

# Continental Lithofacies of the Council Grove

Lithofacies	Features	Dominant grain size (phi)	Interpreted Depositional Environment	Stabilization / Accommodation	Occurrence
Gray muddy siltstone	gray and green-gray, clay rich finely laminated, fine carbonaceous material, blackened grains, globular peds (where at top), occasional burrows, blackened	6-7	marsh or swamp	sea level (marsh) high water table (swamp)	thin zone (0.5 m) common at top and base of redbeds
Fine-grained siltstone	red-brown, massive to rubbly (peds), clay rich, cm size caliche nodules, root traces, peds with thin clay cutans, "haloed" grains, root traces	6-7	coastal plain or savannah	plants/soils	common especially at midshelf, can be relatively thick (to 2 m)
Coarse-grained siltstone	red-brown, massive, moderate-low amt clay, insect burrowing in coarsest, roots, low-moderate amt caliche, light green to gray gleying	4-5	savannah	plants/soils	common especially at midshelf, can be relatively thick (to 2 m)
Very fine-grained burrowed sandstone	lighter red-brown to reddish tan, massive, rare X-bed one core, low clay content, vertical to sub-horizontally burrowed (mensiccate), bioturbated, root traces, "haloed" grains and root traces, minor caliche, light green to gray gleying	3-4	low relief, eolian system	plants, bioturbation	only at west margin, but dominant, thick (to 5 m)
Nodular carbonate mudstone	gray to reddish gray, globular structure ostracodes, globular structure, roots,	NA	perennial lake	high water table	fairly common at west margin, less common otherwise, thin (<0.5 m)
Very fine-grained ostracode sandstone	mottled yellow and red-brown, massive, ostracodes, rooted (filled with red clay) burrowed (mottling)	3-4	salina	sea level	rare, one occurrence as updip equivalent of marine carbonate, thin (1 m)
Laminated very fine-grained sandstone/siltstone	red-brown to gray, alternating layers of finer and coarser material (sand and silt, silt and clay, silt and carbonate mud), mud and sheet cracks	3-6	ephemeral lake or tidal flat	sea level	uncommon but more often at updip margin

## Detailed lithofacies classification for siliciclastics

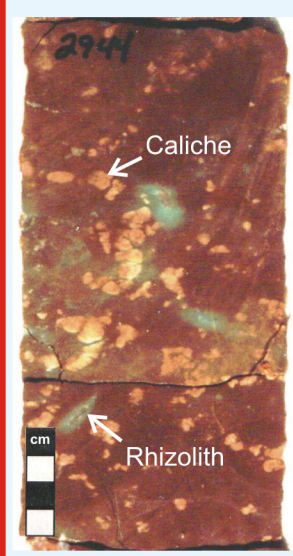
Gray muddy siltstones, nodular carbonate mudstones, very fine-grained ostracode sandstone and laminated very fine-grained sandstone/siltstone combined make only a small portion of the overall volume of continental rocks, however they are important in that they reflect hydrologic conditions. Fine-grained and coarse-grained siltstones dominate cores from wells in the mid-shelf region whereas the fine-grained eolian sandstones dominate the west updip margin of the shelf.

(Color codes are keyed to lithofacies column and descriptions below)

**Gray muddy siltstone**  
(Cross H Cattle 2660')  
Faintly laminated muddy siltstone with abundant fine carbonaceous material sandwiched between coarse-grained siltstone (below) and very fine-grained sandstone (above). Environment: swamp related to climate change or locally high water table.



**Fine-grained siltstone**  
(Newby 2944')  
Fine-grained siltstone (loessite) with abundant cm size caliche nodules, root traces, some with reduction haloes (photo enhanced to contrast features). Environment: Coastal plain; slow accumulation by airfall, stabilized by vegetation and soil processes.

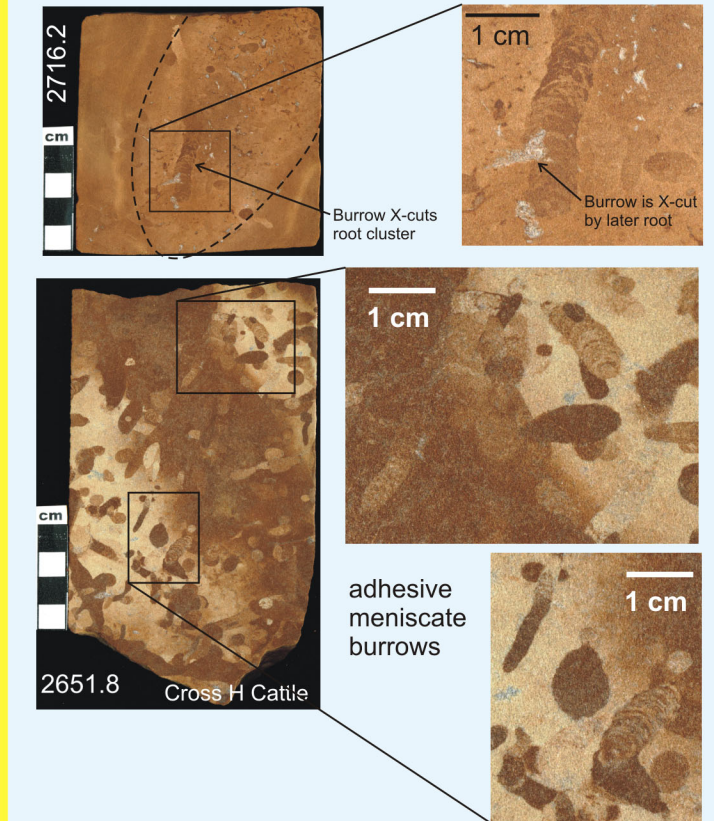


**Coarse-grained siltstone**  
(Newby 2963')  
Fine-grained siltstone (loessite), massive bedded, root traces filled with anhydrite, some roots with reduction haloes (photo enhanced to contrast features). Environment: Savannah; slow accumulation by airfall, stabilized by vegetation and soil processes.



## Very fine-grained sandstone

(Cross H Cattle 2716')  
Fine-grained sandstone (eolianite), massive bedded, large cylindrical fairway for fine root traces extends 0.5 meters vertically, adhesive mensiccate burrows cross cut root traces and vice versa. Environment: low relief migrating eolian system with sands being stabilized by vegetation and, possibly, packing due to burrowing animals.



## Burrows in very fine-grained sandstone

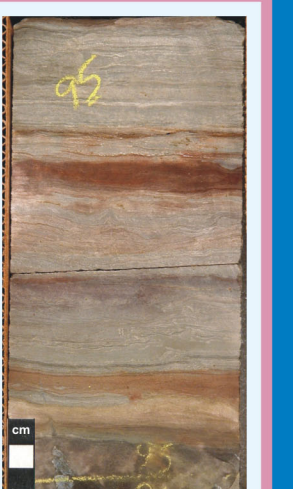
### Observations:

- ▶ Low diversity, one form dominates
- ▶ No apparent lining
- ▶ Backfilled structure in many
- ▶ Vertical to sub-vertical
- ▶ Cross cutting relationship with root traces and vice versa
- ▶ Prevalent in all of the coarser continental sediments but rare or absent in siltstones and mudstones.
- ▶ Observed in four wells close to up dip margin

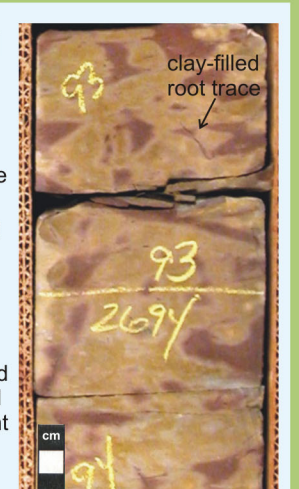
### Interpretation:

Continental; adhesive mensiccate burrows (Hasiotis, personal communication) or possibly *Taenidium* (Buatois, personal communication); probably insect burrows.

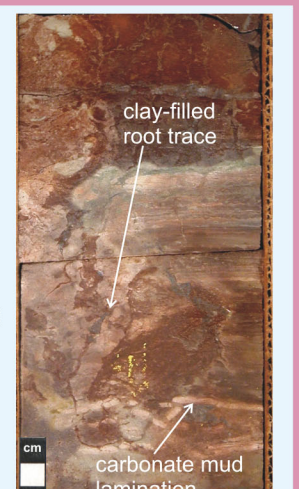
**Laminated fine-grained sandstone**  
(Cross H Cattle 2695')  
Interbedded silt, very fine-grained sand and carbonate mud, crinkly laminated, minor soft sediment deformation, overlies muddy siltstones of a marsh environment. Environment: Tidal flat (supratidal), marginal to marine environment and associated with sea level. This interval may be the base of an interval that is the updip equivalent of the Middleburg (B2LM) marine carbonate that is absent in this well.



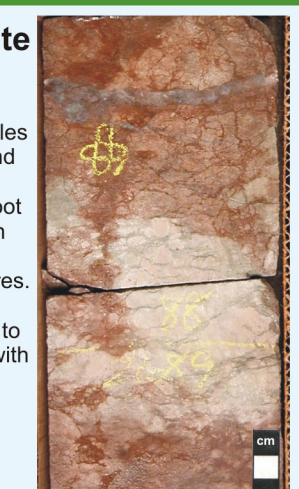
**Very fine-grained ostracode sandstone**  
(Cross H Cattle 2694')  
Very fine-grained sandstone with sparse ostracodes throughout, burrow mottling evident by patchy coloration, fine root traces are filled with red clay and silt disrupt the laminations. Environment: Ephemeral lake that may or may not be associated with sea level position.



**Laminated siltstone**  
(Cross H Cattle 2691')  
Interbedded coarse silt and carbonate mud laminae, some carbonate mudstone laminae have desiccation cracks, root traces filled with red clay and silt disrupt the laminations. Environment: Ephemeral lake that may or may not be associated with sea level position.



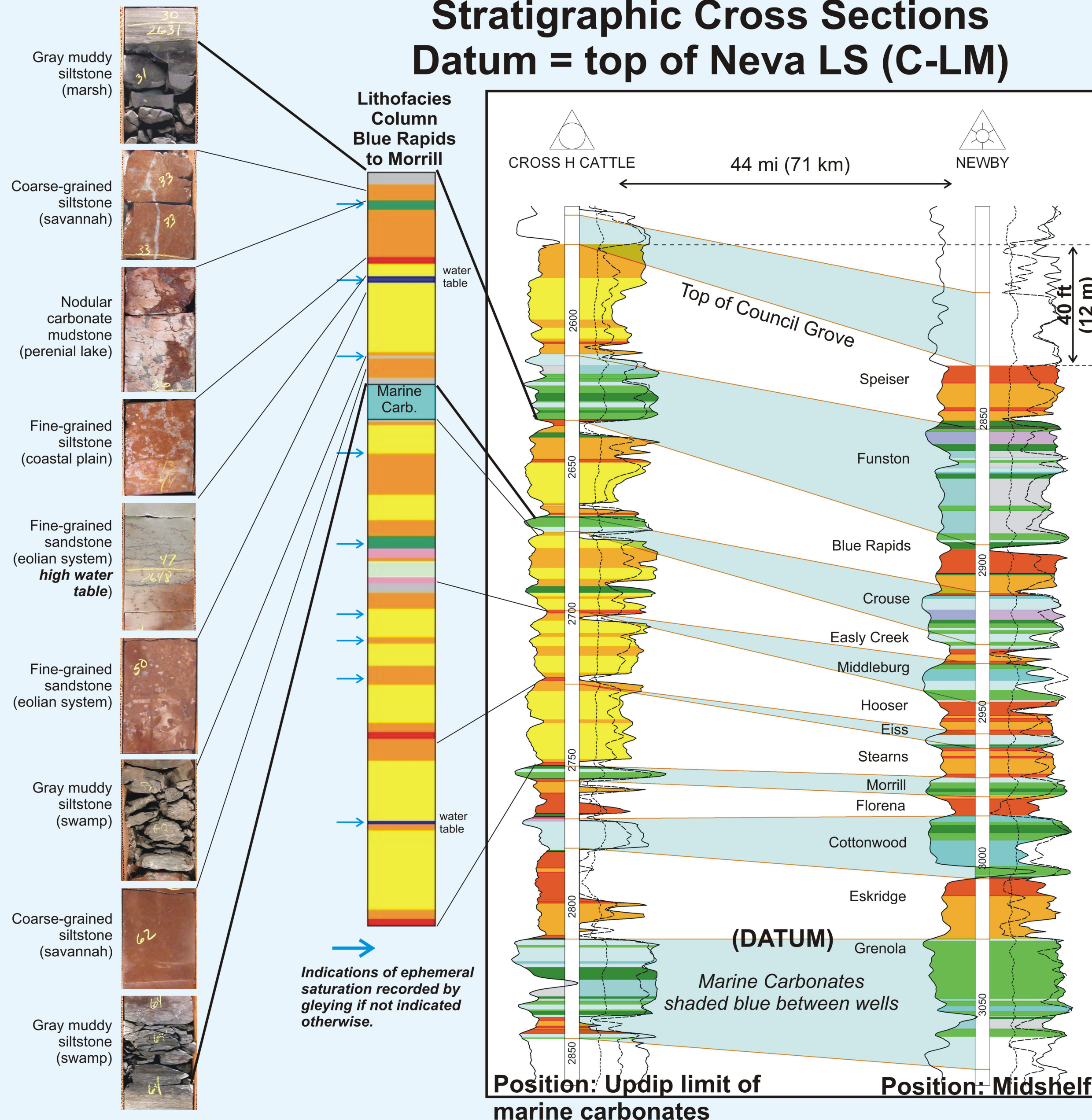
**Nodular carbonate mudstone**  
(Cross H Cattle 2689')  
Carbonate mudstone nodules with clay and silt drapes and seams, rare fine shell fragments, red clay filled root traces, overlain by clay-rich silt with carbonate mud lithoclasts and ped structures. Environment (for the carbonate mud): Lake due to ponded water associated with a perched water table.



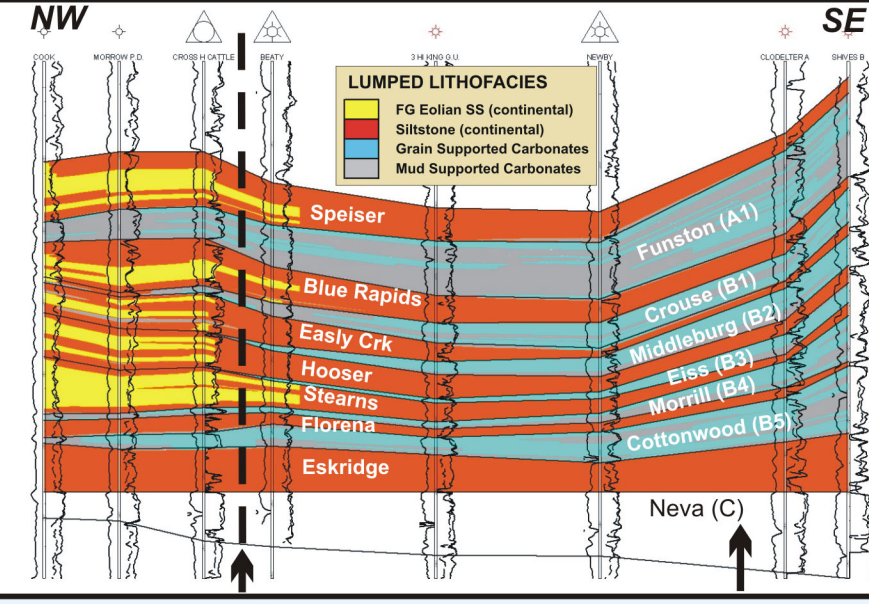
# Stratigraphic Cross Sections

Datum = top of Neva LS (C-LM)

"Typical" succession of continental lithofacies in a cycle



## Regional Stratigraphic Trends

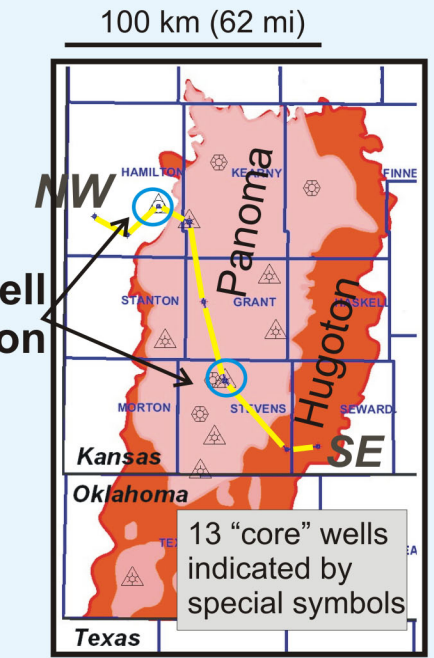


**Updip Limit of Production Panoma Field**  
Thick eolian siliciclastics and thin to absent marine carbonates at updip margin

**Council Grove is thinnest at the mid-shelf position**

**Panoma Downdip Limit**  
Thick marine carbonates and thin continental siltstones where shelf steepens marginal to Anadarko basin

**Relief is built**  
40 feet in 25 miles perpendicular to depositional strike (12 m in 40 km)



## Accommodation reduced for marine carbonates

All carbonates thin and the Eiss and Middleburg pinchout updip where continental sediments are thick. Positive relief on eolianites in addition to regional dip appears to have reduced accommodation for marine carbonates.

