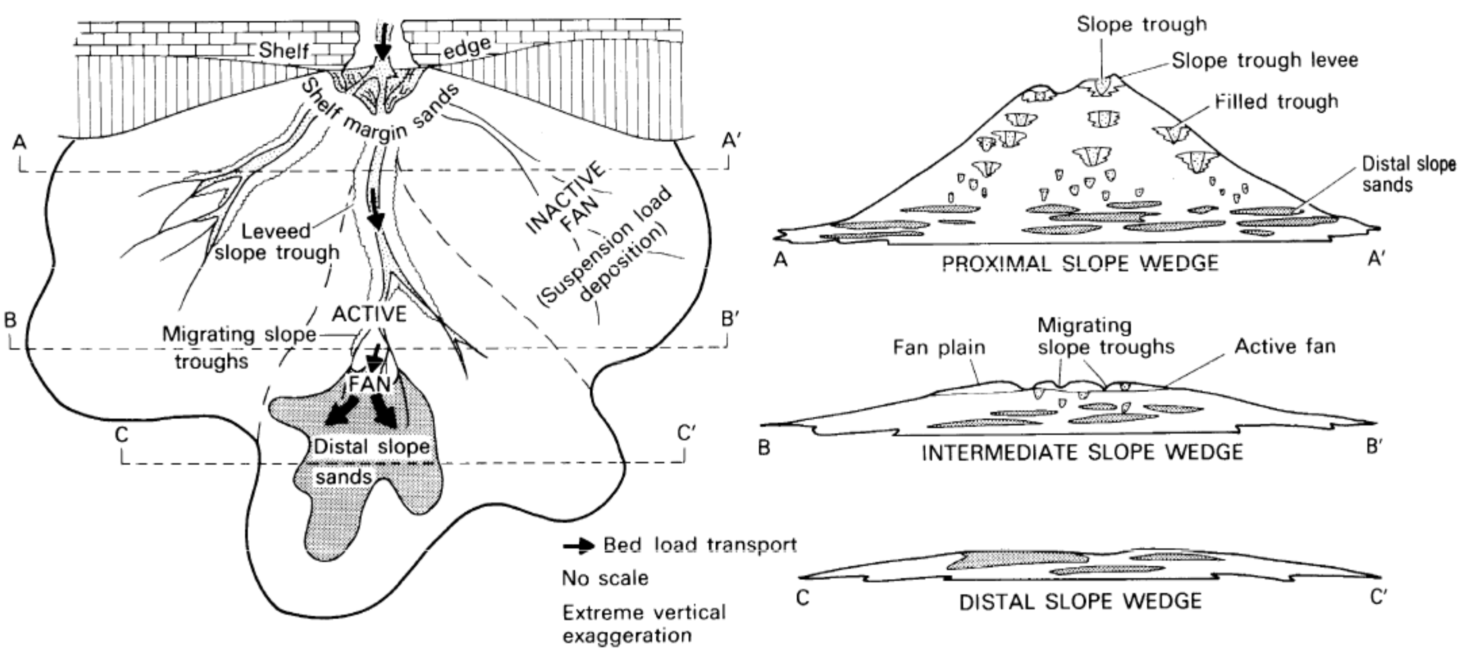
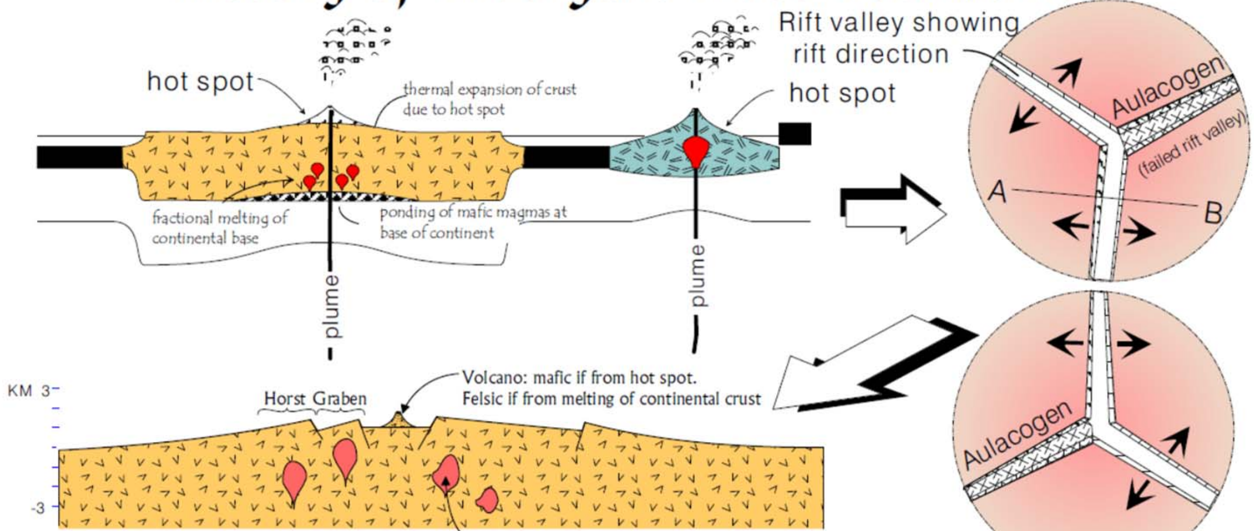


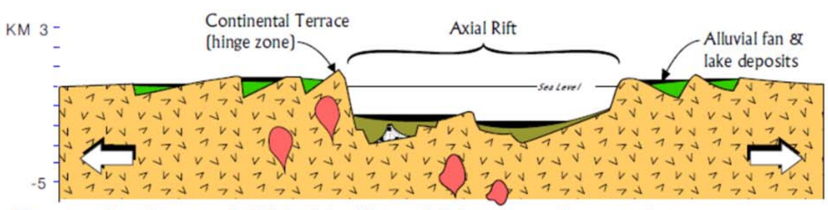
Fig. 12.45. Carboniferous-Permian Sweetwater Slope Group of the Midland Basin Texas (after Galloway and Brown, 1973).

History of Divergent Plate Boundaries

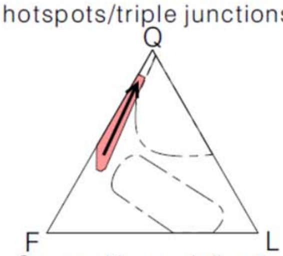


Hot Spot / Thermal Doming

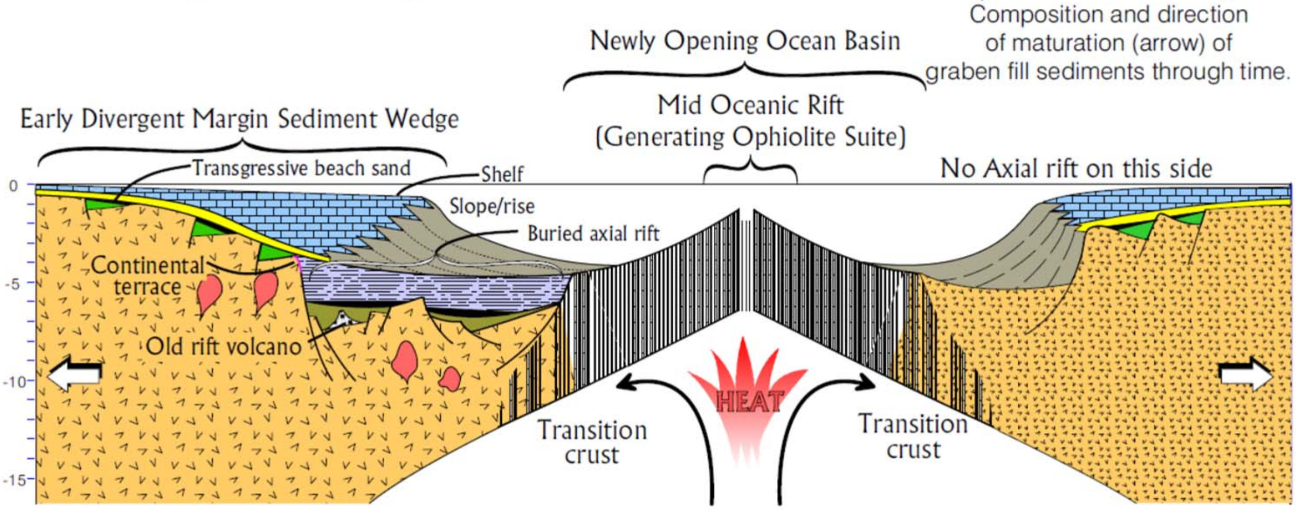
Areal view of two hotspots/triple junctions



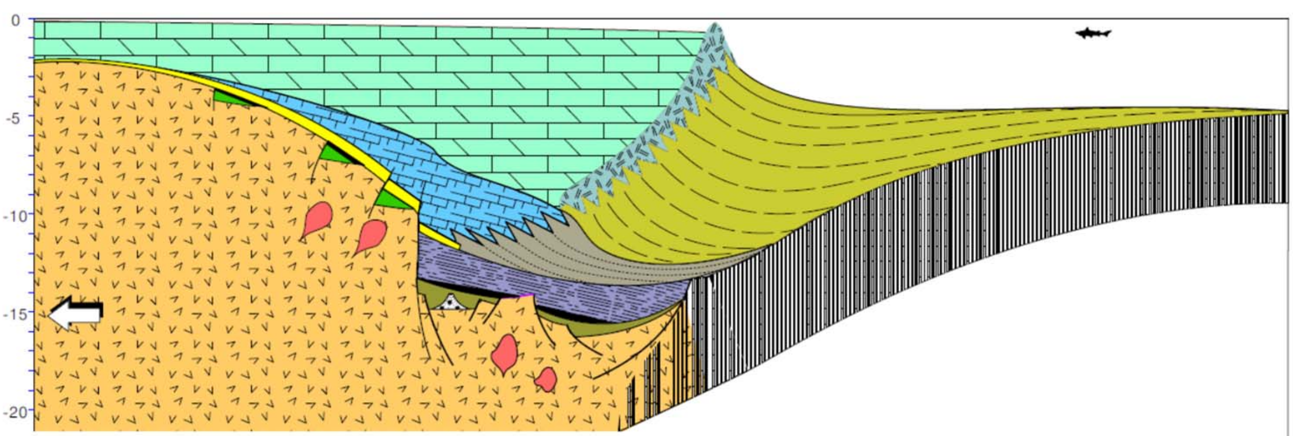
Foundering of Rift Valley / Marine Invasion



Composition and direction of maturation (arrow) of graben fill sediments through time.

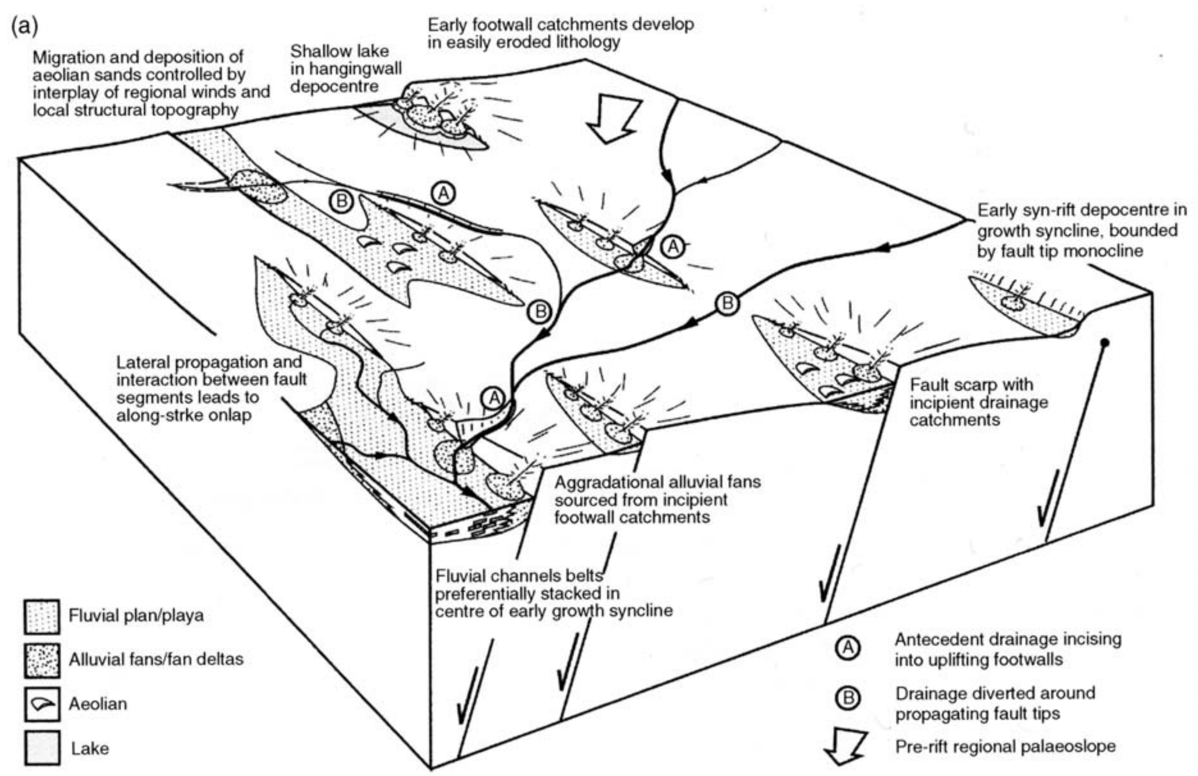


Early Divergent Margin

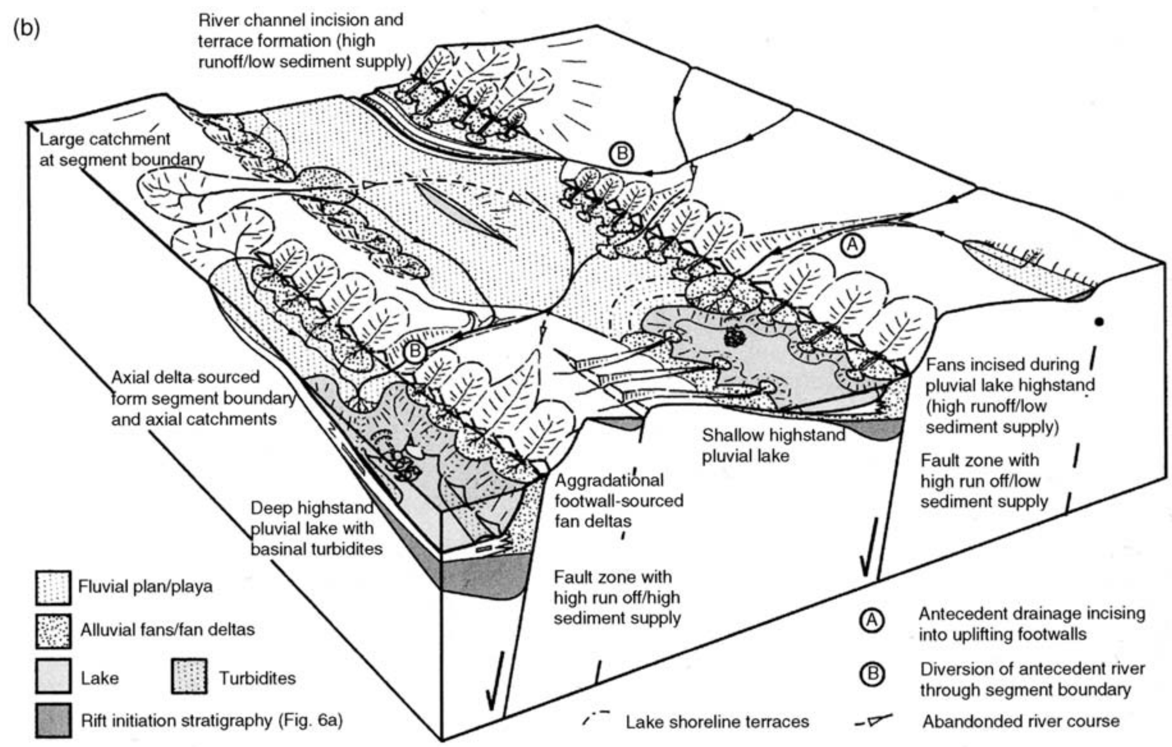


Full Divergent Margin

Depositional Systems in Two Stages
In the Development of a Terrestrial Rift System



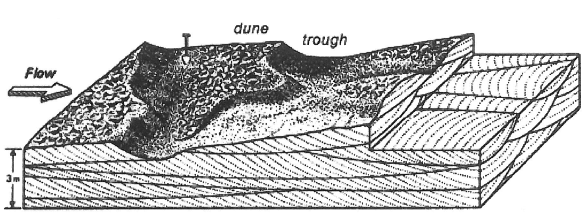
a - Early Fault Stage: Initiation stage: numerous isolated fluvio-lacustrine sub-basins.

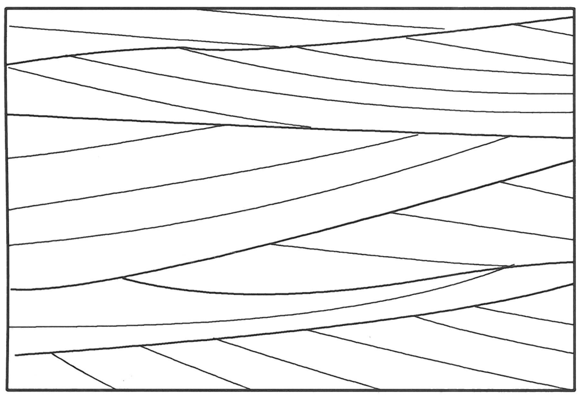


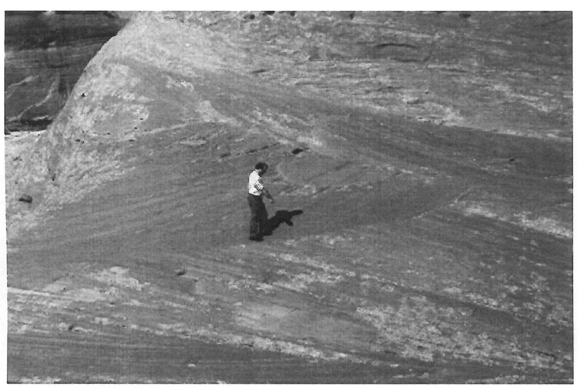
b - Interaction and Linkage Stage; abandonment of smaller grabens.

Trough, Planar, and Hummocky Cross Stratification

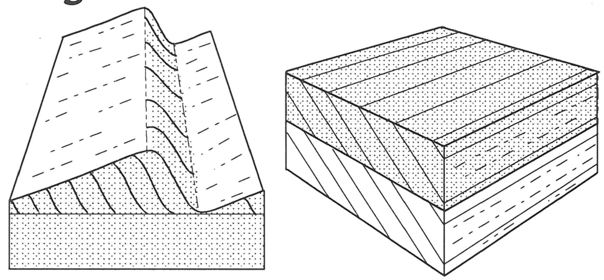
Large Trough Cross Stratification

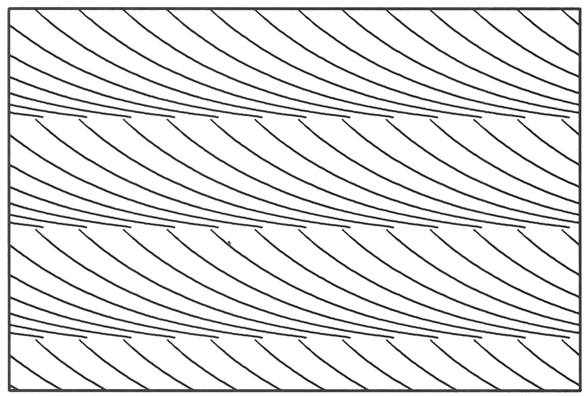


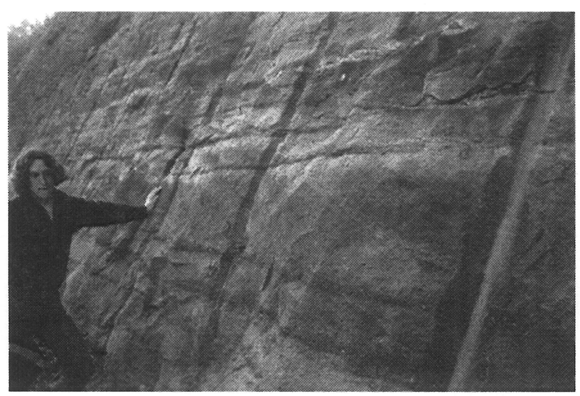




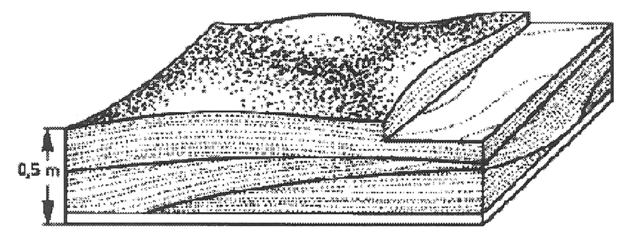
Large Planar Cross Stratification

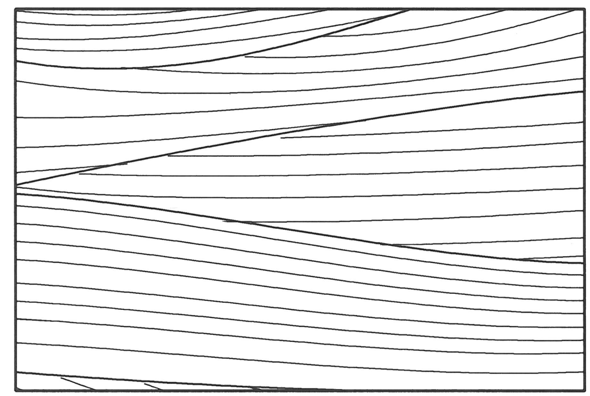




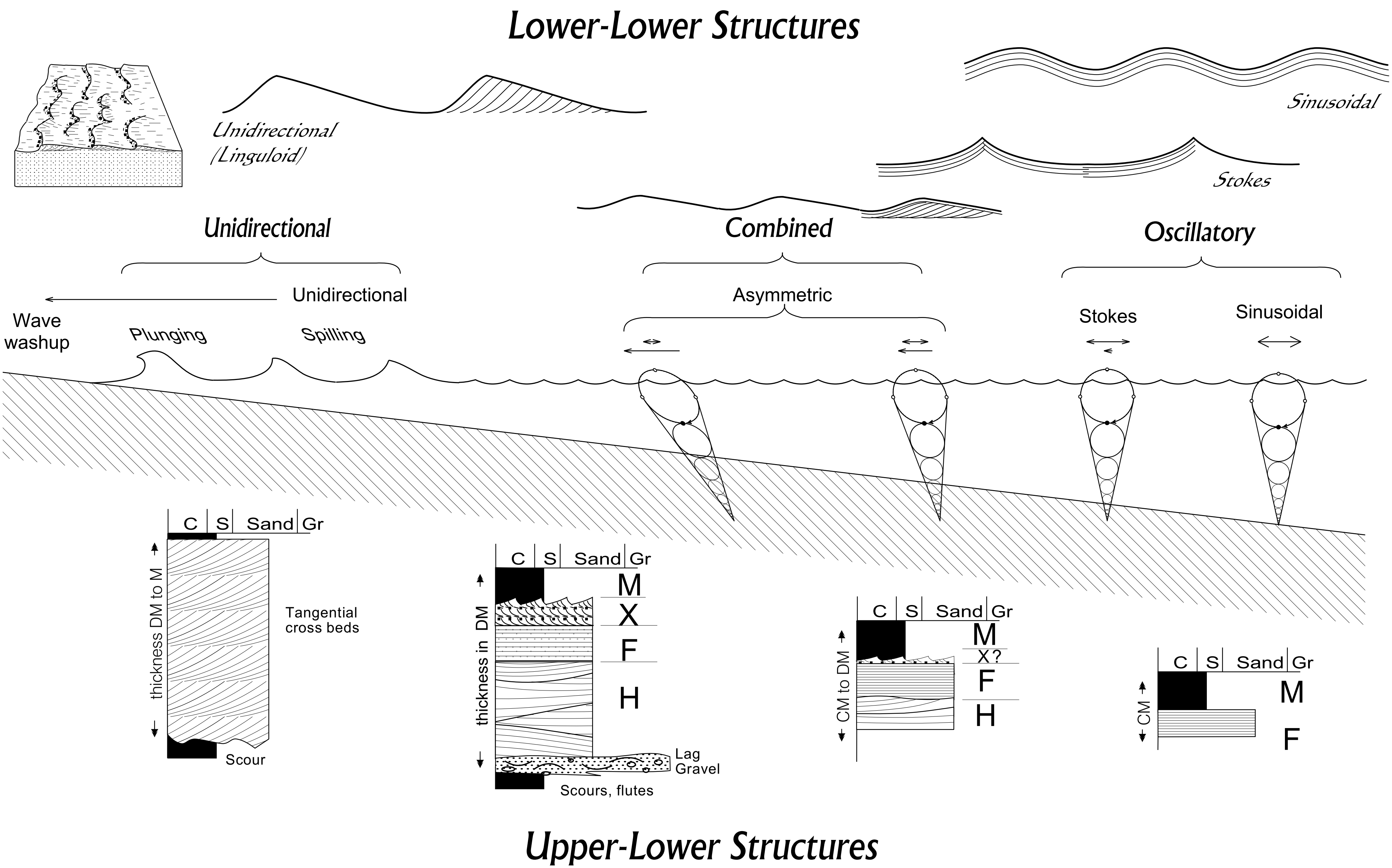


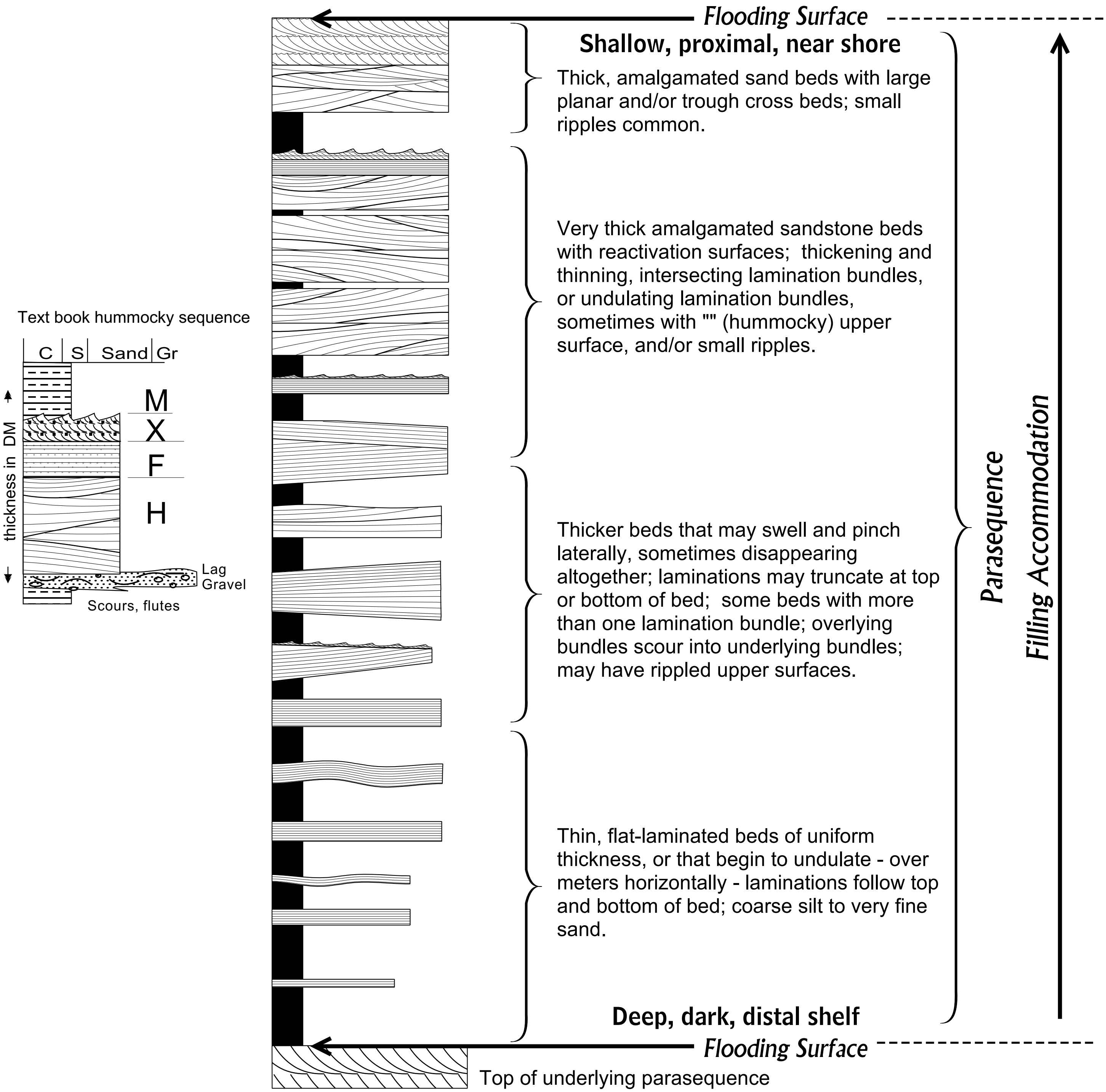
Hummocky Cross Stratification



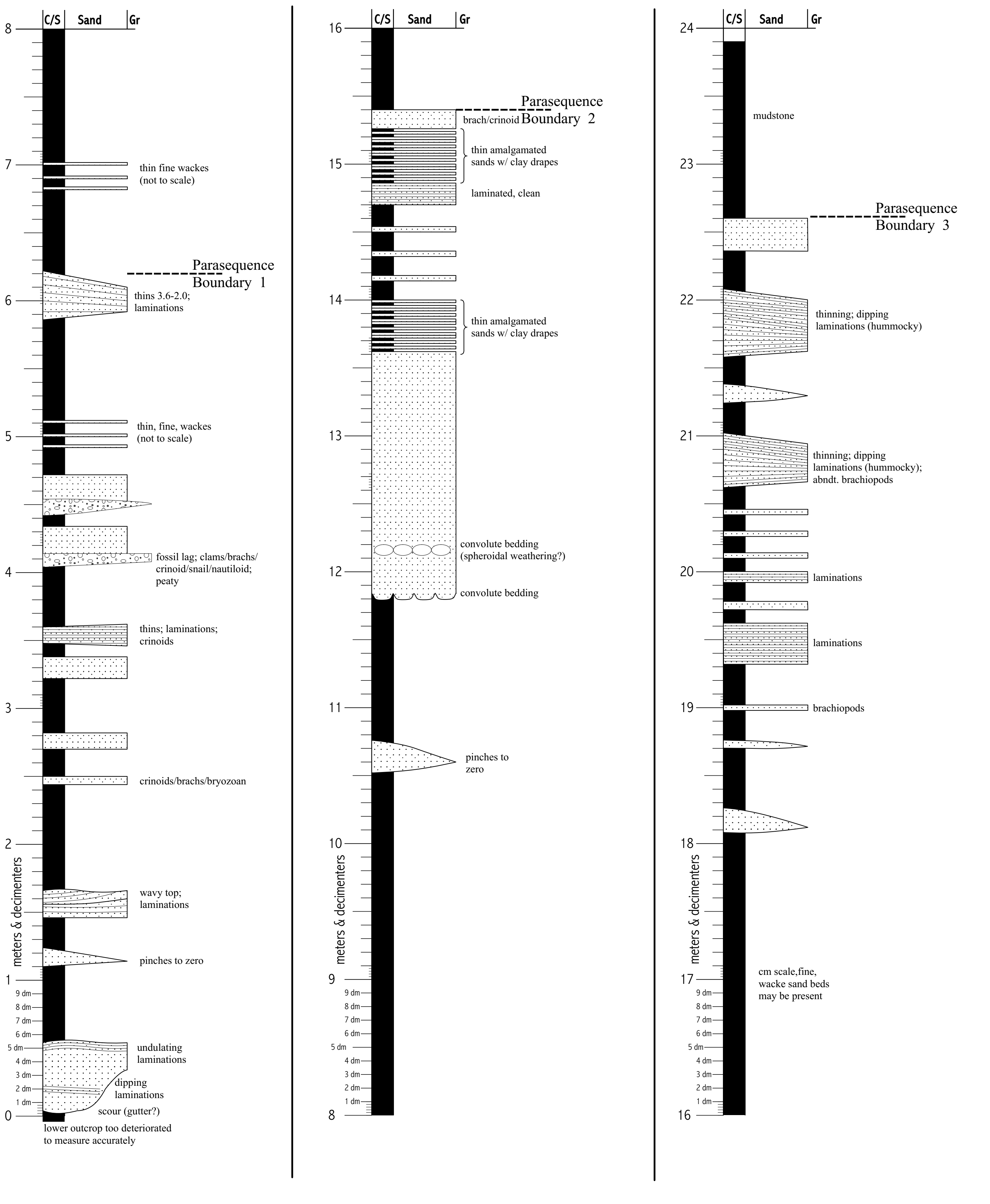


Wave Translation Across a Shallowing Shelf and Typical Structures

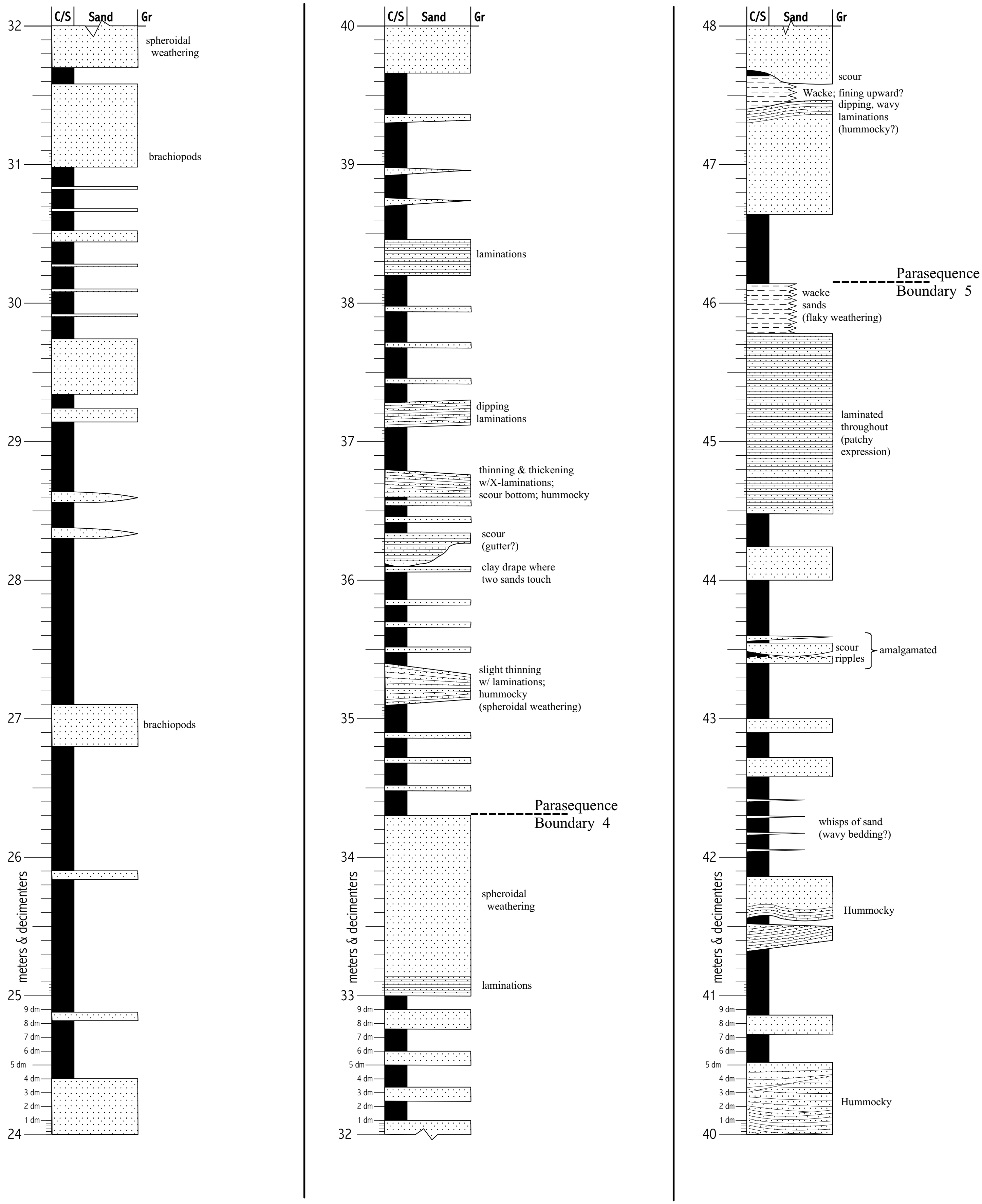



Flooding Surface
Shallow, proximal, near shore
Thick, amalgamated sand beds with large planar and/or trough cross beds; small ripples common.
Very thick amalgamated sandstone beds with reactivation surfaces; thickening and thinning, intersecting lamination bundles, or undulating lamination bundles, sometimes with "" (hummocky) upper surface, and/or small ripples.
Thicker beds that may swell and pinch laterally, sometimes disappearing altogether; laminations may truncate at top or bottom of bed; some beds with more than one lamination bundle; overlying bundles scour into underlying bundles; may have rippled upper surfaces.
Thin, flat-laminated beds of uniform thickness, or that begin to undulate - over meters horizontally - laminations follow top and bottom of bed; coarse silt to very fine sand.
Deep, dark, distal shelf
Flooding Surface
Top of underlying parasequence
Parasequence
Filling Accommodation
Text book hummocky sequence
C
S
Sand
Gr
M
X
F
H
thickness in DM
Lag
Gravel
Scours, flutes

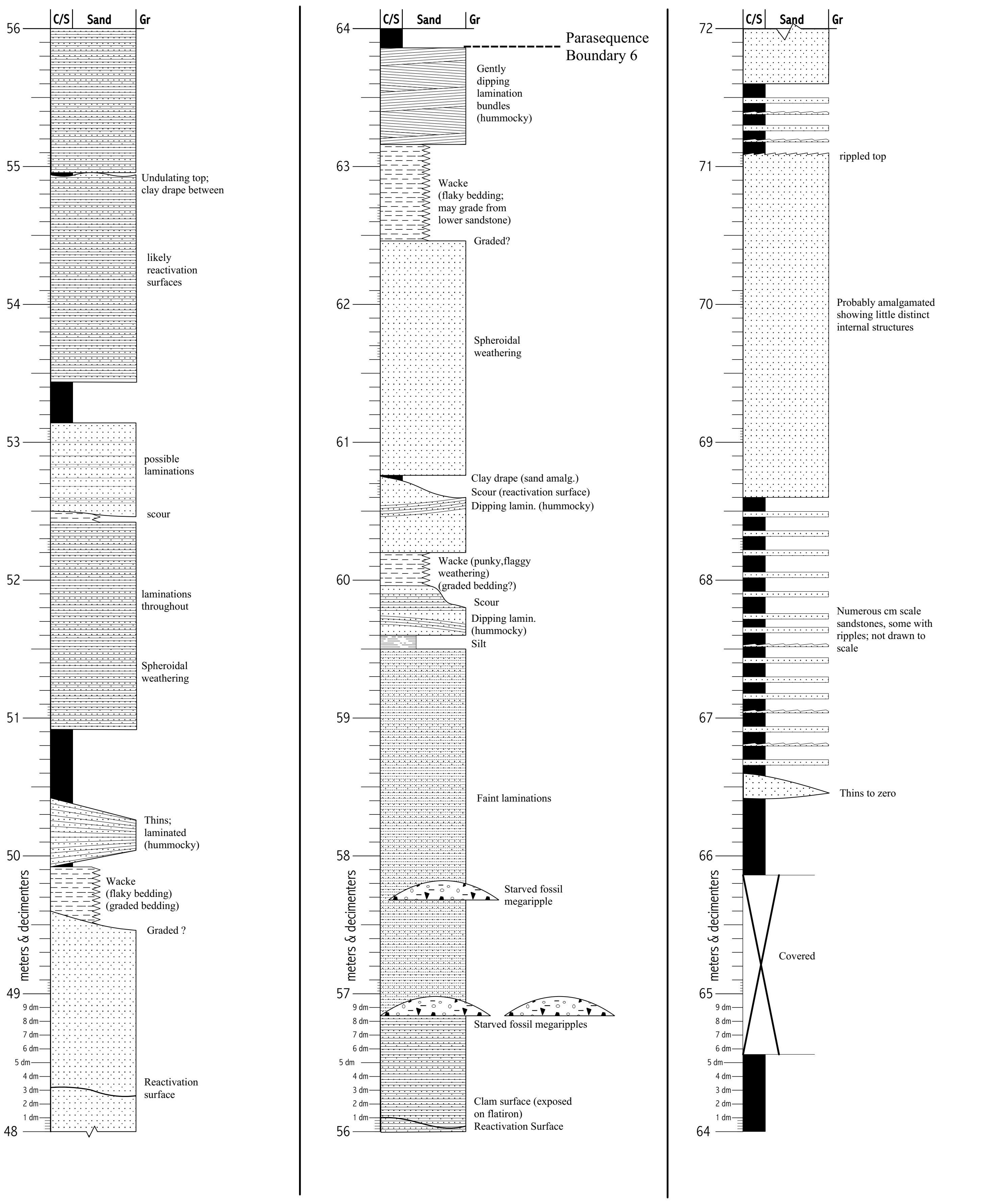
Upper Martinsburg (Cub Sandstone), Catherine Furnace.
Measured by Rick Diecchio and Lynn Fichter, August, 2012



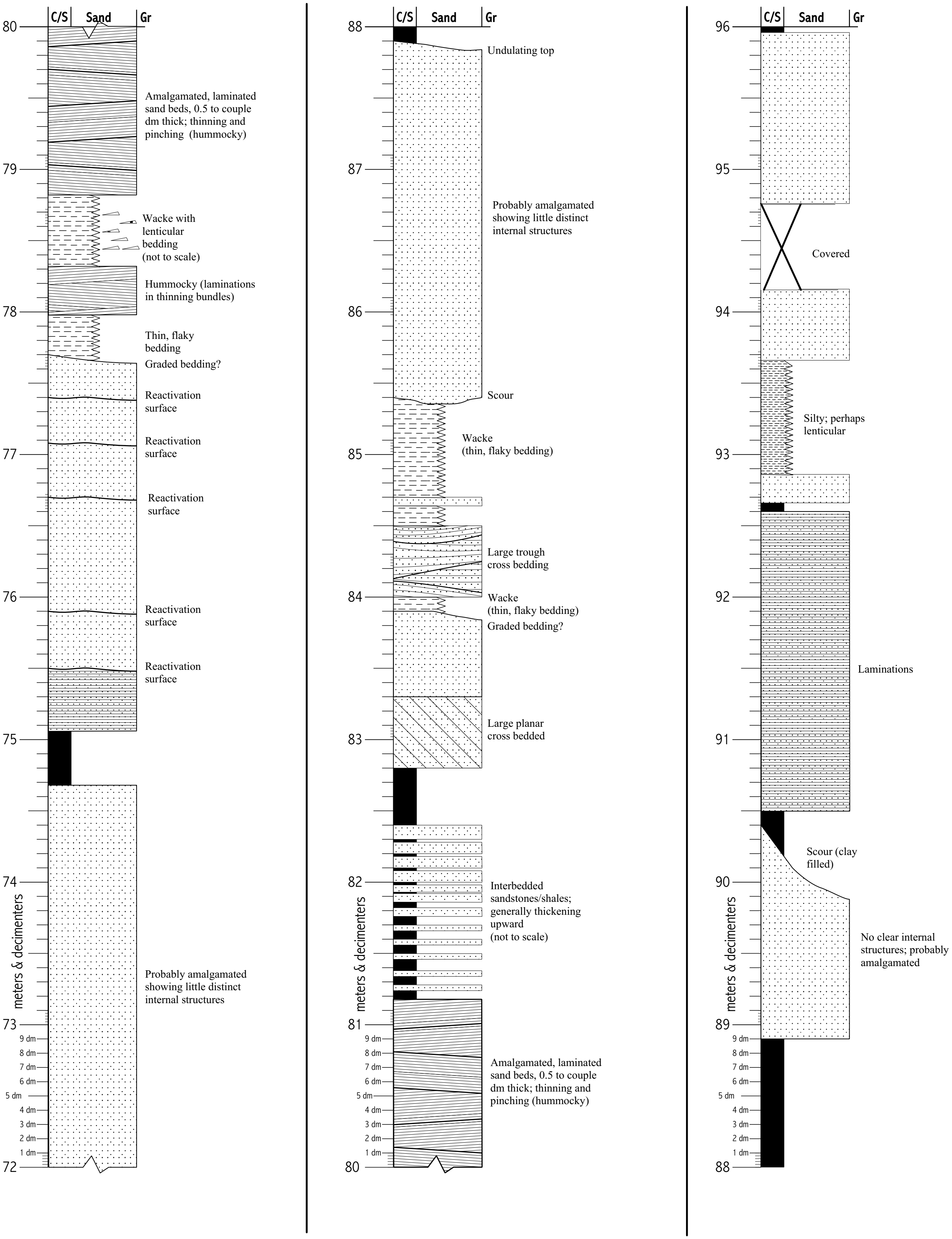
Upper Martinsburg (Cub Sandstone), Catherine Furnace.
Measured by Rick Diecchio and Lynn Fichter, August, 2012



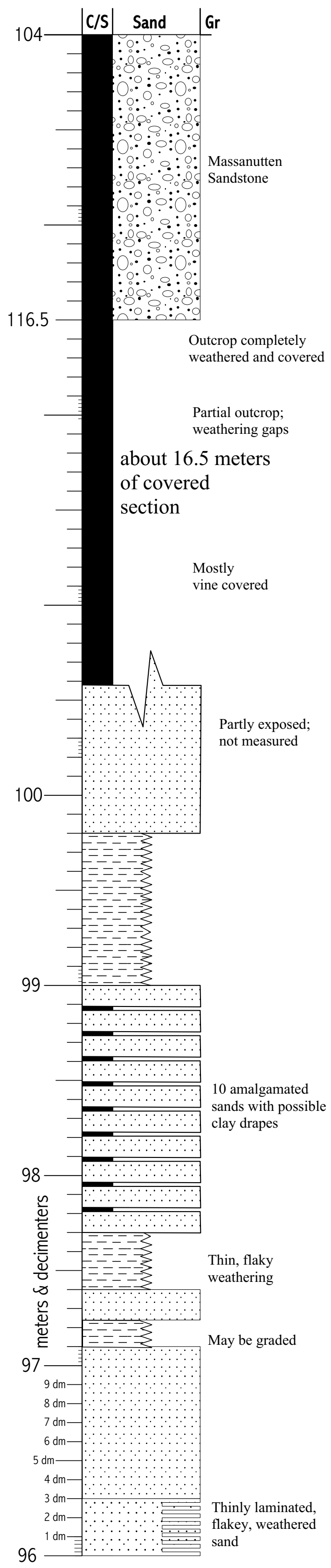
Upper Martinsburg (Cub Sandstone), Catherine Furnace.
Measured by Rick Diecchio and Lynn Fichter, August, 2012



Upper Martinsburg (Cub Sandstone), Catherine Furnace.
Measured by Rick Diecchio and Lynn Fichter, August, 2012



Upper Martinsburg (Cub Sandstone), Catherine Furnace.
Measured by Rick Diecchio and Lynn Fichter, August, 2012



State of the Outcrop and Measured Section

The Catherine's Furnace section of the "Cub sandstone" or upper Martinsburg is badly deteriorated by weathering, masking many of the sedimentologic and stratigraphic signatures. Some relatively clean arenite beds do stand out, but wacke beds are more common and often have diffuse boundaries, especially at the top where they may grade or fine upward into flaky weathered units looking superficially like weathered silt or shale but on close examination are sand rich. Many parts of the outcrop that look to be dominated by weathered shale/silt have sand rich zones that may be lenticular, wavy, or flaser-type bedding, but without distinct bed contacts to identify them. Sand rich zones were not mapped as beds unless distinct contacts were visible. We frequently used the cleavage to distinguish shale layers because the shale cleavage differs by a few degrees from the bedding fissility of weathered wacke or silt beds.

Many of the sand beds change thickness laterally, thickening and/or thinning, or pinching to zero, but it is easy to miss these changes. The thickening/thinning may occur on both the top and bottom of the bed; or on one or the other; often it is not possible to tell. Some sandstones shows internal layering (laminations or cross bedding), and were indicated as such, but many do not, or have only a faint hint of internal layering. We assume that all the sandstone beds were deposited by flow regime conditions that would result in laminations, beds, or bedsets (as opposed to mass transport mechanisms), consistent with the beds for which we do have flow regime structures

Many of the thicker sandstone beds are almost certainly amalgamated (composed of more than one deposition event separated by reactivation surfaces, such as scours, clay drapes, or pebble lags). In some cases the reactivation surfaces were visible, but often they were not. Flow regime and environmental interpretations are based on a composite of all the information in the section and extrapolated to parts of the section where evidence was sketchy or missing. Our interpretation is most consistent with storm shelf parasequence models.

It is difficult to be entirely objective when measure a section like this. We strove to be consistent in the accuracy and precision of the data collected, especially across the coarsening/thickening upward changes in the section, but someone else might make different judgements about what is significant or not, and therefore what patterns are present. We welcome discussion and debate on these differences of observation and opinion.

Condensed Section (red)

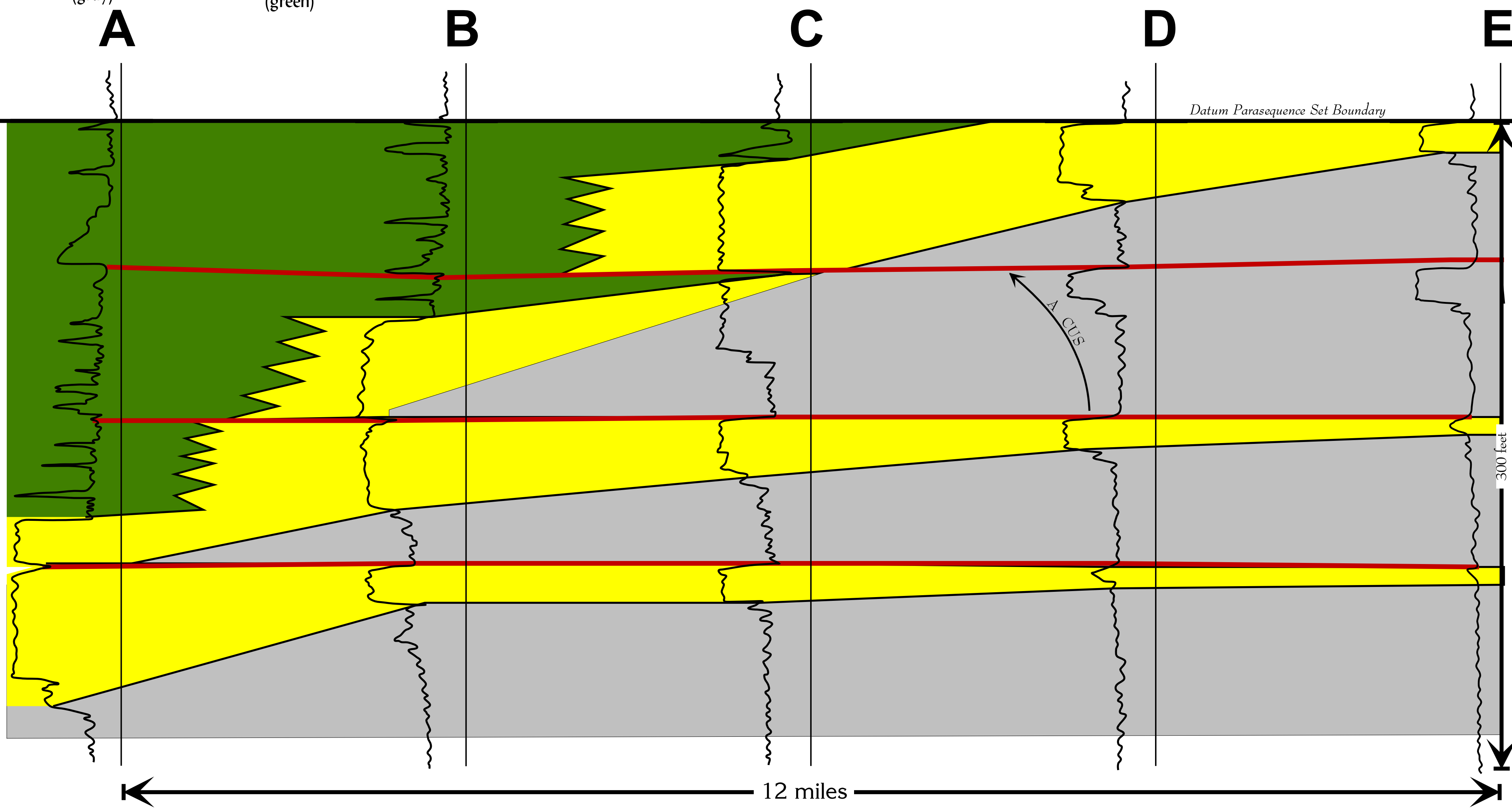
Offshore (gray)

Mid to Upper Shoreface (yellow)

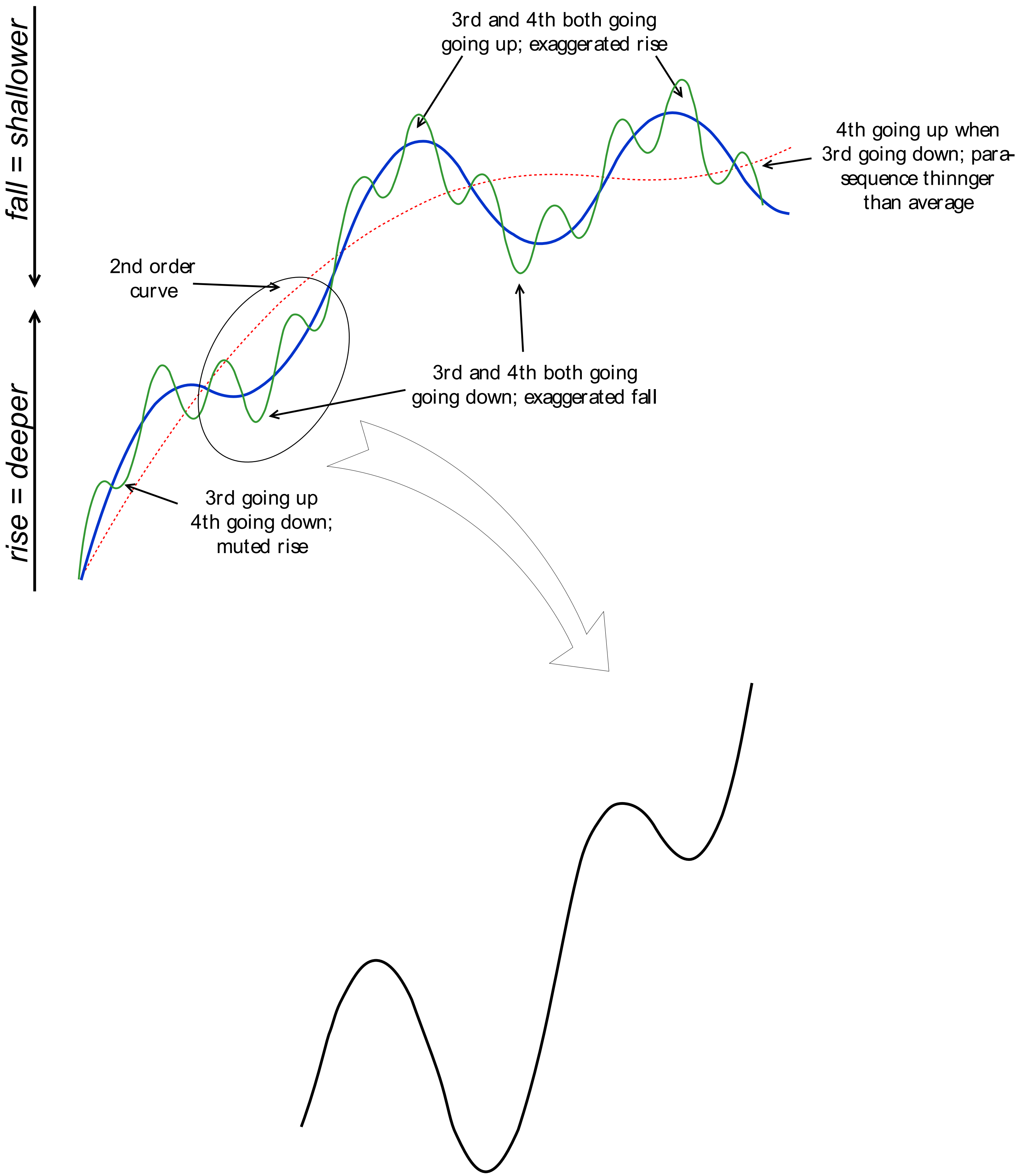
Coastal Plain (green)

Gamma Log Parasequence Correlation

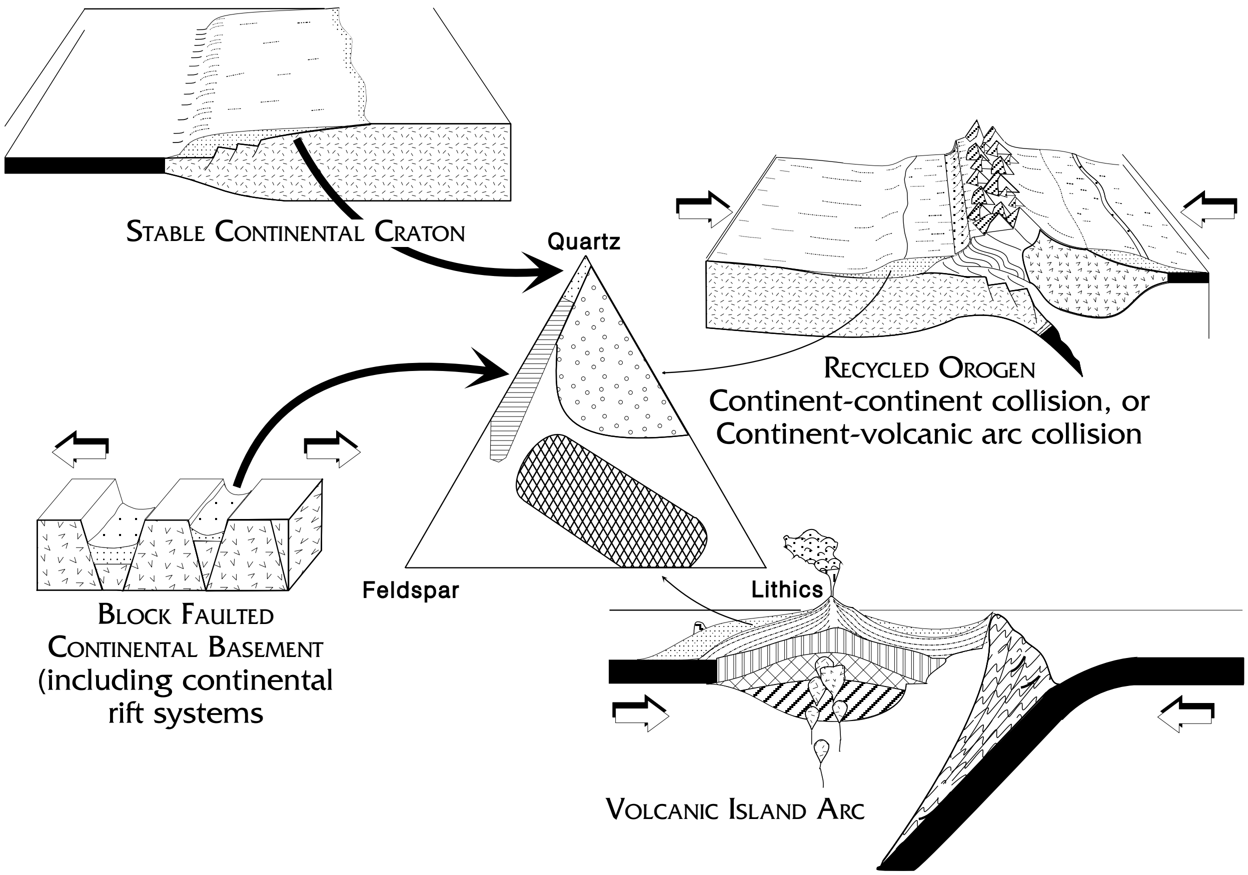
Name: ____________________

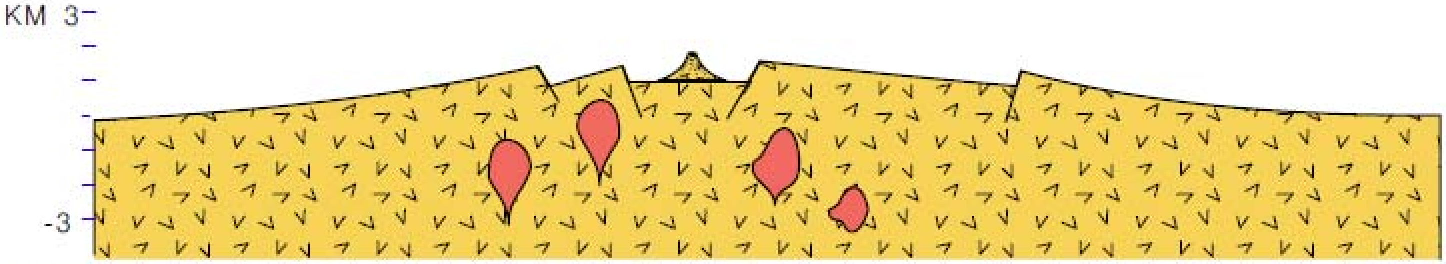


Composite Sea Level Curves and Sequences

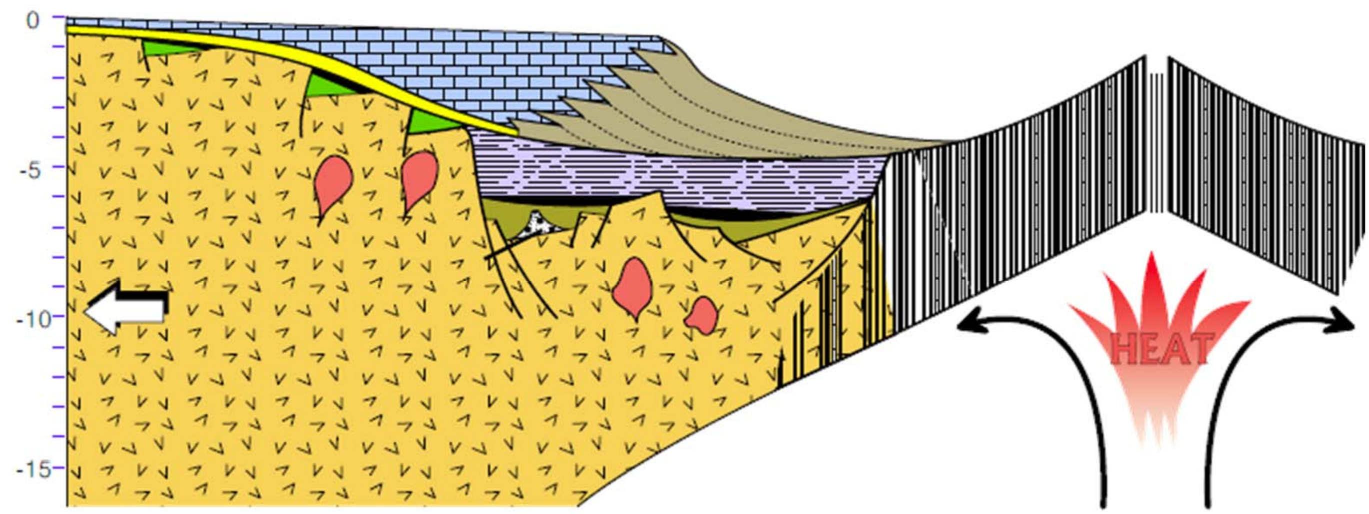


The QFL Distribution Of Sedimentary Rocks In Various Tectonic Regimes

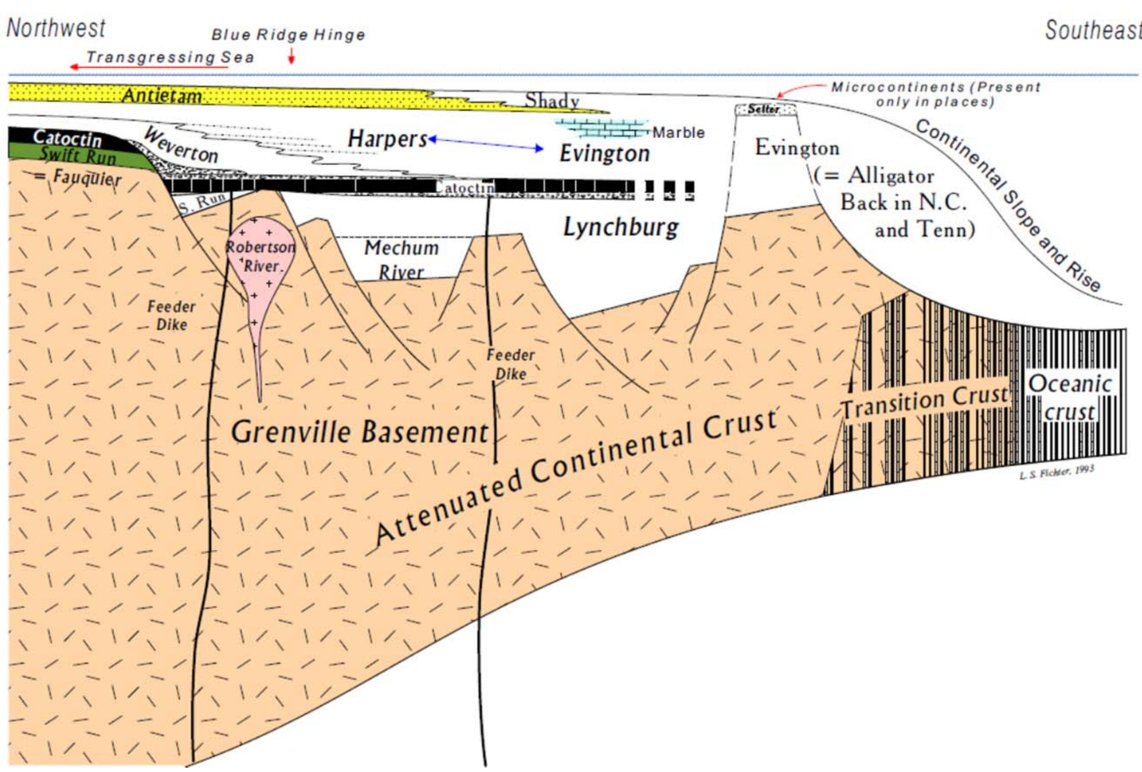


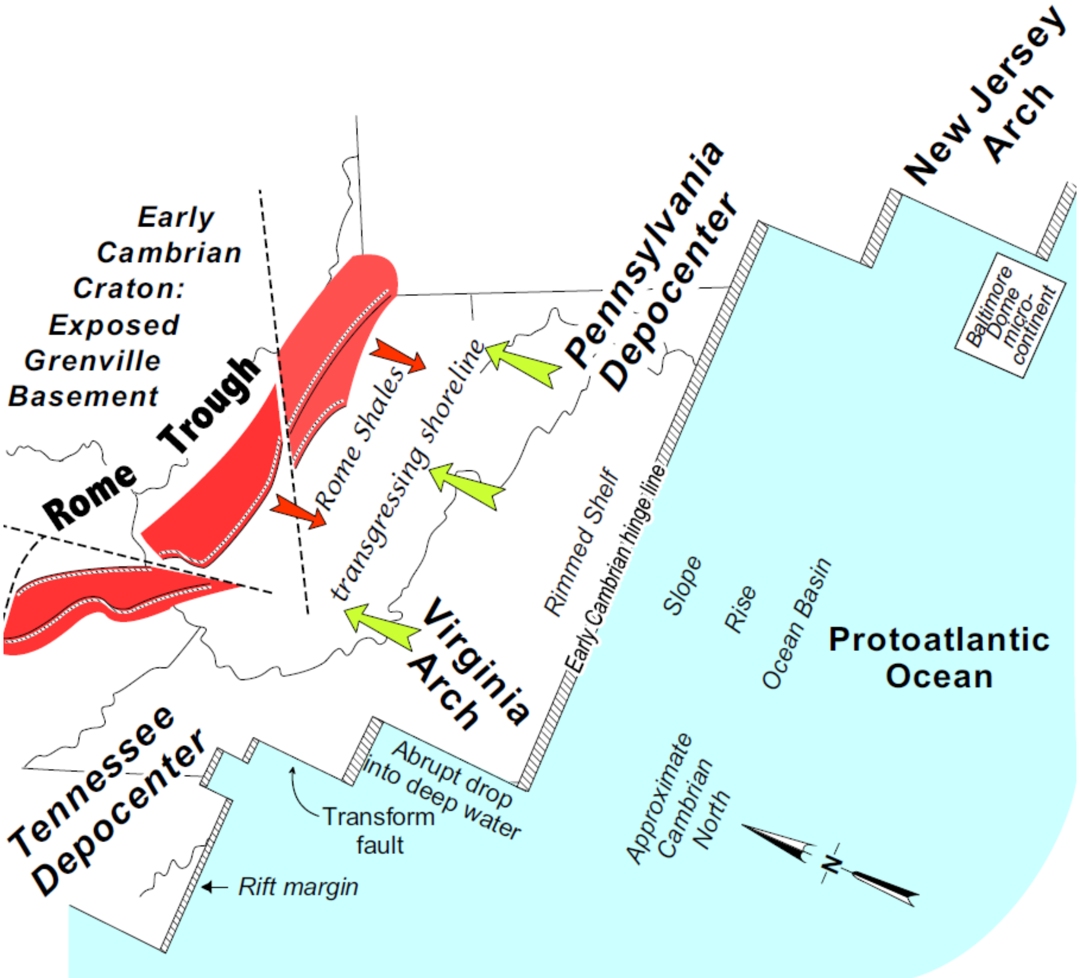


Hot Spot / Thermal Doming

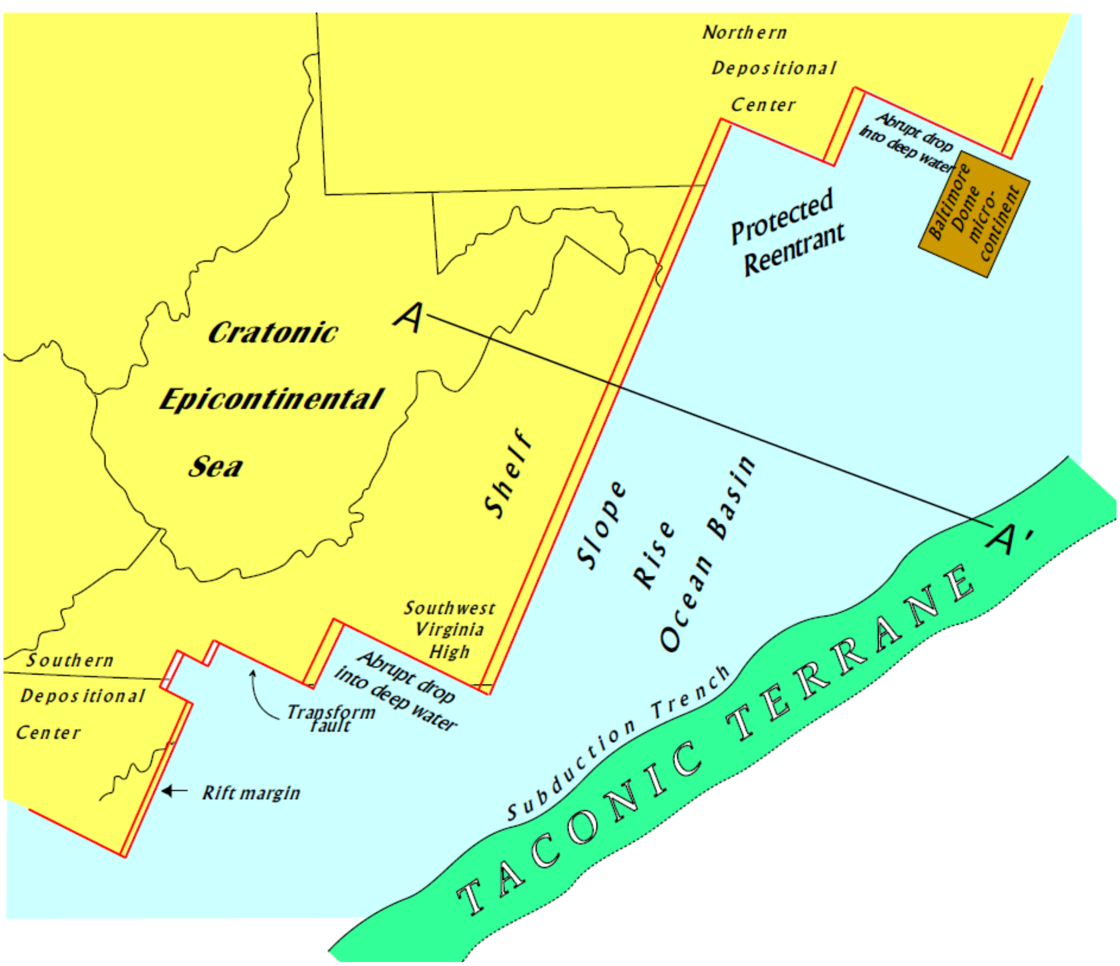


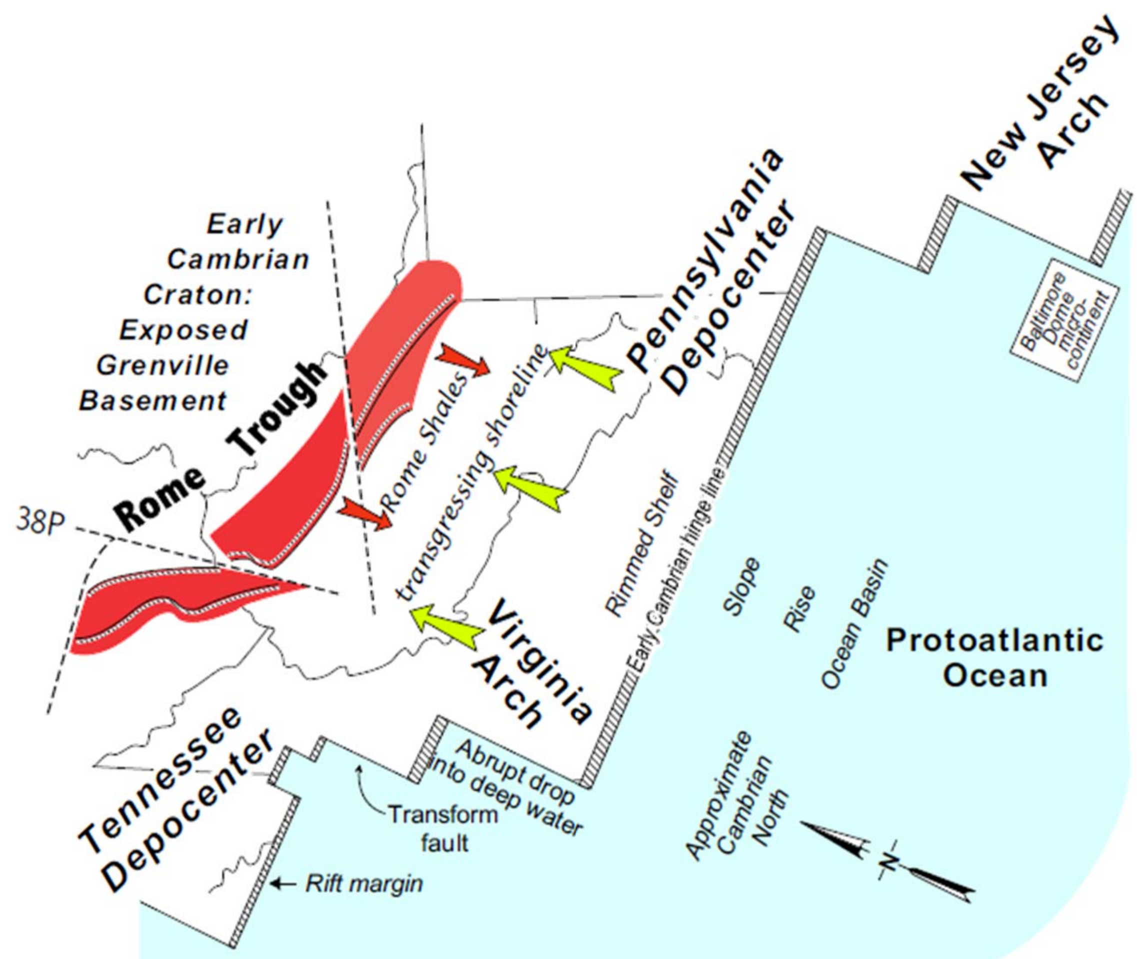
Early Divergent Margin

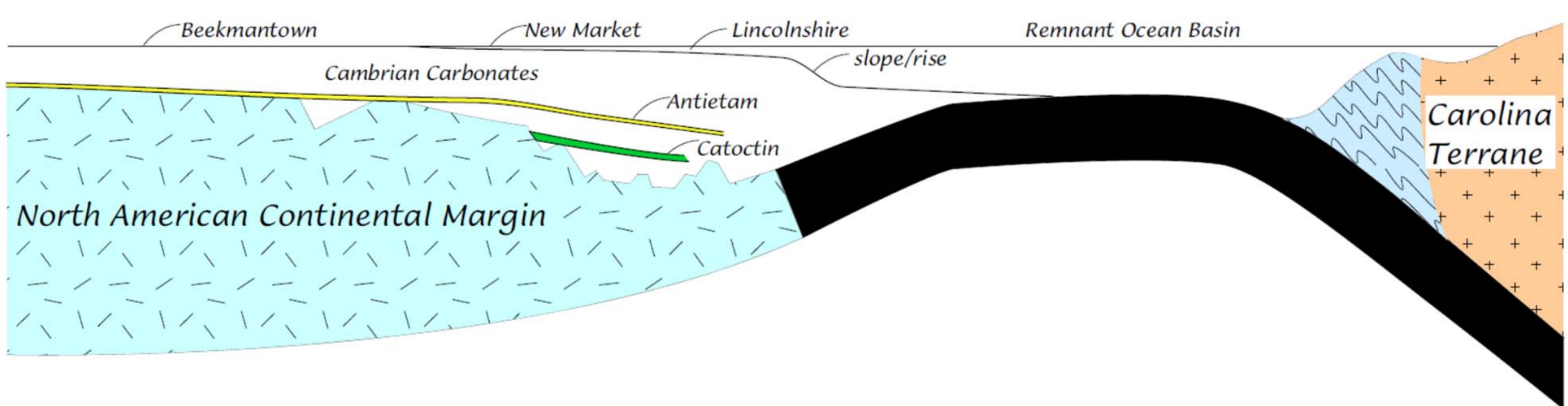


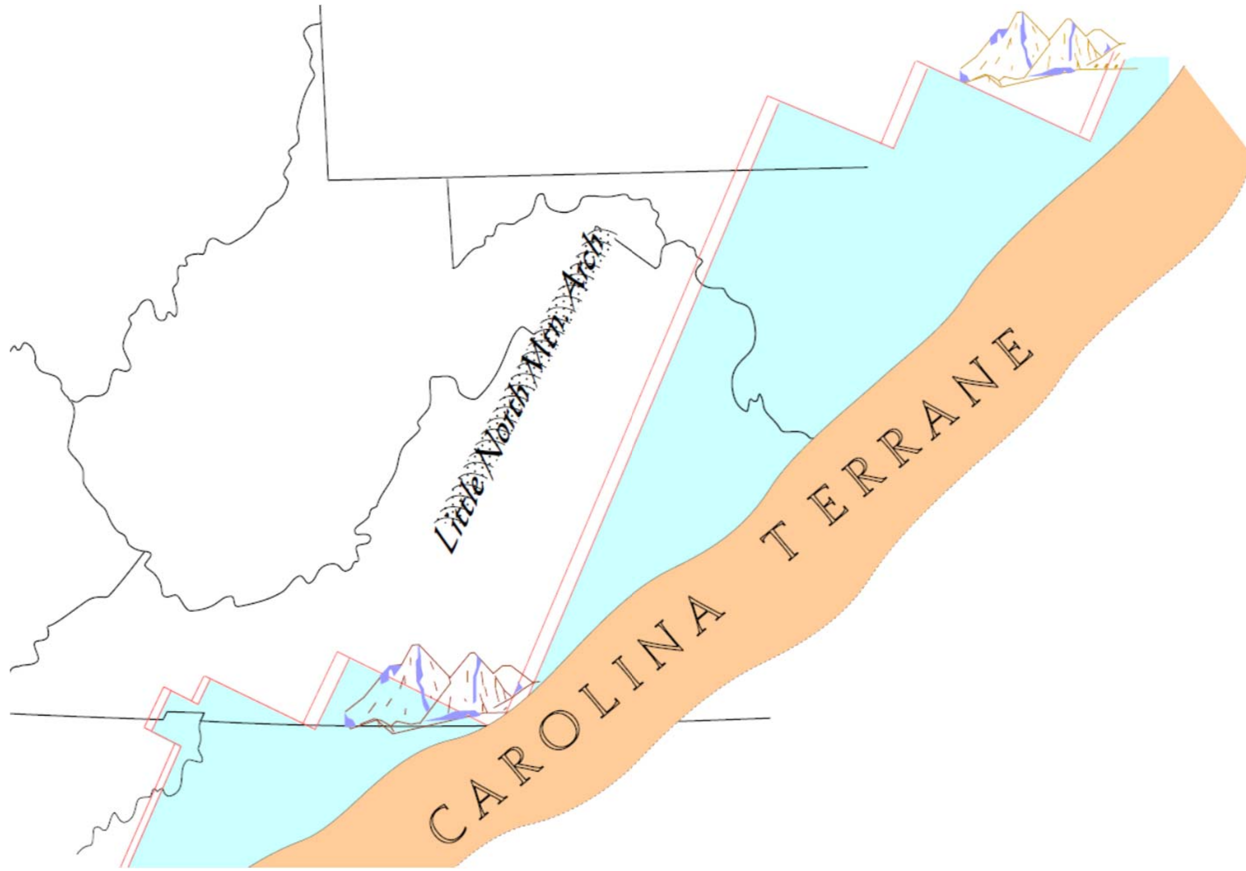


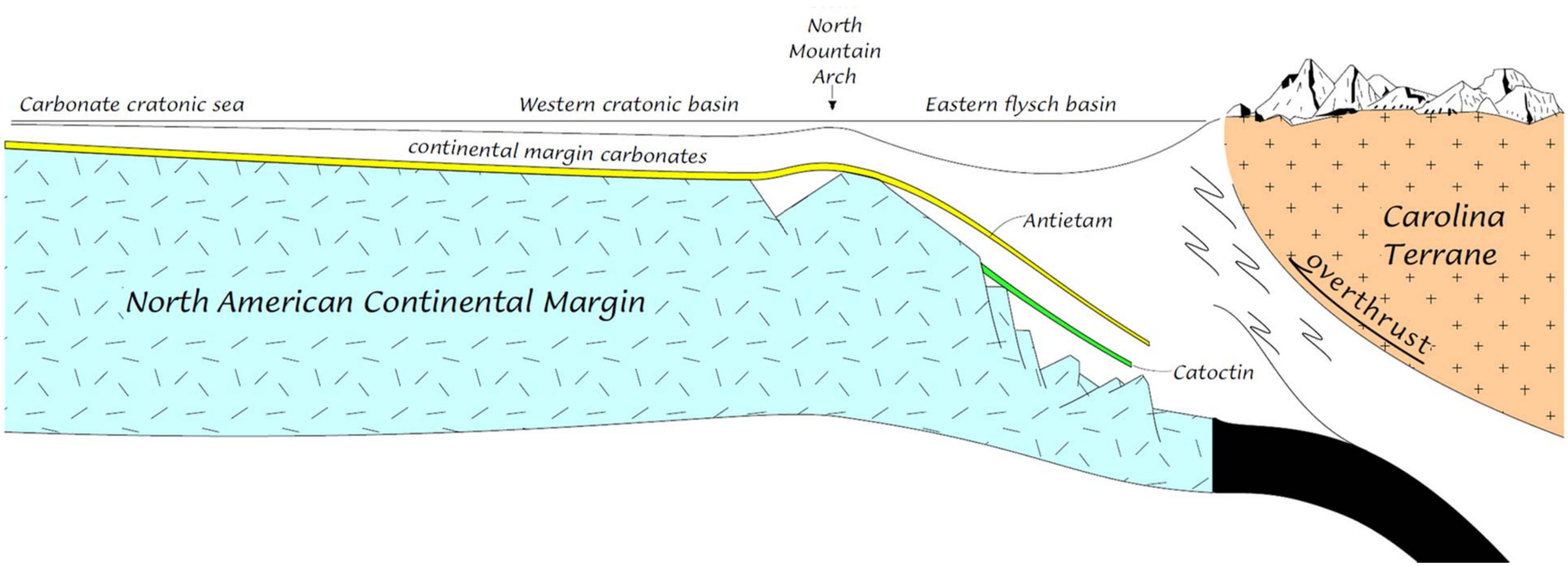
Cambrian Continental Margin



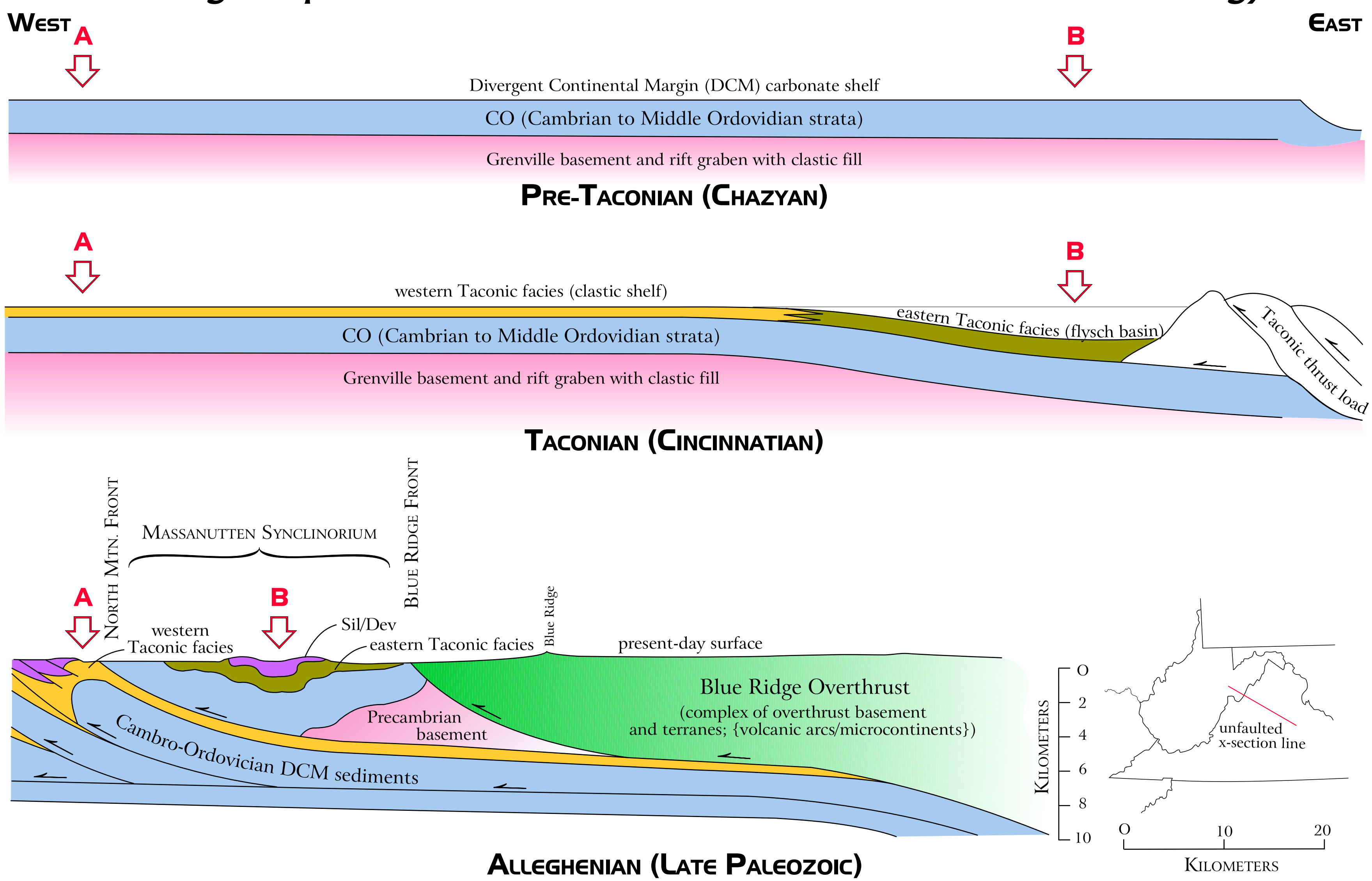

Early
Cambrian
Craton:
Exposed
Grenville
Basement
Rome Trough
38P
Rome Shales
transgressing shoreline
Pennsylvania
Depocenter
New Jersey
Arch
Baltimore
Dome
micro-
continent
Rimmed Shelf
Early Cambrian hinge line
Slope
Rise
Ocean Basin
Protoatlantic
Ocean
Virginia
Arch
Tennessee
Depocenter
Abrupt drop
into deep water
Transform
fault
Rift margin
Approximate
Cambrian
North
N


Beekmantown
New Market
Lincolnshire
Remnant Ocean Basin
slope/rise
Cambrian Carbonates
Antietam
Catoctin
North American Continental Margin
Carolina
Terrane

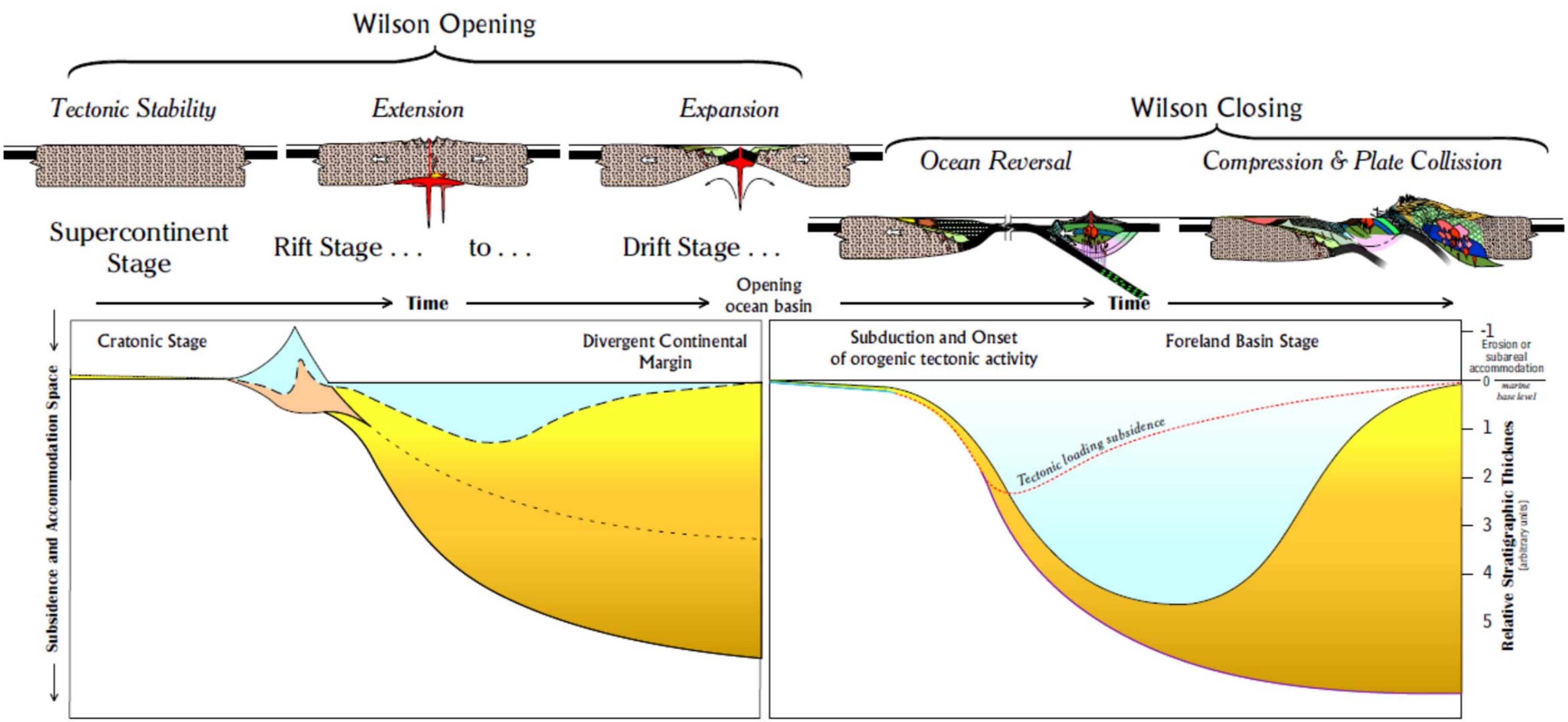

Little North Mtn. Arch
CAROLINA TERRANE


North Mountain Arch
Carbonate cratonic sea
Western cratonic basin
Eastern flysch basin
continental margin carbonates
Antietam
Catoctin
North American Continental Margin
Carolina Terrane
overthrust

Interpretive Cross Sections From Eastern West Virginia Across Northern Virginia Showing Deep and Shallow Taconic Facies Relative to Present Geology



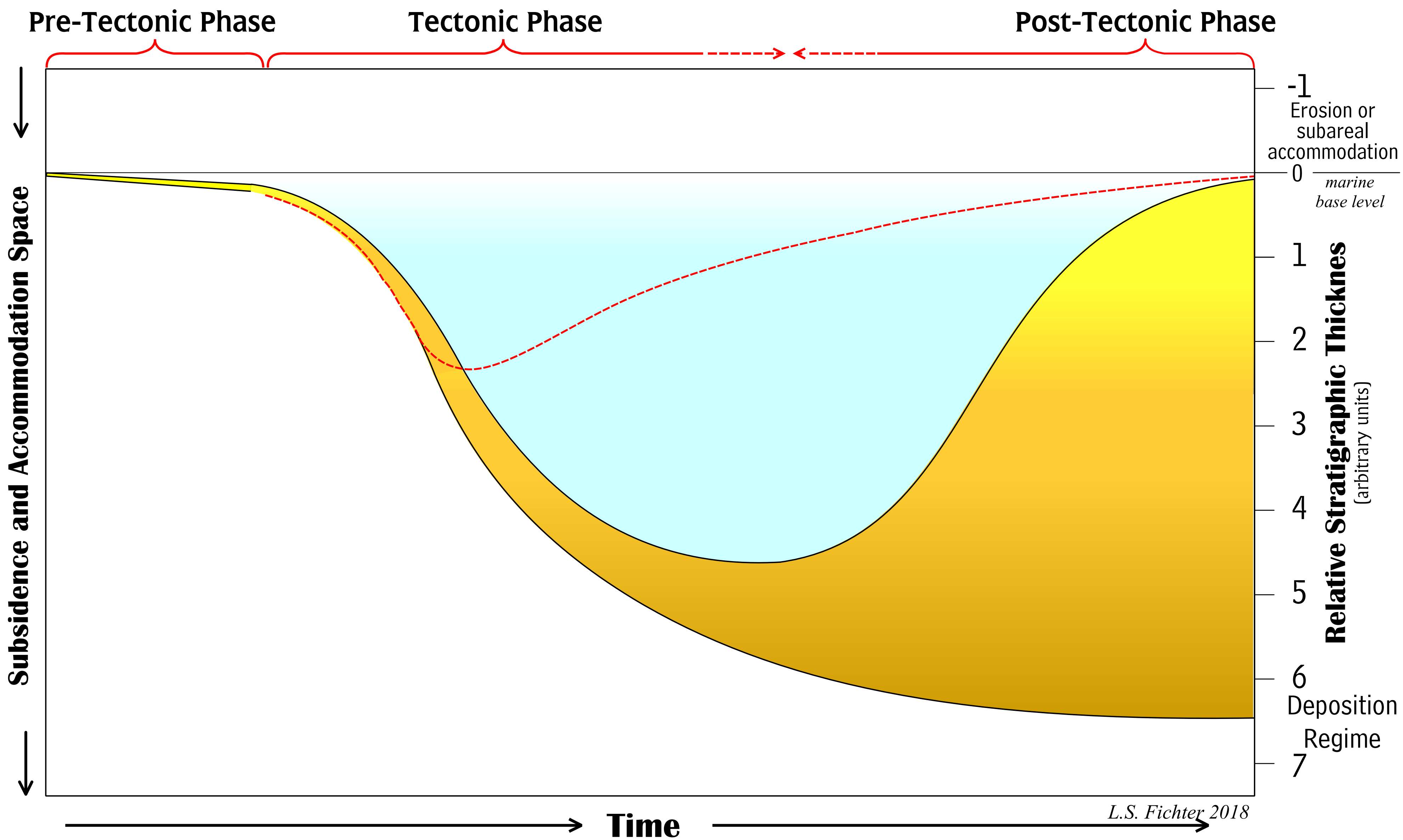
R.J. Diecchio, 1993 Tectonics v 12, no 6,
redrawn by L.S. Fichter, 1999



Wilson Opening
Tectonic Stability
Extension
Expansion
Wilson Closing
Ocean Reversal
Compression & Plate Collission
Supercontinent Stage
Rift Stage . . .
to . . .
Drift Stage . . .
Time
Opening ocean basin
Time
Cratonic Stage
Divergent Continental Margin
Subduction and Onset of orogenic tectonic activity
Foreland Basin Stage
Tectonic loading subsidence
Subsidence and Accommodation Space
-1
Erosion or subareal accommodation
0
marine base level
1
2
3
4
5
Relative Stratigraphic Thicknes
(arbitrary units)

SAATS Model for the History of a Foreland Basin

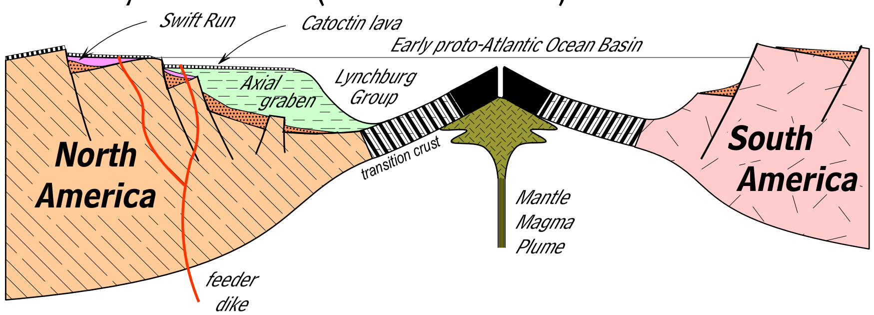
(Subsidence-Accommodation-Accumuation-Time-Series)



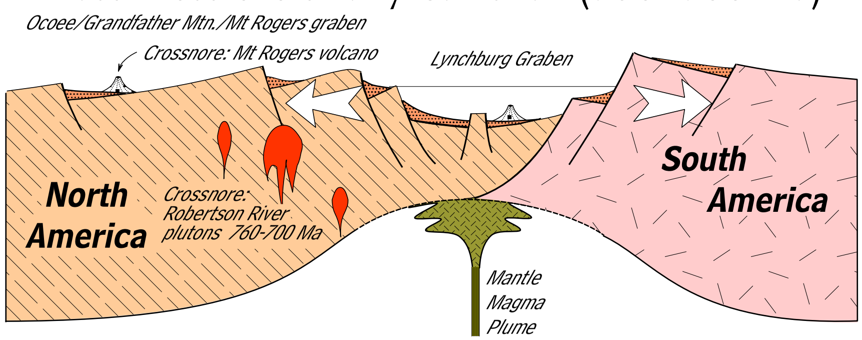
Version 8.1

Predictive Model for Development of the Chilhowee Group in the Blue Ridge From Elkton to Luray, Virginia

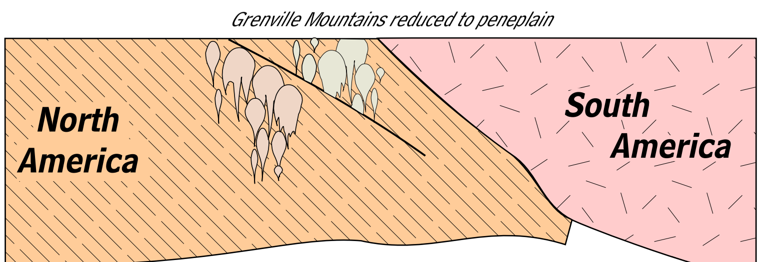
F - Early Cambrian (700 - 570 Ma)



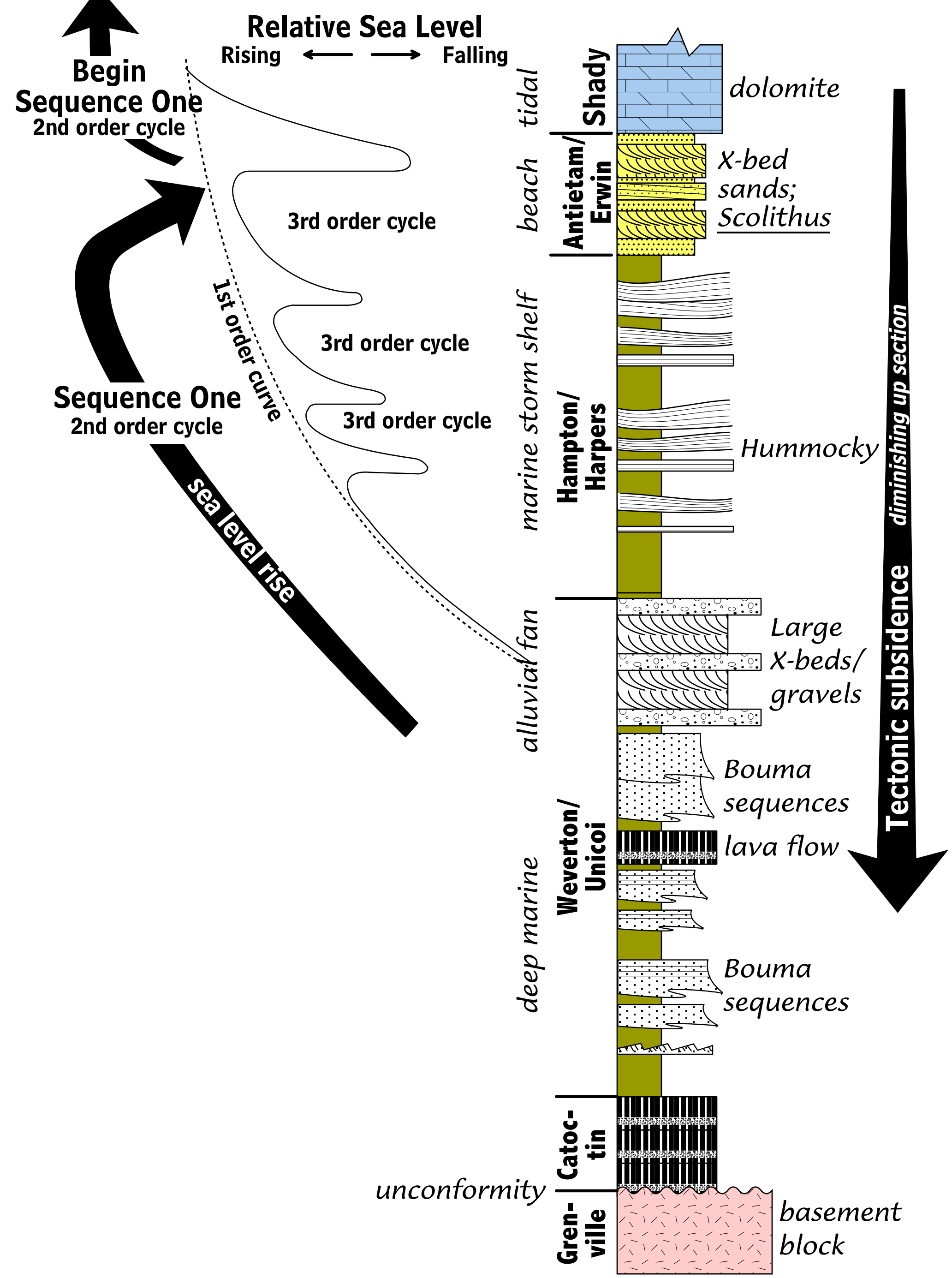
E - Late Proterozoic-Early Cambrian (760 -700 Ma)

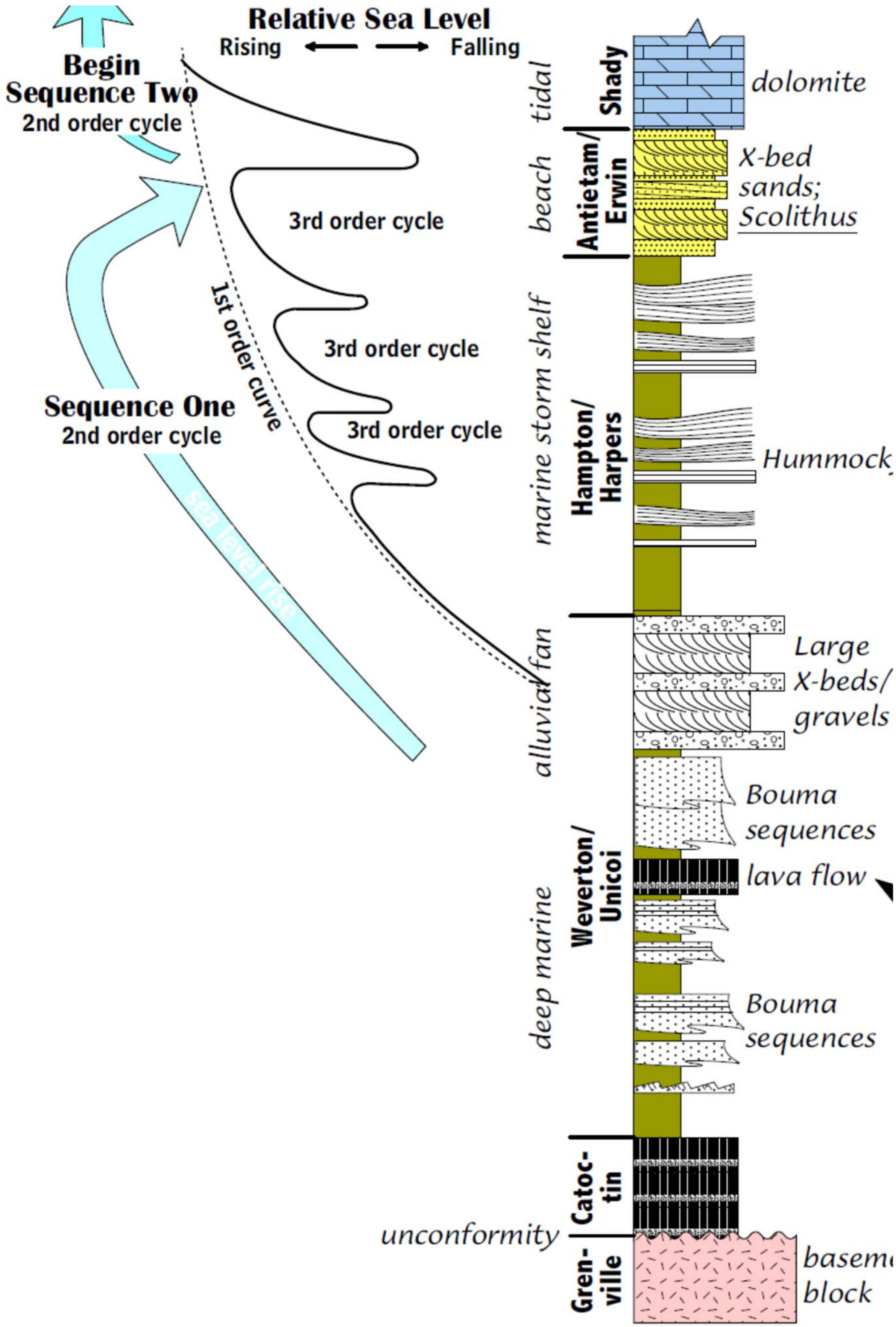


D - Late Proterozoic (~0.8 Ga)



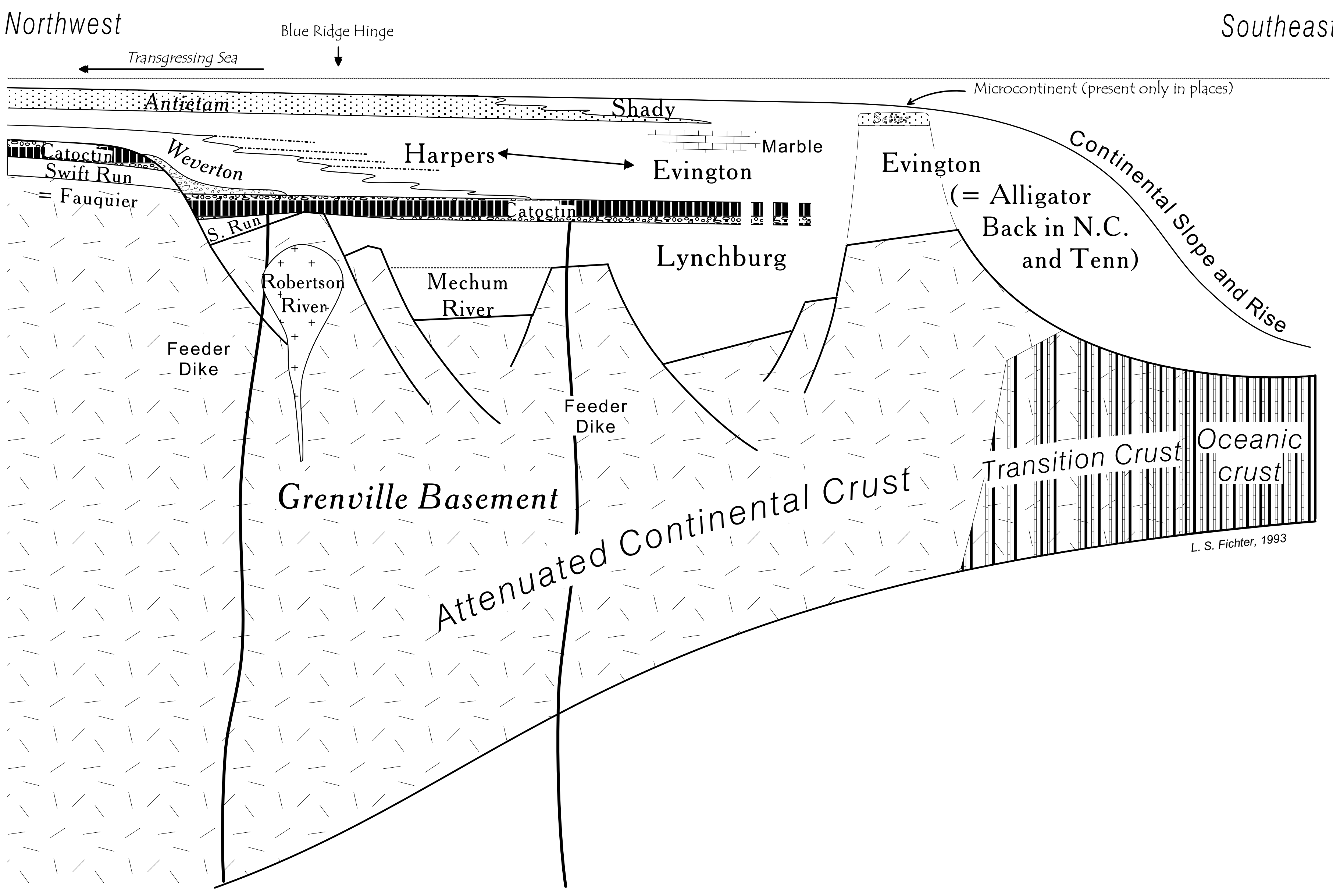
Erosion of Grenville mountains exposing metamorphosed batholiths; initiation of the largest unconformity in the region's history, now exposed in the Blue Ridge mountains.

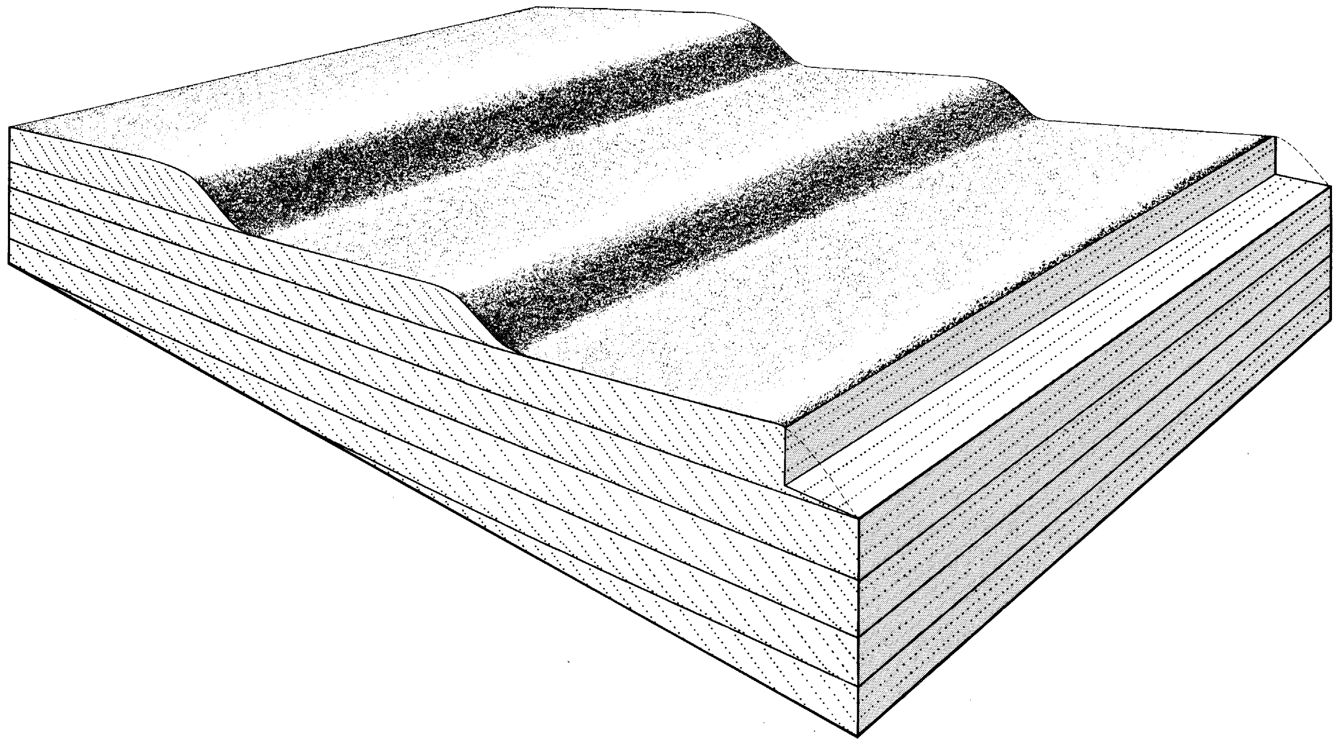


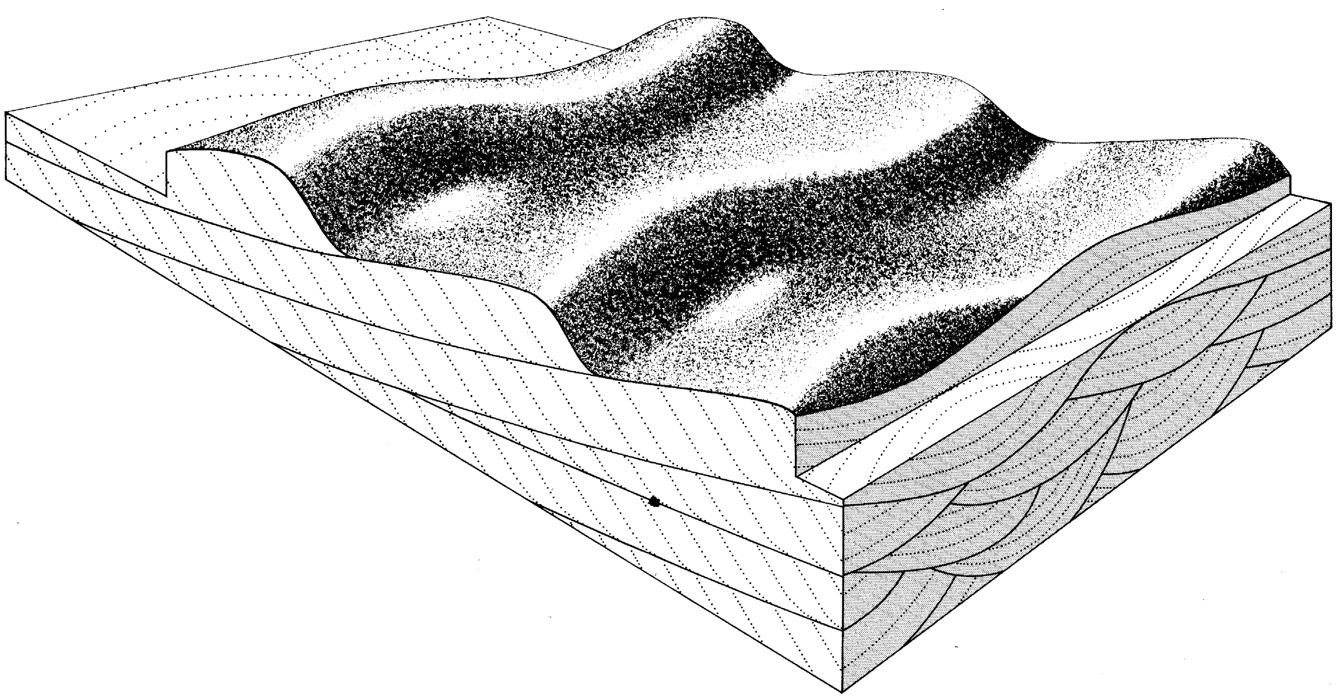


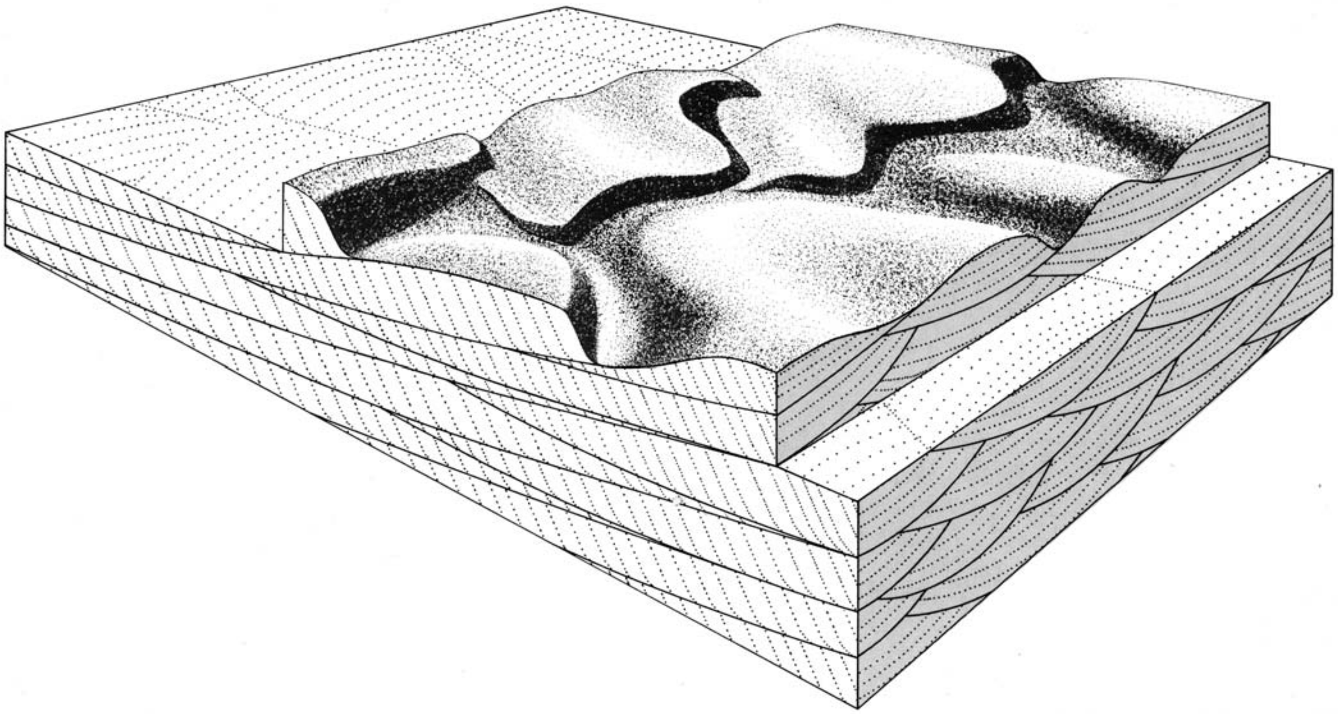
Relative Sea Level
Rising
Falling
Begin
Sequence Two
2nd order cycle
3rd order cycle
3rd order cycle
3rd order cycle
1st order curve
Sequence One
2nd order cycle
sea level rise
tidal
beach
marine storm shelf
alluvial fan
deep marine
unconformity
Shady
Antietam/
Erwin
Hampton/
Harpers
Weverton/
Unicoi
Catoc-
tin
Gren-
ville
dolomite
X-bed
sands;
Scolithus
Hummock
Large
X-beds/
gravels
Bouma
sequences
lava flow
Bouma
sequences
basem
block

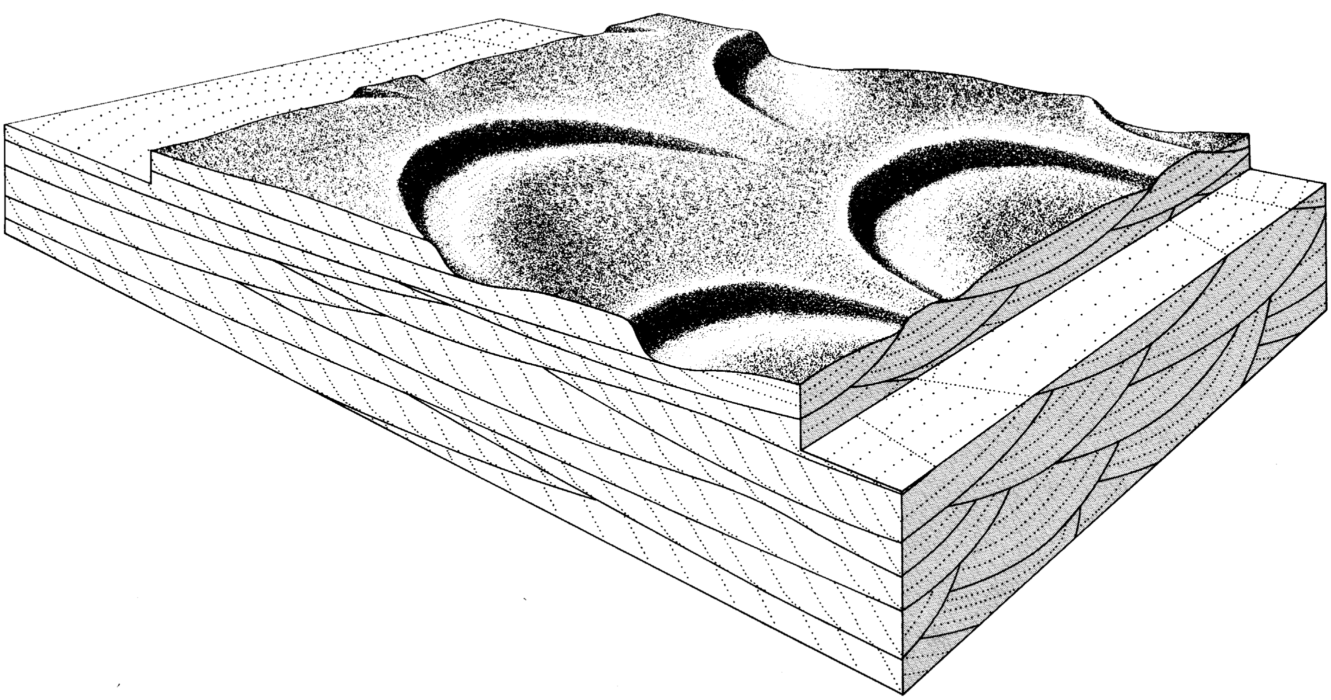
Composite Reconstruction Across the Blue Ridge During the Lower Cambrian





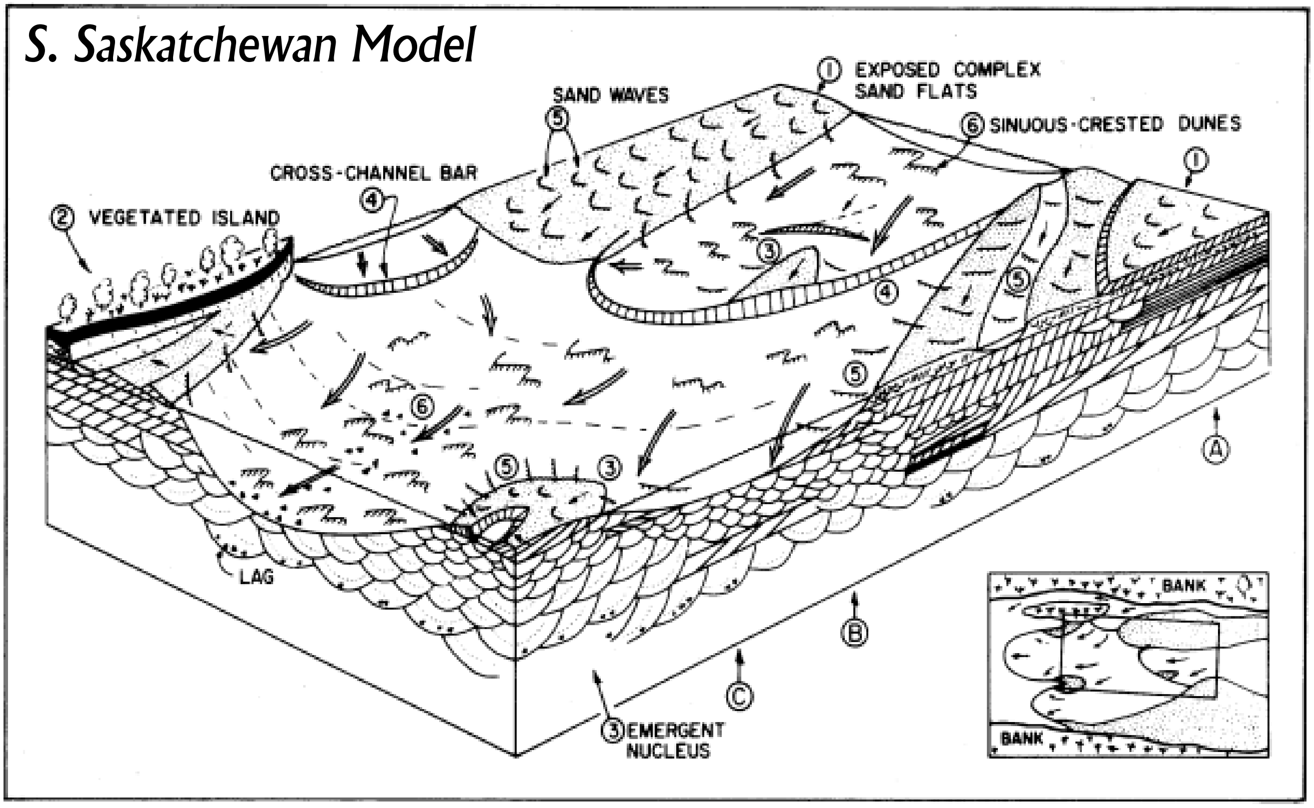




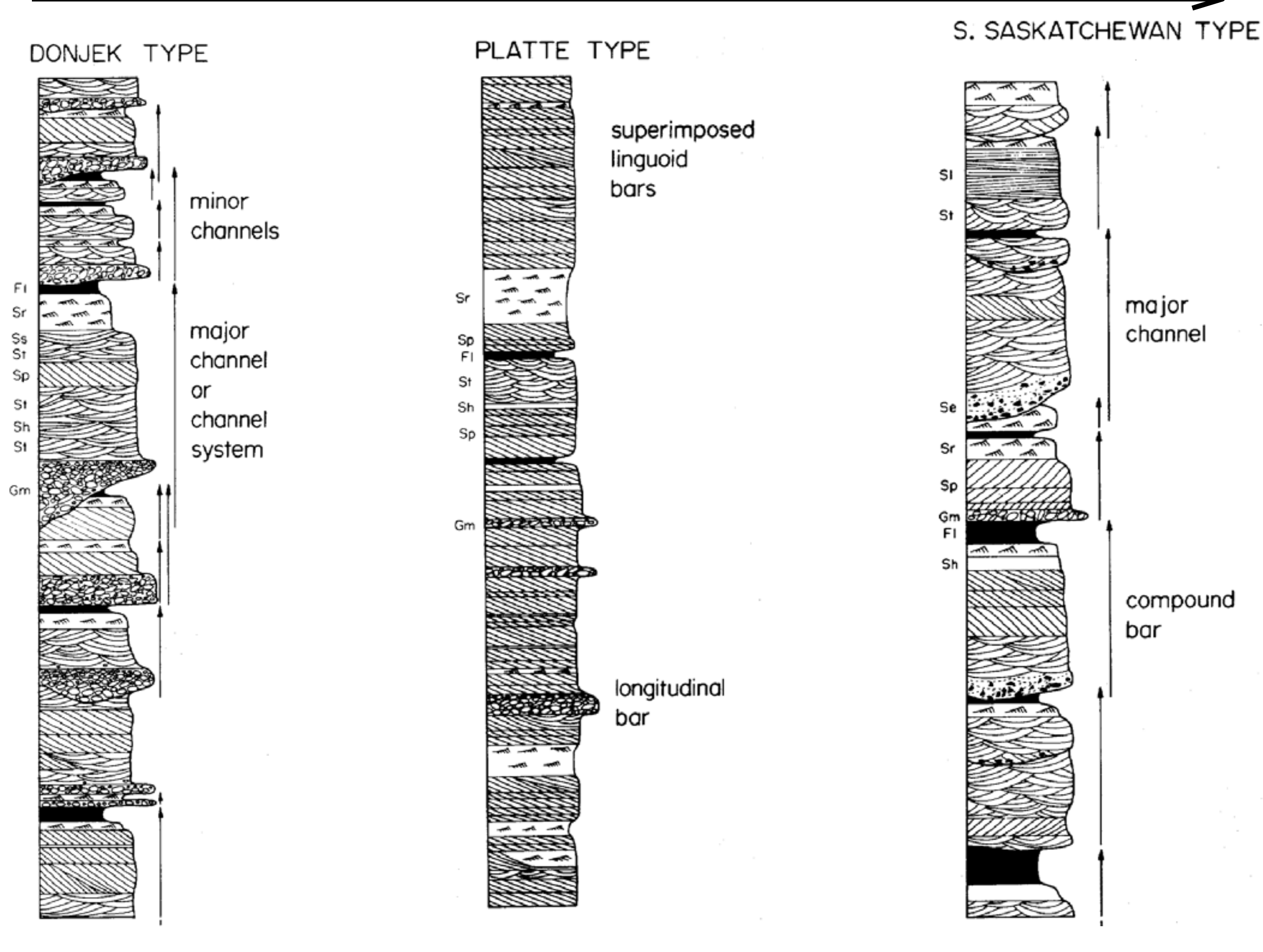


Braided River Spectrum

S. Saskatchewan Model

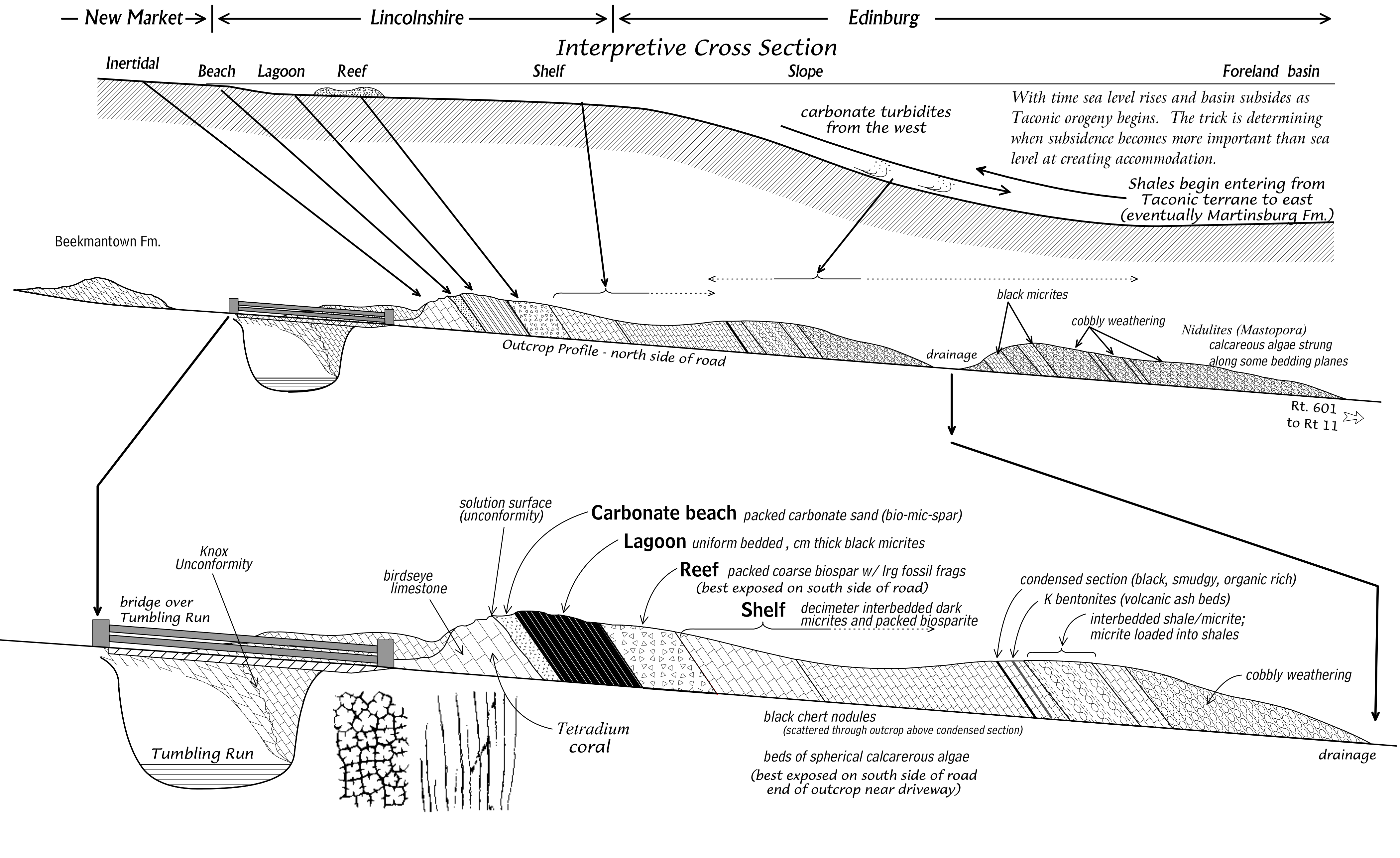


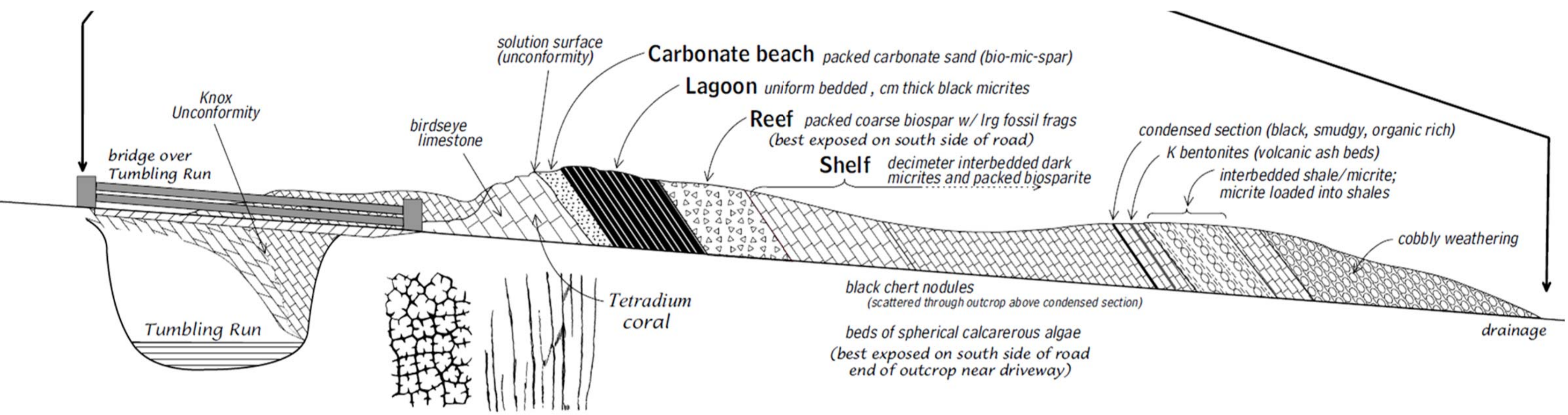
Proximal → Distal



Stratigraphy and Interpretation of the Tumbling Run Section, Strausburg, Virginia

Route 601, Fisher's Hill Road, North Side Outcrop Profile





bridge over Tumbling Run
Knox Unconformity
Tumbling Run
birdseye limestone
solution surface (unconformity)
Carbonate beach packed carbonate sand (bio-mic-spar)
Lagoon uniform bedded , cm thick black micrites
Reef packed coarse biospar w/ lrg fossil frags
(best exposed on south side of road)
Shelf decimeter interbedded dark micrites and packed biosparite
Tetradium coral
condensed section (black, smudgy, organic rich)
K bentonites (volcanic ash beds)
interbedded shale/micrite; micrite loaded into shales
cobbly weathering
black chert nodules
(scattered through outcrop above condensed section)
beds of spherical calcarerous algae
(best exposed on south side of road end of outcrop near driveway)
drainage