

Estuarine Facies within Incised Valley Fill Systems, Mt. Garfield Formation, Book Cliffs, Colorado*

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Abstract

Incised valley fills (IVF) are complex features which complicate the interpretation of stratal successions. The Upper Cretaceous Mt. Garfield Formation, exposed near Grand Junction, Colorado, consists of shallow marine sandstones truncated by numerous sequence boundaries and contains multiple incised valleys. These valley fills are often nested and show significant lateral variability. When nested, facies successions alone are not distinct enough to distinguish individual valleys. Some IVF are dominantly nonmarine/fluvial with numerous coal beds and paleosols. Other IVF have a strong tidal signature: evidence for tidal influence include multiple reactivation surfaces, double mud drapes, flaser/wavy/lenticular bedding, heterolithic bedding, and tidal bundles. Field study of IVF at the facies level yields a detailed sequence stratigraphic analysis at the parasequence scale. Parasequences are traced from canyon to canyon to determine lateral and down dip extent of facies. Valley fills which show tidal dominance contain numerous estuarine facies associations: tidally influenced channel-fill sandstones, estuarine deltas, coals/mires, paleosols, and migrating tidal bars/burrowed sandstones interpreted as estuarine floor deposits. Individual facies average 5 to 7 meters in thickness. This is interpreted to reflect accommodation steps during sea level rise of 5 to 7 meters. Some facies have limited lateral extent (coals, tidally influenced channel-fill sandstones) and are aerially restricted within individual valley fill, while other facies are correlated over a distance of kilometers (estuarine floor deposits, estuarine deltas) and seen in multiple canyons. The IVF facies can be partitioned into high energy and low energy/protected depositional settings. Estuarine floor deposits contain meter-scale tidal bars which indicate the velocity of the tidal currents within the estuary were significant. Other estuarine facies, such as the estuarine deltas, were deposited in a more protected part of the estuary. Estuarine deltas are upward coarsening successions and rarely show large scale cross stratification. These heterolithic deposits are thinly bedded, contain flaser/wavy/lenticular bedding and have double mud drapes within finer grained interbeds. These deltas are abundant in the IVF but are not a dominant sub-environment in modern estuaries. Other estuarine floor deposits are mud dominated and highly burrowed, and were deposited in a protected setting.

References Cited

Blakey, R., 1997, Southwestern North America Sedimentation Maps: Colorado Plateau Geosystems, Arizona.

Blakey, R., 2014, Western Interior Seaway: Colorado Plateau Geosystems, Arizona.

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Book Cliffs, Colorado

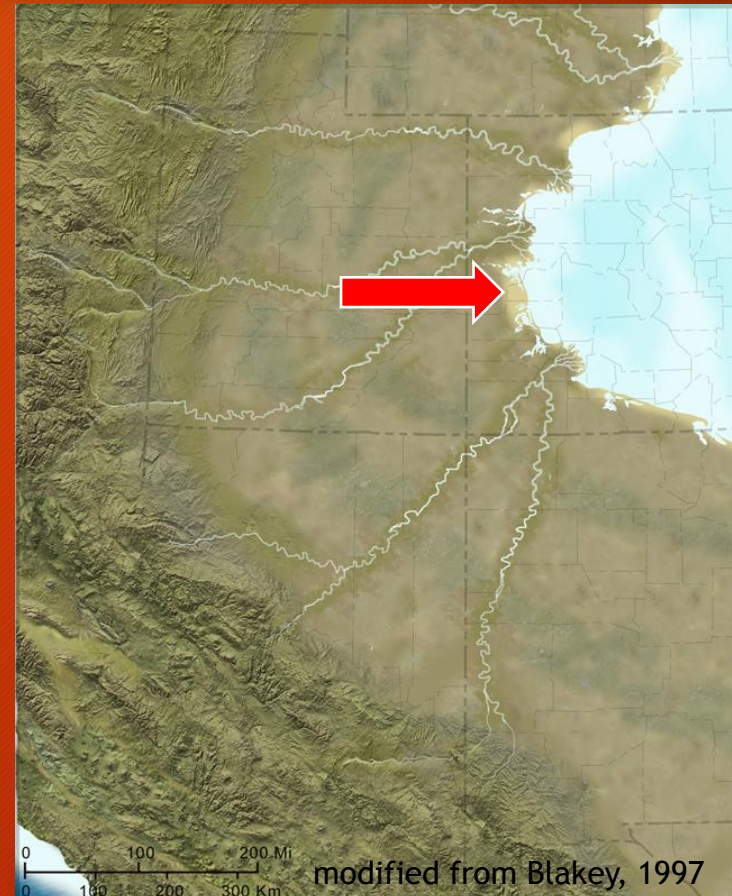
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Goals for Today



1. Describe and identify the estuarine facies
2. Determine the EOD
3. Analyze stacking patterns
4. Determine correlation potential

Study Area (Campanian)



- Sevier FLB
- Lies within coastal plain setting

Mt. Garfield Formation Stratigraphy



- Consist of 3 shoreface dominated members
 - Rollins S.S. Member
 - Cozzette Member
 - Corcoran Member
- Last marine deposits of the formation

Estuarine Floor



Estuarine Floor



Estuarine Floor



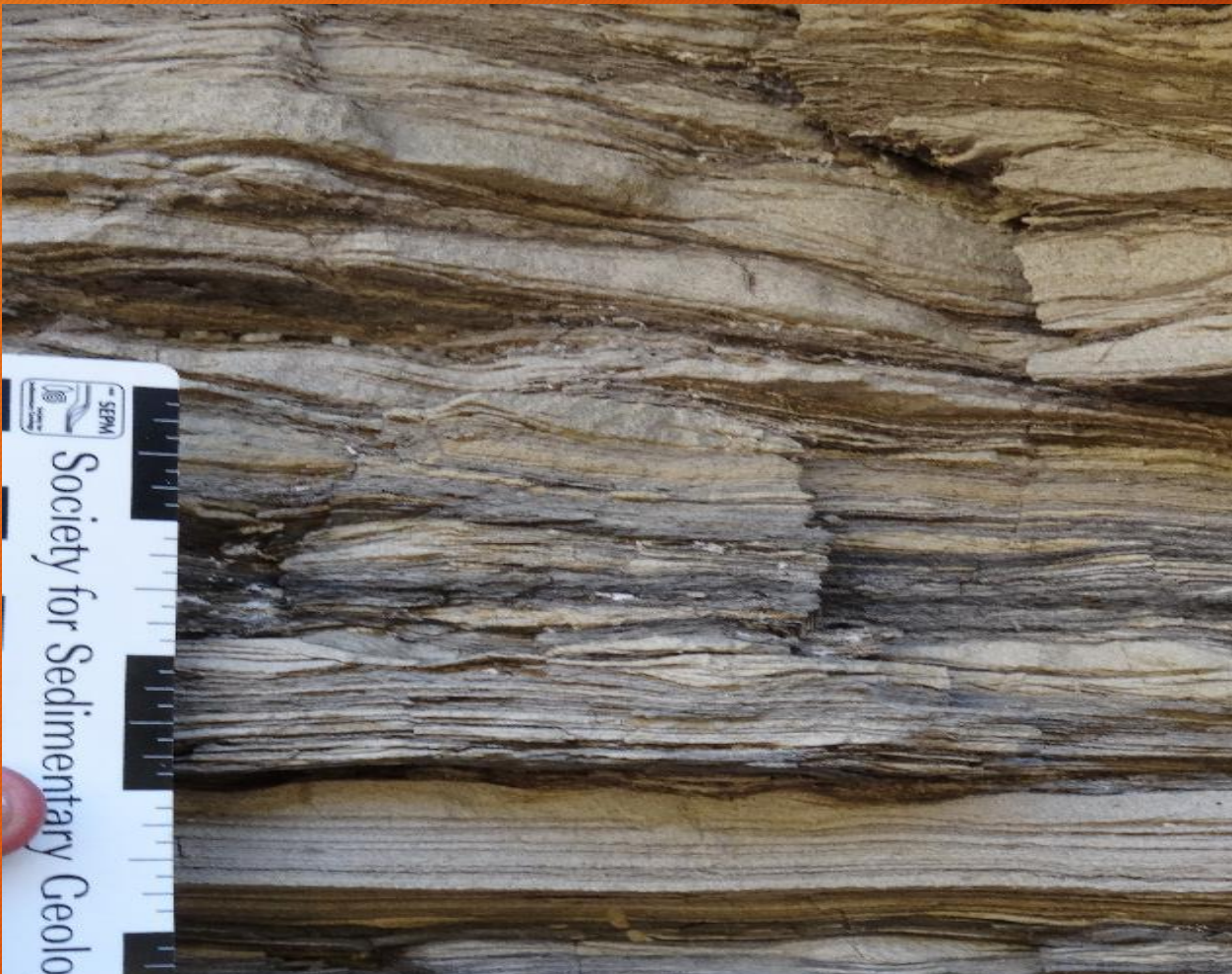
- Wavy bedding
- Wave modified current ripples

Estuarine Floor



- Wavy bedding
- Wave modified current ripples

Estuarine Floor



- Double mud drapes
- Wavy bedding

Estuarine Floor



- Meter-scale cross bedding
- Abrupt base
- Internal scour and fill features

Landward Valley Fill



- Tidally influenced channel
- Coal
- Paleosol
- River mouth bar

Tidal Channel



- Fining-upward successions
- Flaser bedding
- Wave modified current ripples
- Sigmoidal bedding
- Scouring base
- Inclined heterolithic strata

Tidal Channels



Alternating Currents



- Bars have bi-directional flow orientation
- Bars separated by thinly laminated muddy to carbonaceous material

Alternating Currents

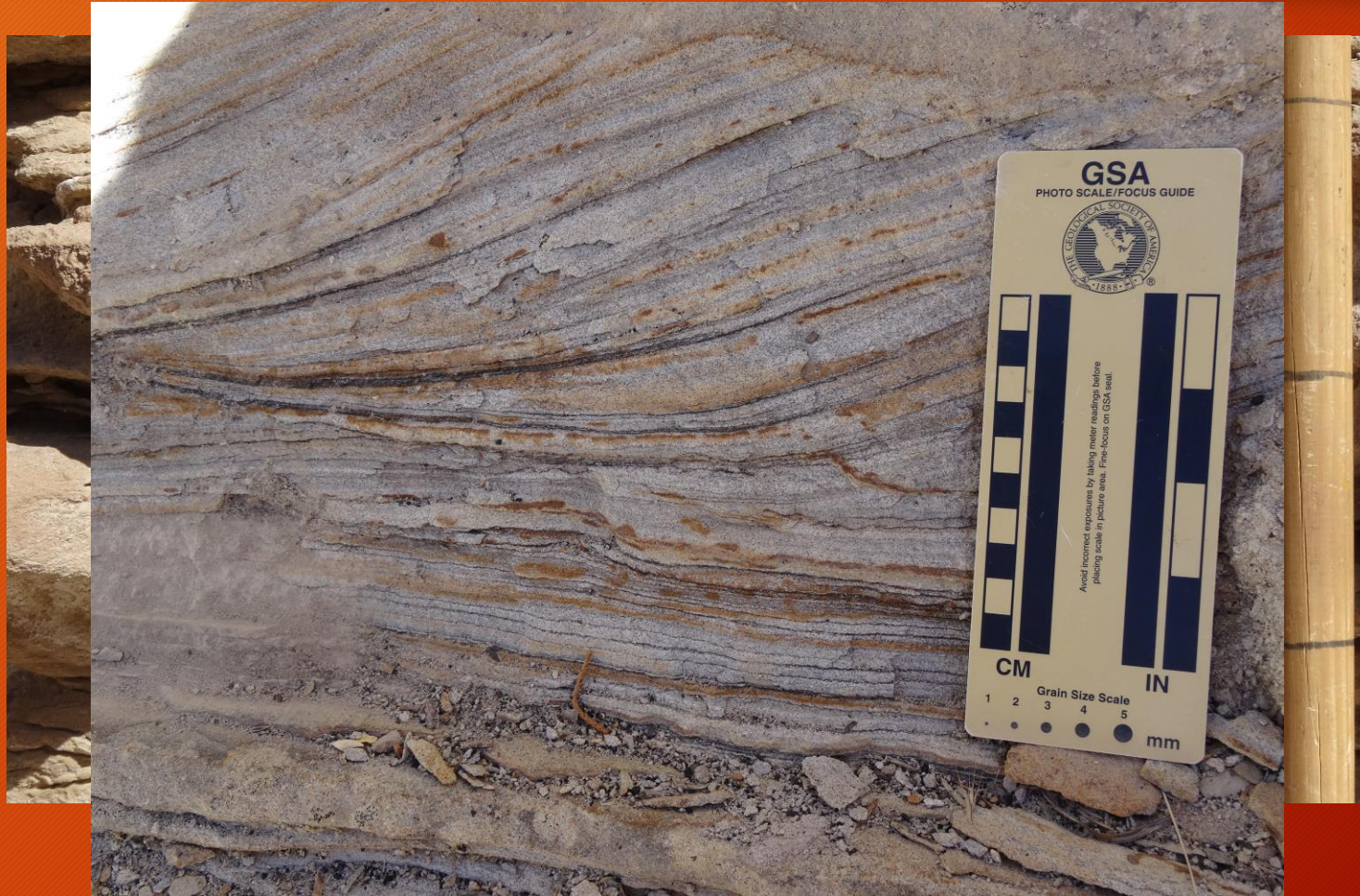


- Bars and sigmoidal cross bedding show bi-directional flow dominance

Wave modified current ripples and carbonaceous mud drapes



Wave modified current ripples and carbonaceous mud drapes



Variability of Coal Deposits



Type 1:

- Black
- Glassy appearance
- Amorphous
- Defined cleats

Variability of Coal Deposits



Type 2:

- Black
- Isolated cleated coal
- Poorly consolidated

Variability of Coal Deposits



Type 3:

- Black
- Fissile in nature
- Silt-sized grains observed

Paleosol (Gleysol)



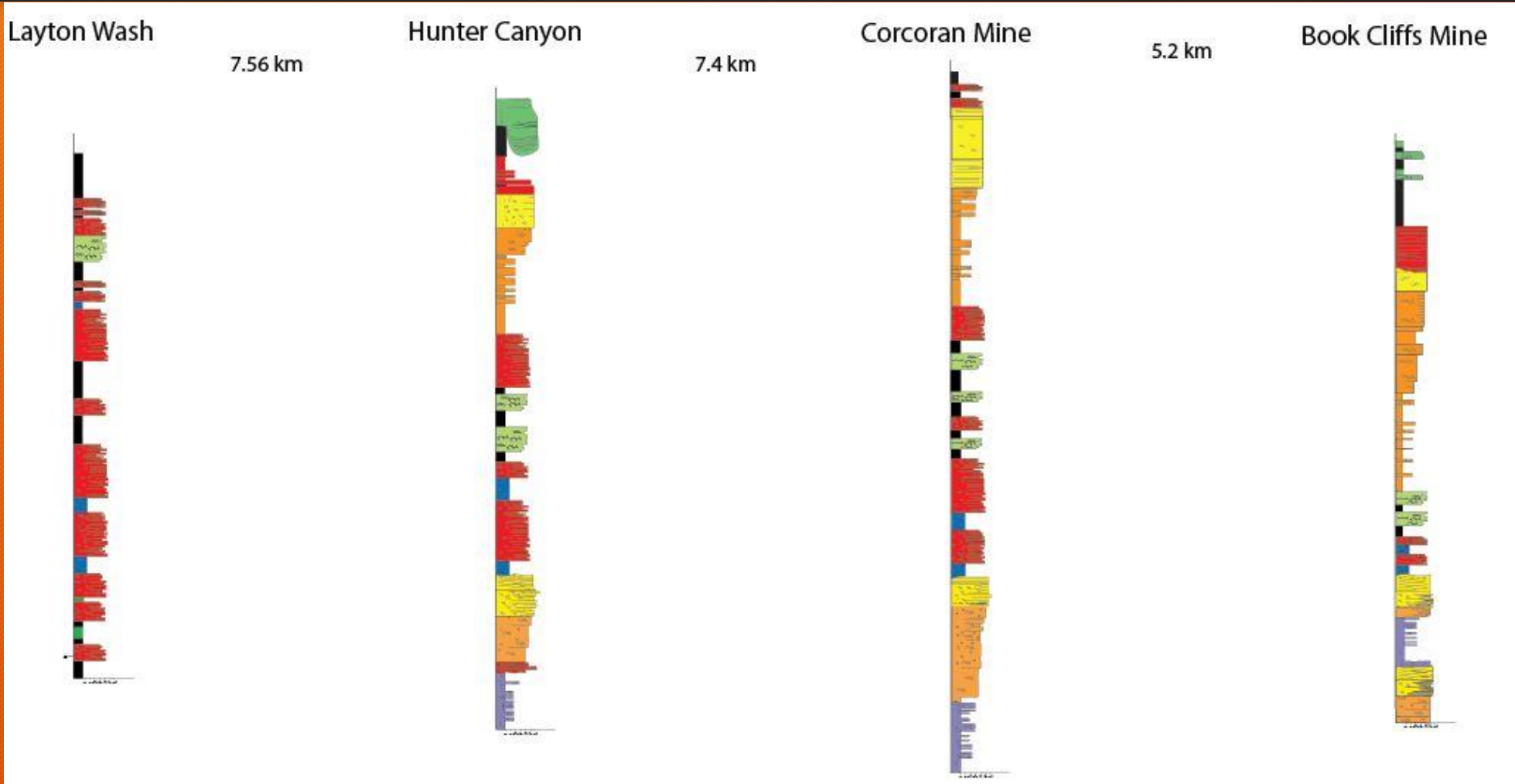
- Gray in color
- Poor horizonation development
- Black root traces
- Blocky pedogenic features

River Mouth Bar

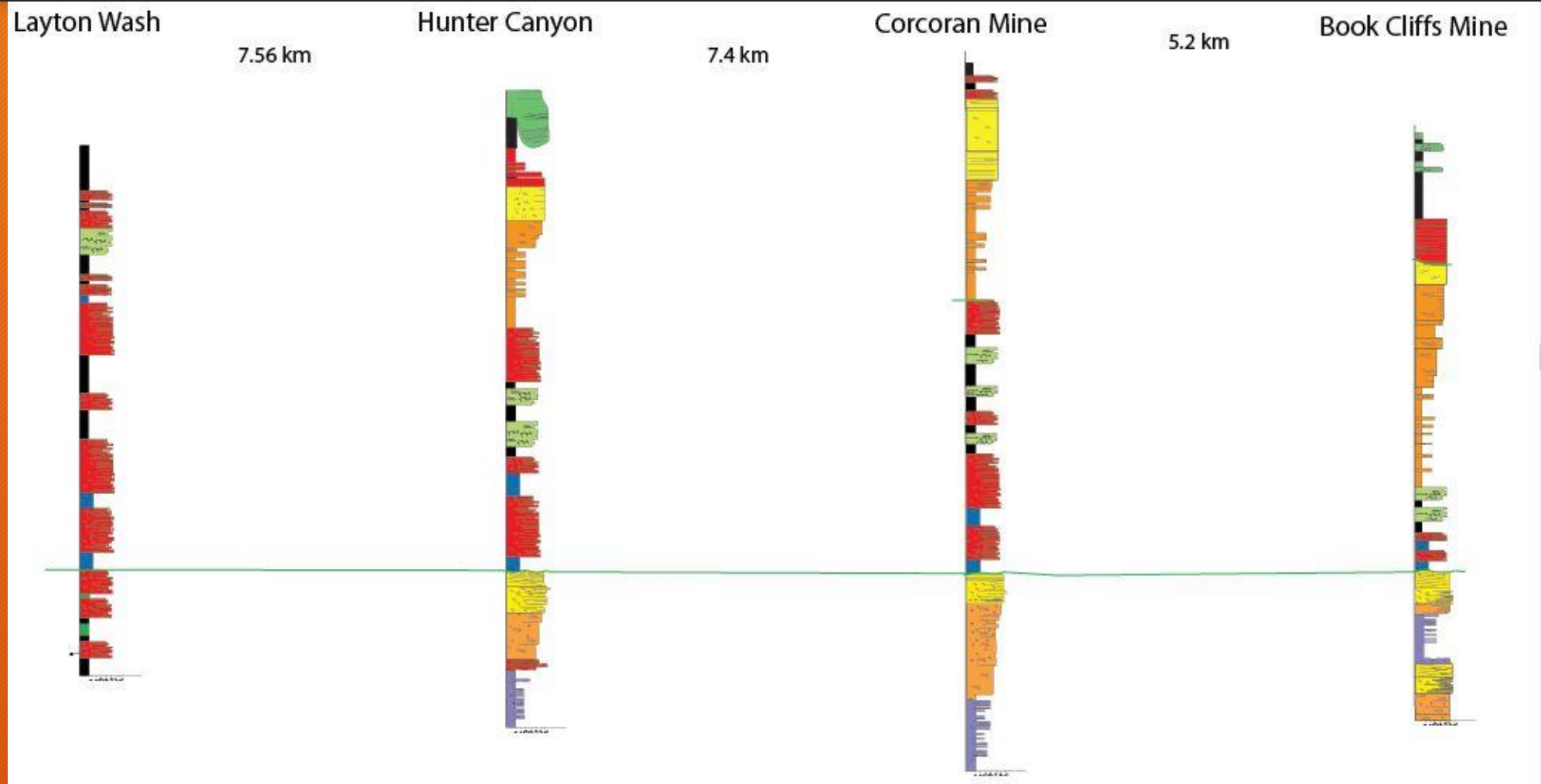


- Coarsening-upward
- Heterolithic
- Wave modified current ripples
- Base = Wavy bedding
Top = Flaser bedding

Measured Sections



Measured Sections



- Tidal Channel
- Mouth Bar
- Estuarine Floor
- Coal

Lateral Continuity



Estuarine floor

Tidal channel

Estuarine floor

Lateral Continuity



Conclusion

Valley Fill Deposits:

- Estuarine floor
- Tidal channel
- Coal
- River mouth bar
- Paleosol (Gleysol)

Tidal Signatures:

- Mudstone/siltstone drapes
- Double mud drapes
- Inclined heterolithic strata
- Flaser, wavy, lenticular bedding
- Wave modified current ripples
- Sigmoidal bedding

Conclusion

1. These facies associations are interpreted as a bay-head delta with distributive channels avulsing within mires as relative sea level continues to rise.
2. The stacking patterns indicate rapid accommodation during early transgression and rate of accommodation generation slows.
3. Transgressive estuarine floor deposits display great lateral continuity and can serve as the reference and correlatable datum.

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