Eagle Ford - Colorado Connection: Cenomanian to Coniacian in Southwestern North America*

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Abstract

Preliminary reconstructions of early Late Cretaceous paleogeography suggest a complex series of events for organic mudrock deposition in southwestern North America. In middle Cenomanian time, shelf carbonate deposition in Texas suddenly ceased with formation of a major hardground and/or exposure surface. About the same time, Dakota clastic shorelines were being transgressed in New Mexico. In late Cenomanian and earliest Turonian time, marine transgression reached a peak. Clastics from the emerging Cordillera were trapped far westward. The deepwater Ojinaga trough connected northward to the Rio Salado tongue of the Mancos and ultimately to the Graneros and Greenhorn section to the north, and bounded the Eagle Ford shelf platform on the west. In middle Turonian time, a rapid shoreline progradation in New Mexico formed the Tres Hermanos regression, a zone of remarkably stable character and thickness suggesting a forced regression. At the same time, the Lozier Canyon section records a significant unconformity, perhaps on the flanks of the San Marcos Arch. The San Vicente section contains a few clastic grains but major clastic progradation was probably stopped by the Ojinaga trough. In the late Turonian, renewed transgression resulted in the D-Cross member of the Mancos, possibly time-correlative with the Langtry member of the Eagle Ford. However, a major deltaic headland developed in southern New Mexico causing progradation of Gallup shorelines and deposition of the thick Crevasse Canyon Formation. This headland sealed the north end of the Ojinaga trough and possibly inhibited the circulation of anoxic waters in and out of the Western Interior Basin. This disruption of circulation may be partly responsible for gradual lithologic changes from Eagle Ford to Austin (oxygenated facies) in Texas, and a partial separation of Austin from Niobrara facies during Coniacian-Santonian time. Additional work is needed on key outcrop sections in west Texas and New Mexico to confirm this conjecture.

Selected References

Cobban, W.A., S.C. Hook, and K.C. McKinney, 2008, Upper Cretaceous molluscan record along a transect from Virden, NM to Del Rio, TX: New Mexico Geology, v.30, no.3, p. 75−92.

Donovan, A.D., T.S. Staerker, T. Scott, A. Pramudito, M.J. Corbett, C.M. Lowery, A.M. Romero, and R. Gardner, 2012, The Eagle Ford outcrops of West Texas: a laboratory for understanding heterogeneities within unconventional mudstone reservoirs: GCAGS Journal, v.1, p. 162−185.

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Molenaar, C.M., 1983, Major depositional cycles and regional correlations of Upper Cretaceous rocks, southern Colorado Plateau and adjacent areas; in Mesozoic paleogeography of west-central United States: RMS-SEPM, p. 201−224.

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The Eagle Ford – Colorado Connection:

Cenomanian to Coniacian in Southwestern North America

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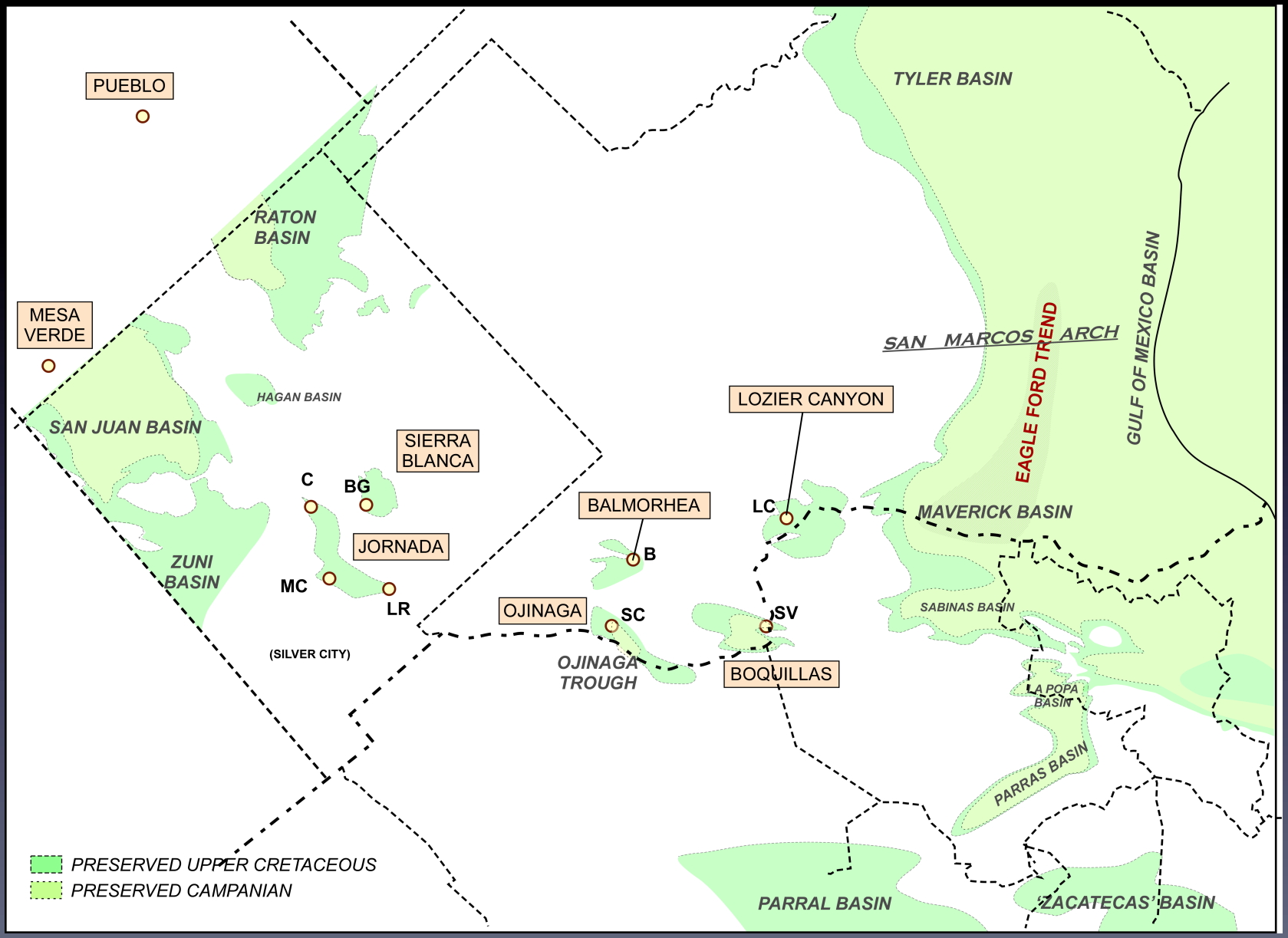
ABSTRACT

- Preliminary reconstructions of early Late Cretaceous paleogeography suggest a complex series of events for organic mudrock deposition in southwestern North America.
  - In **middle Cenomanian** time, shelf carbonate deposition in Texas suddenly ceased with formation of a major hardground and/or exposure surface. About the same time, Dakota clastic shorelines were being transgressed in New Mexico.
  - In **late Cenomanian** and **earliest Turonian** time, marine transgression reached a peak. Clastics from the emerging Cordillera were trapped far westward. The deepwater Ojinaga trough connected northward to the Rio Salado tongue of the Mancos and ultimately to the Graneros and Greenhorn section to the north, and bounded the Eagle Ford shelf platform on the west.
  - In **middle Turonian** time, a rapid shoreline progradation in New Mexico formed the Tres Hermanos regression, a zone of remarkably stable character and thickness suggesting a forced regression. At the same time, the Lozier Canyon section records a significant unconformity, perhaps on the flanks of the San Marcos Arch. The San Vicente section contains a few clastic grains but major clastic progradation was probably stopped by the Ojinaga trough.
  - In the **late Turonian,** renewed transgression resulted in the D-Cross member of the Mancos, possibly time-correlative with the Langtry member of the Eagle Ford. However, a major deltaic headland developed in southern New Mexico causing progradation of Gallup shorelines and deposition of the thick Crevasse Canyon Formation. This headland sealed the north end of the Ojinaga trough and possibly inhibited the circulation of anoxic waters in and out of the Western Interior Basin.
  - This disruption of circulation may be partly responsible for gradual lithologic changes from Eagle Ford to Austin (oxygenated facies) in Texas, and a partial separation of Austin from Niobrara facies during Coniacian-Santonian time. Additional work is needed on key outcrop sections in west Texas and New Mexico to confirm this conjecture.

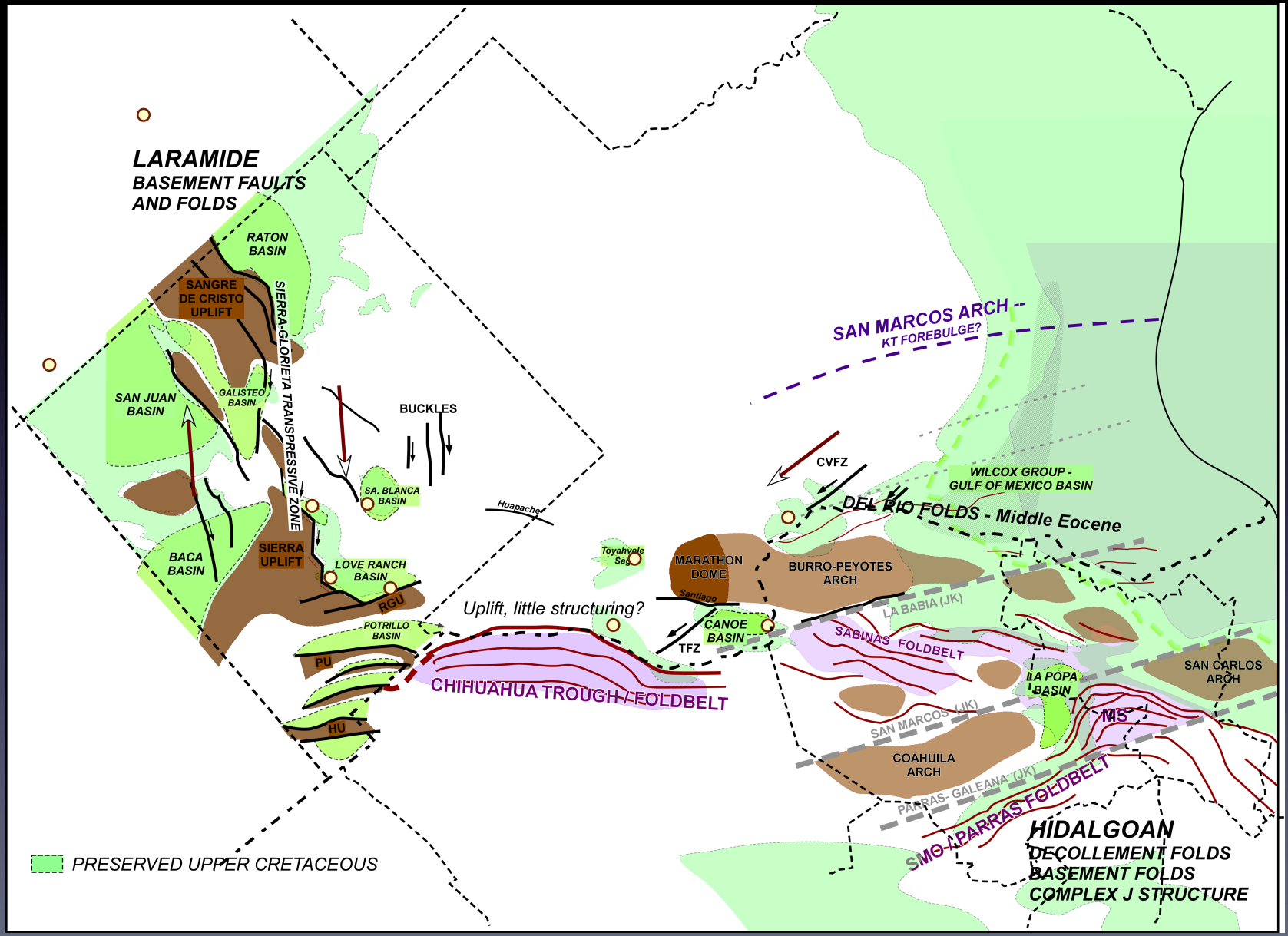
‘EAGLE FORD TIME’

- Pronounced anoxia w/ high TOC in northwest Gulf of Mexico Basin leads to Eagle Ford and correlative shale plays
- Also have high TOC in the coeval Graneros-Greenhorn section of Western Interior
- Subsequent high TOC in Niobrara, not in Austin so much

REGIONAL MAP



UK BASINS AND LARAMIDE



THESIS

- Deep **Ojinaga Trough** traps Cordilleran clastics from entering Texas Cretaceous section until Campanian time
- Falling RSL in **mid-Turonian** forces Tres Hermanos delta out in southern NM, unconformity in parts of Texas, Kurten Delta (ETX incised valley) in East Texas
- Major **Gallup/Crevasse Canyon delta** in latest Turonian seals north end of Ojinaga Trough, helps to fill trough (but doesn't make it into Texas)
- GCC delta breaks ocean currents on deeper western margin and entrance to Ojinaga Trough

LOZIER CANYON SECTION

LOZIER CANYON SECTION

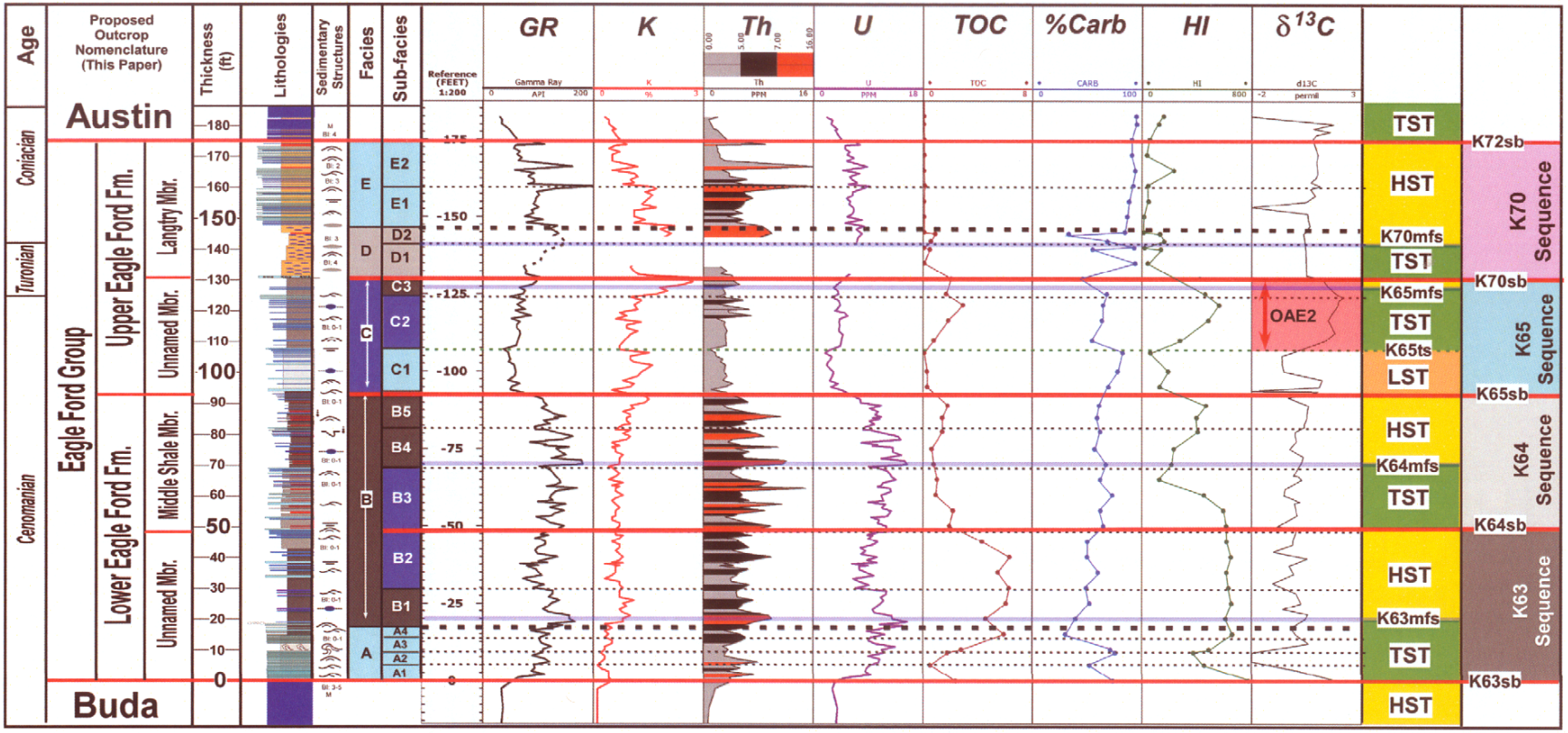
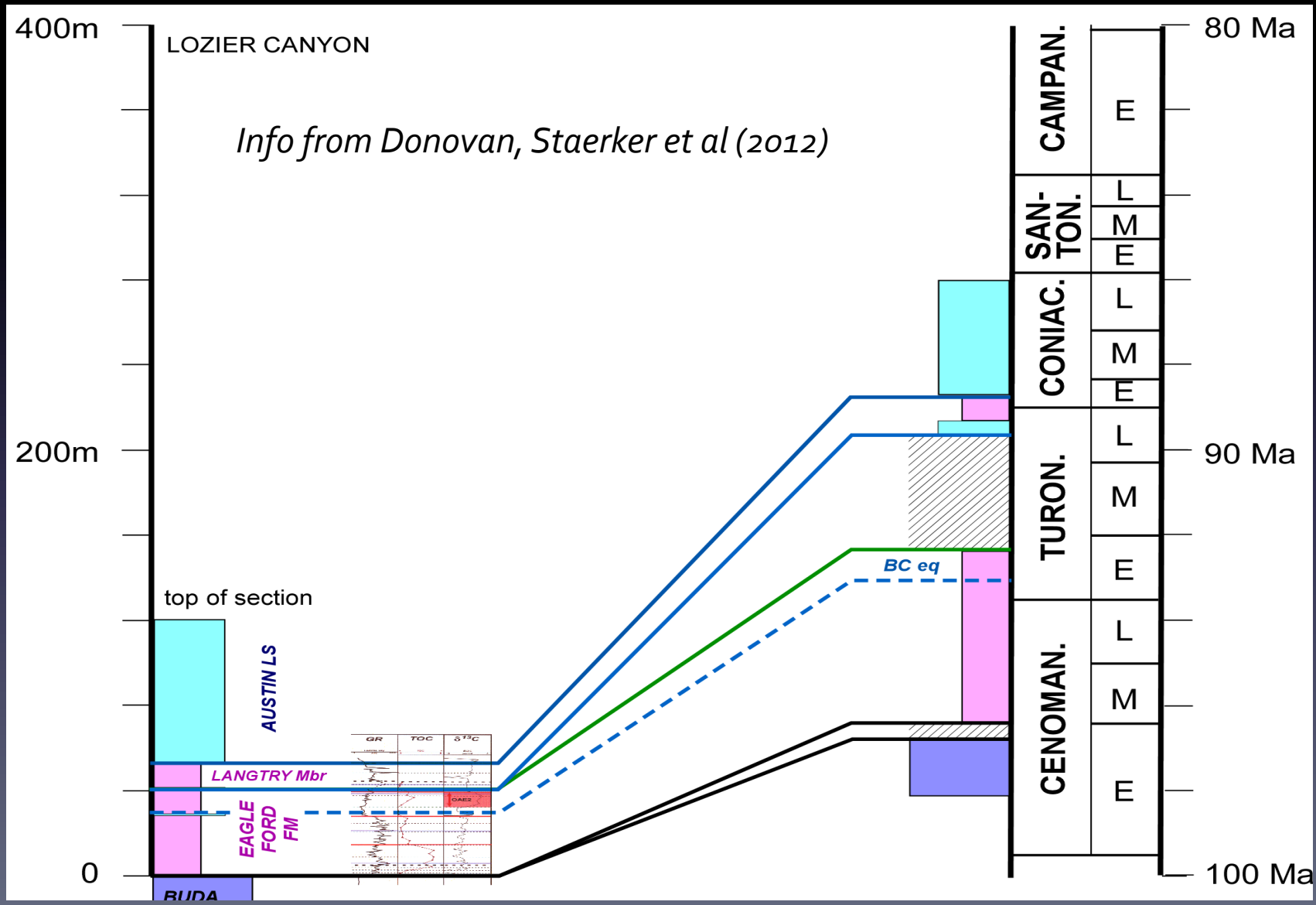
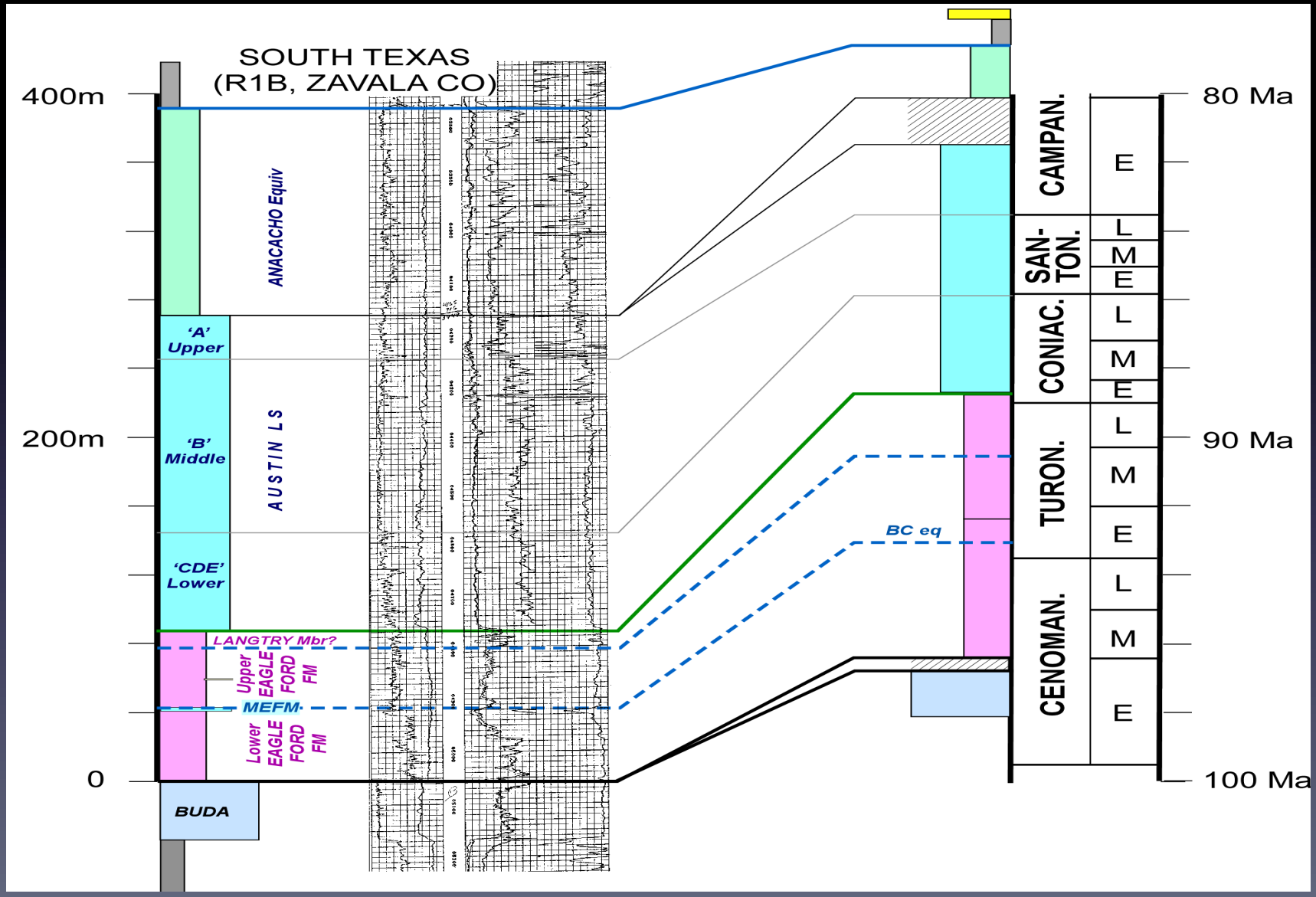


Figure 8. Summary of the lithologic, petrophysical, and geochemical data collected in Lozier Canyon in Terrell County, Texas. Comparison with Figure 7 indicates that the same lithostratigraphic and sequence stratigraphic units defined in the West Texas outcrops can be carried into the subsurface of South Texas. Legend for "Lithologies" column found in Figure 5. LST = lowstand systems tract, TST = transgressive systems tract, HST = highstand systems tract, GR = gamma ray, K = potassium, Th = thorium, U = uranium, TOC = total organic carbon, %Carb = percent carbonate, HI = hydrogen index, and $\delta^{13}C$ = carbon isotopic signature.

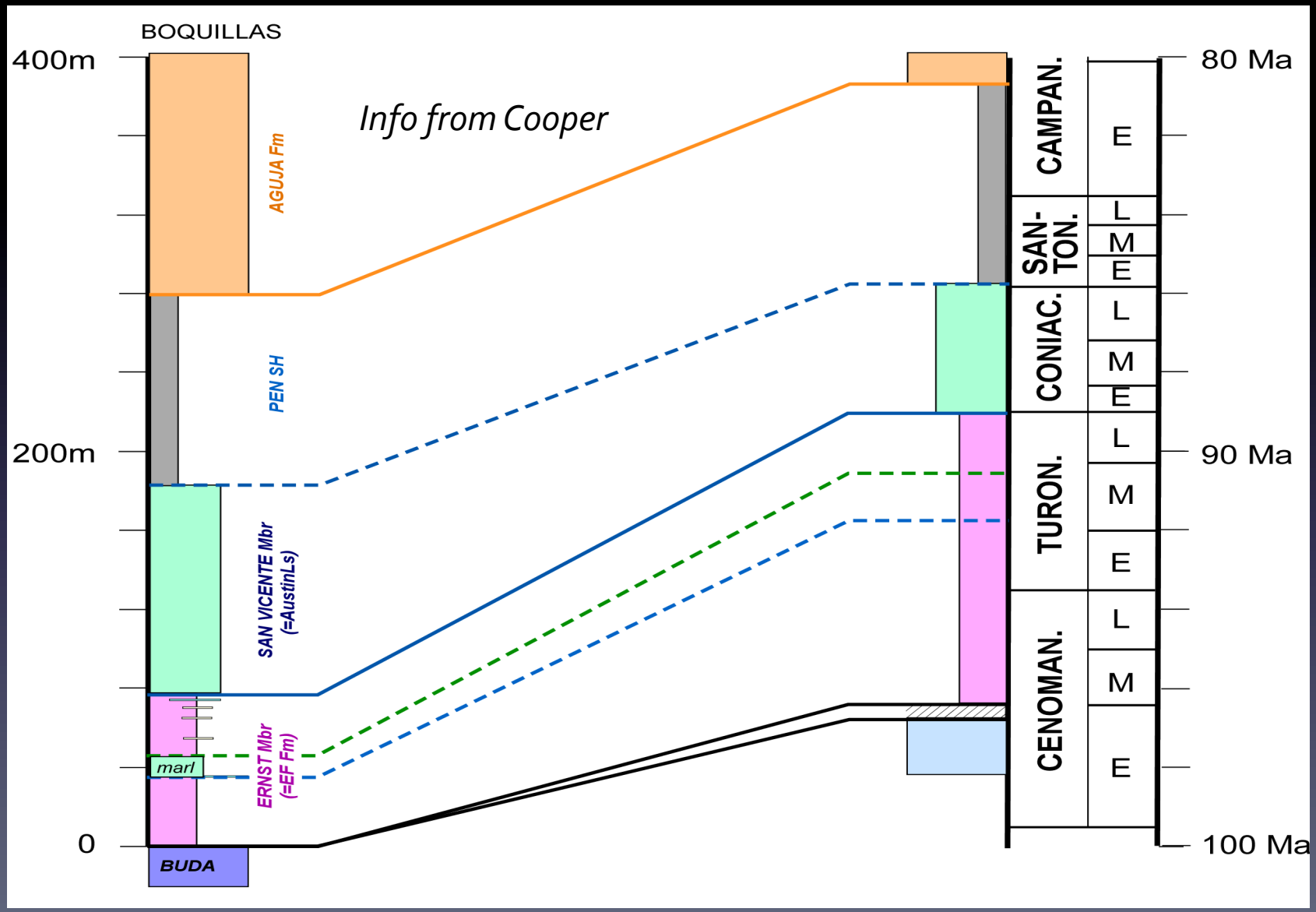
LOZIER CANYON SECTION



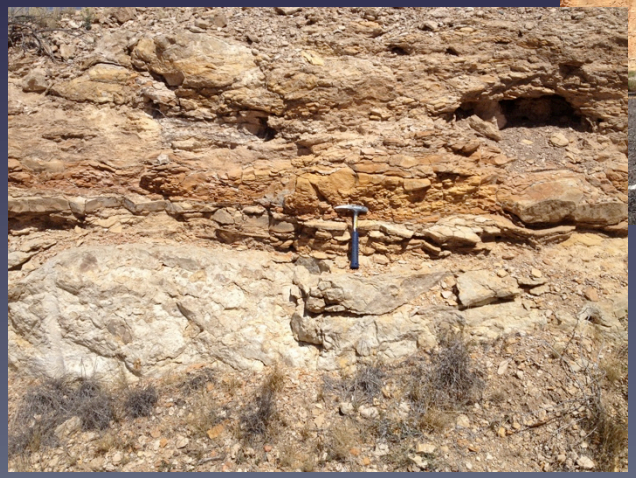
MAVERICK SECTION



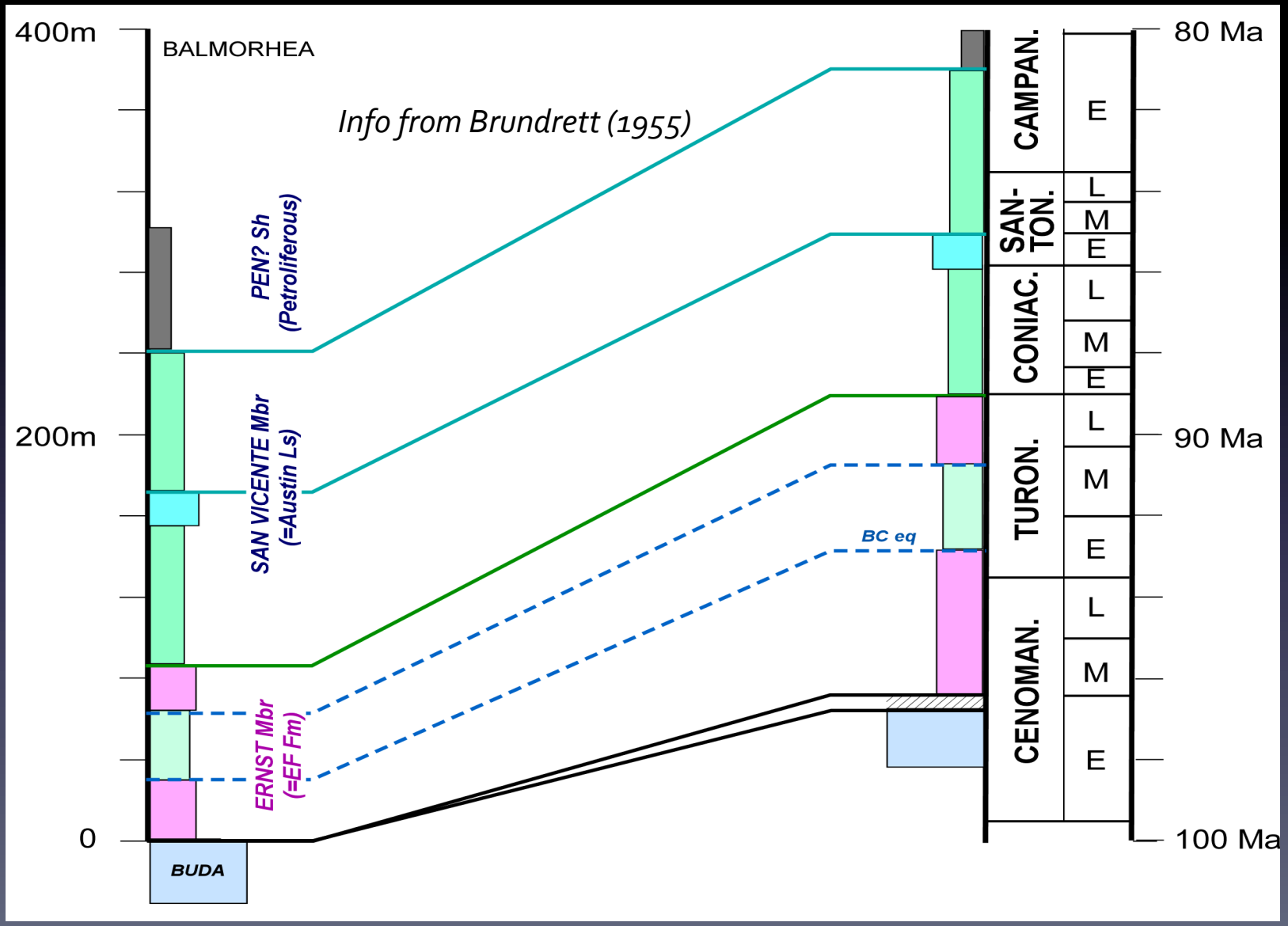
BOQUILLAS SECTION

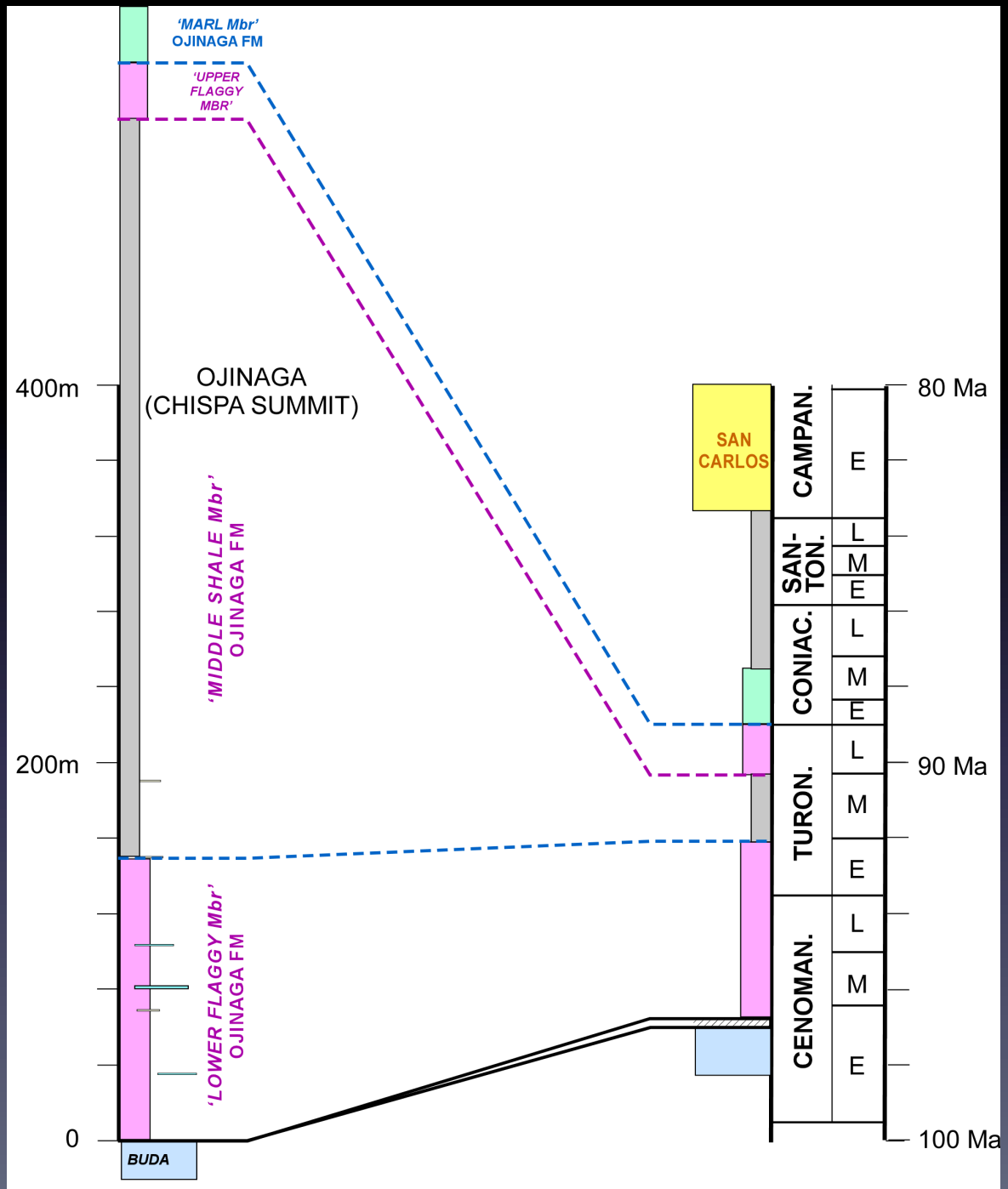


BALMORHEA SECTION



BALMORHEA SECTION



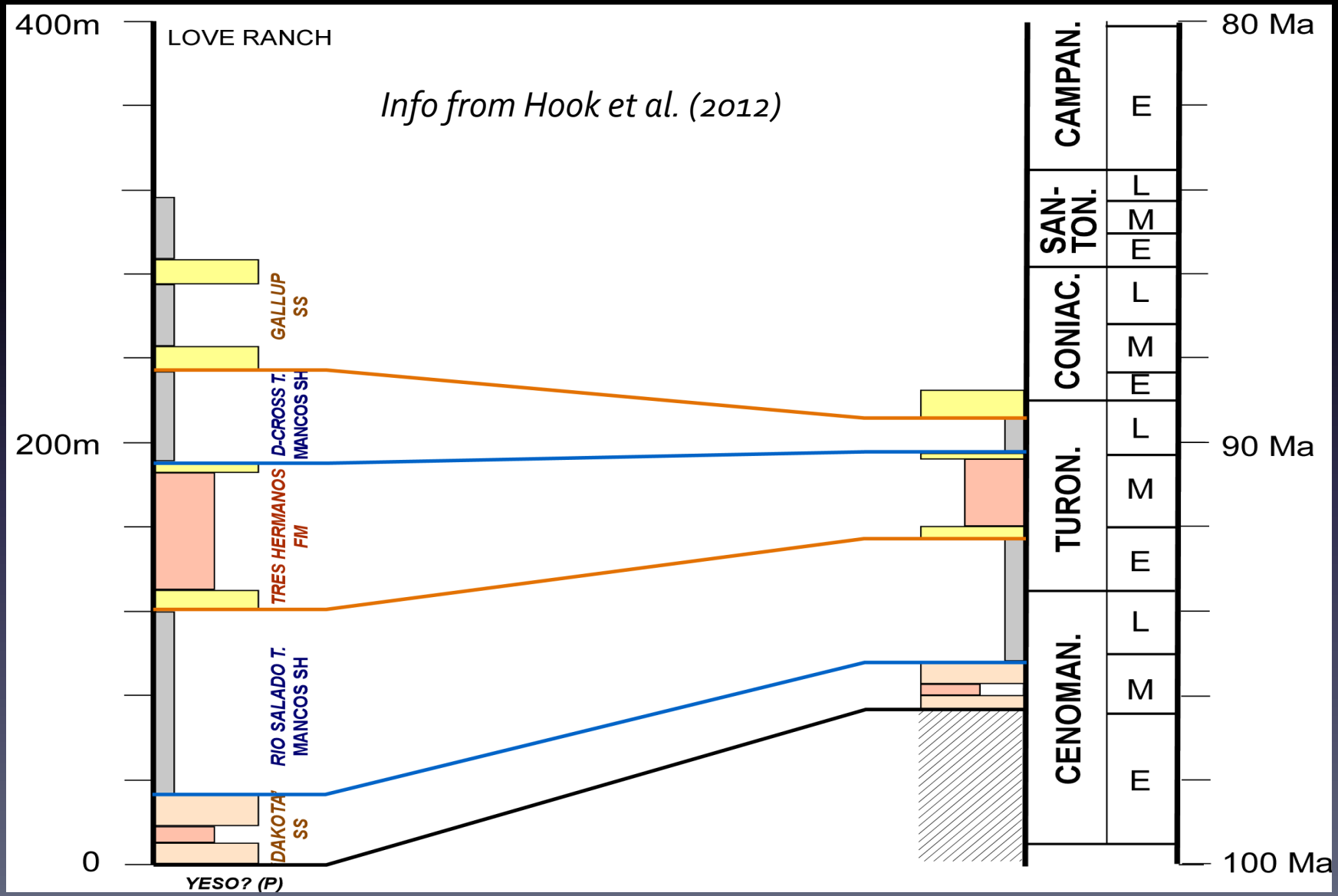


OJINAGA (Chispa) SECTION

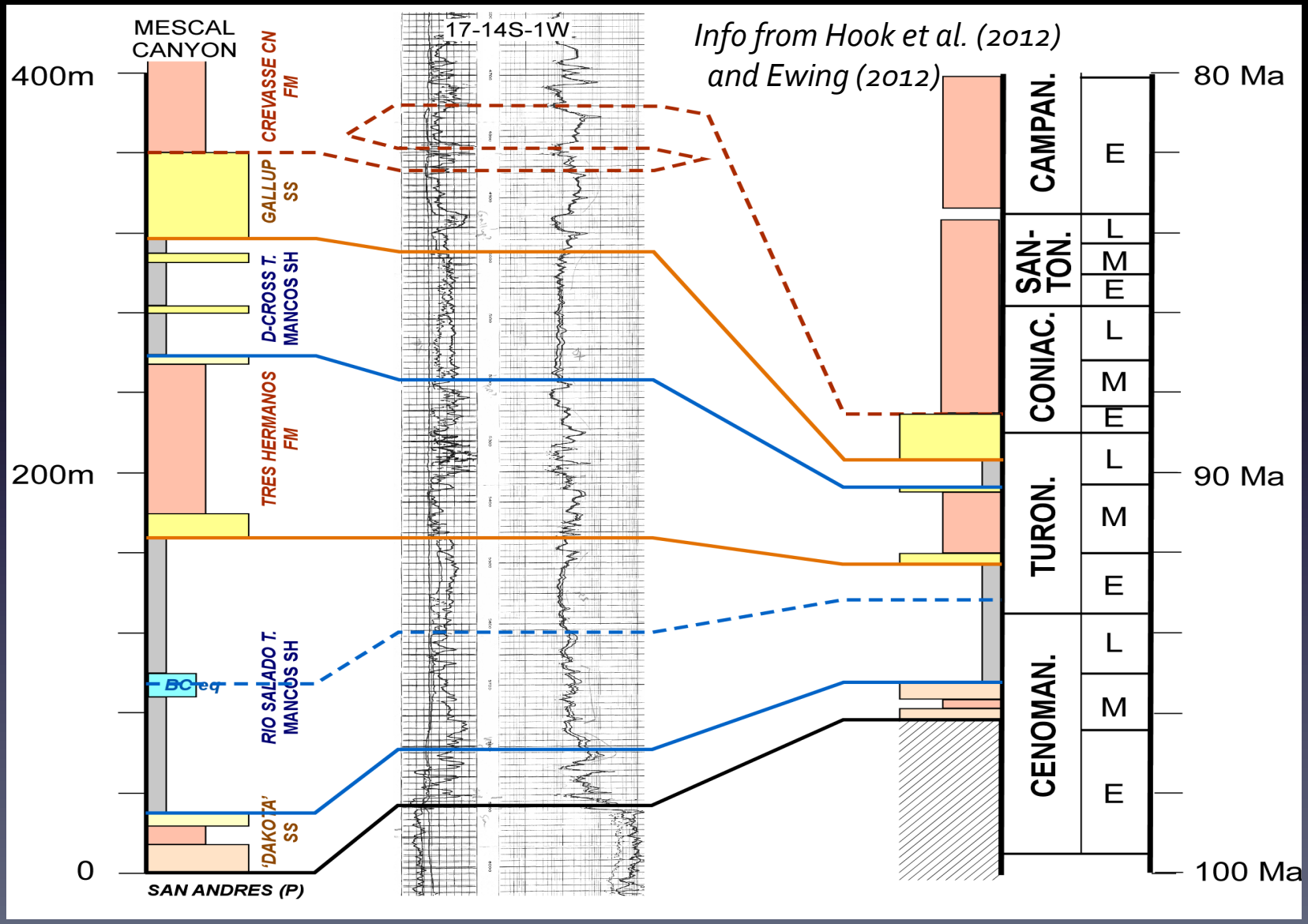
Info from Powell (1965) also Adkins, Wolleben

SOUTHERN NM SECTIONS

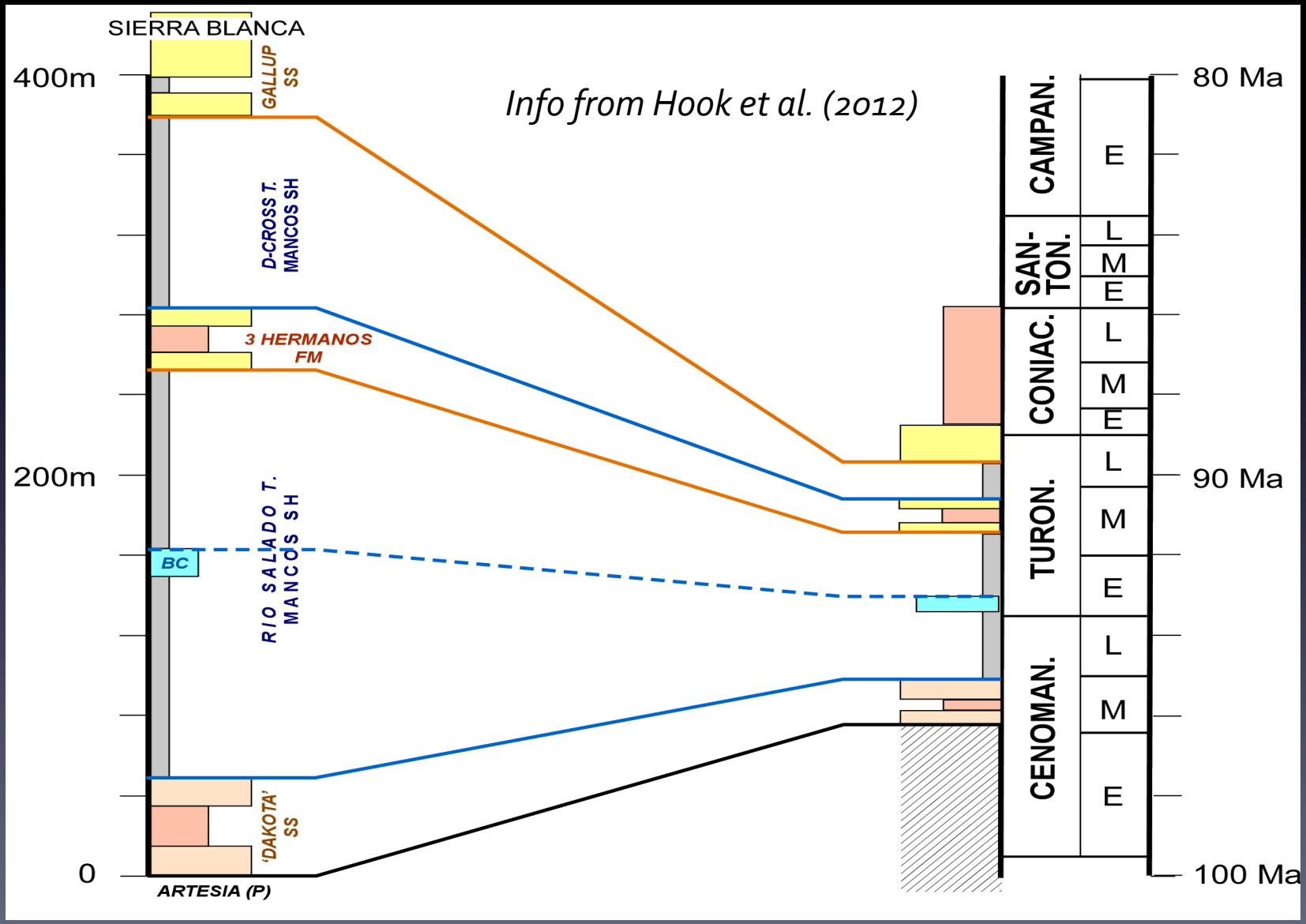
LOVE RANCH SECTION



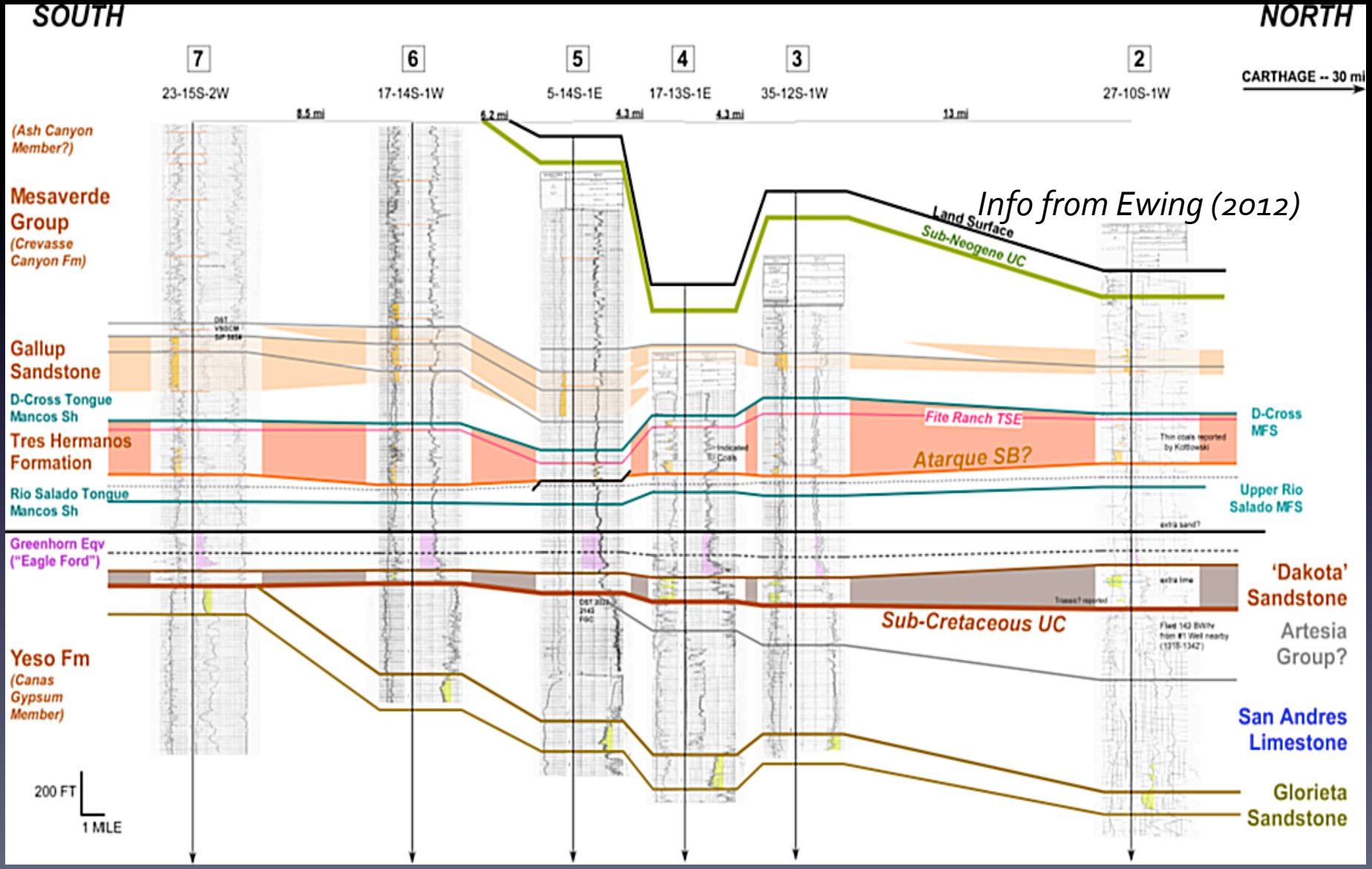
MESCAL CANYON SECTION



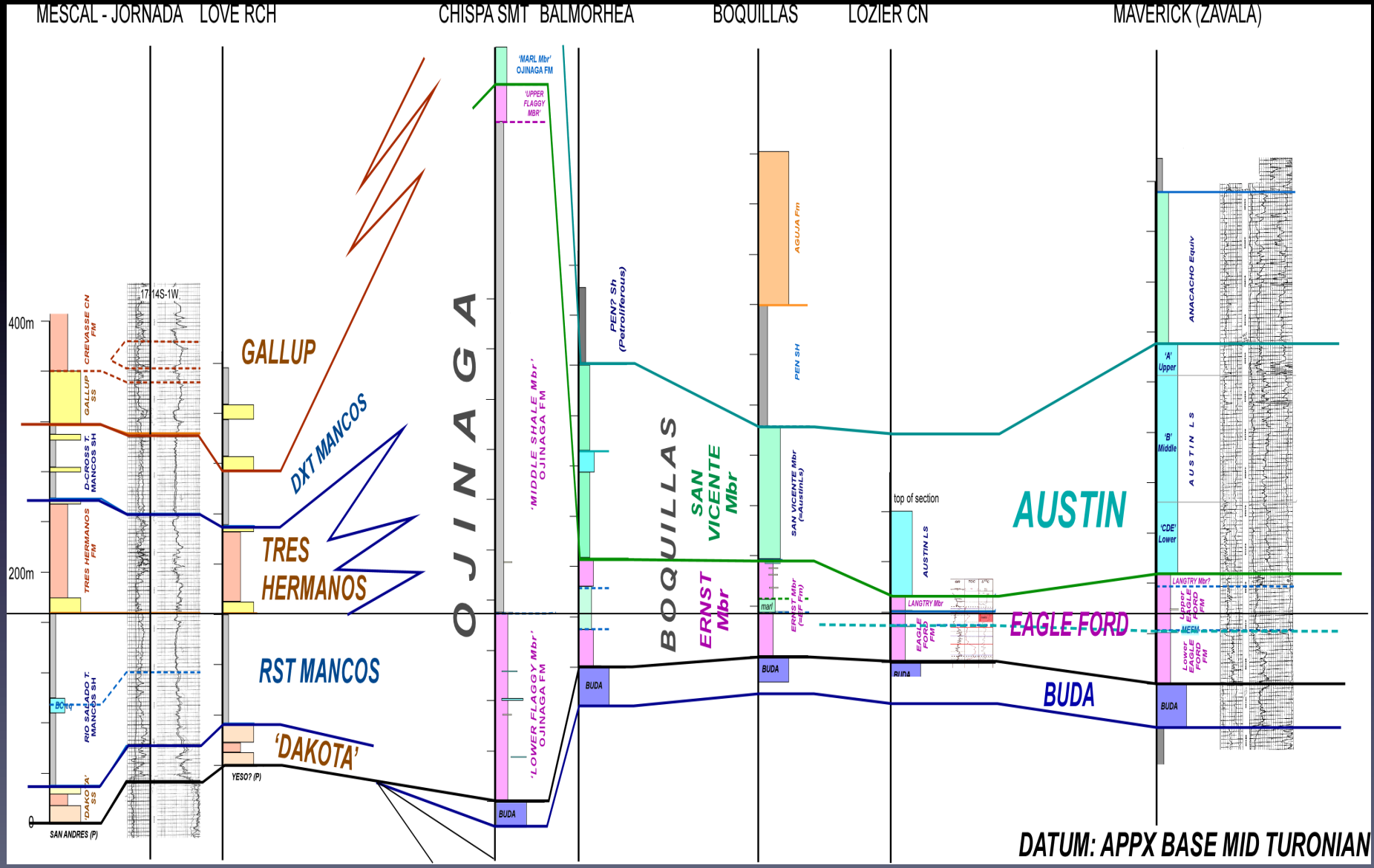
SIERRA BLANCA SECTION



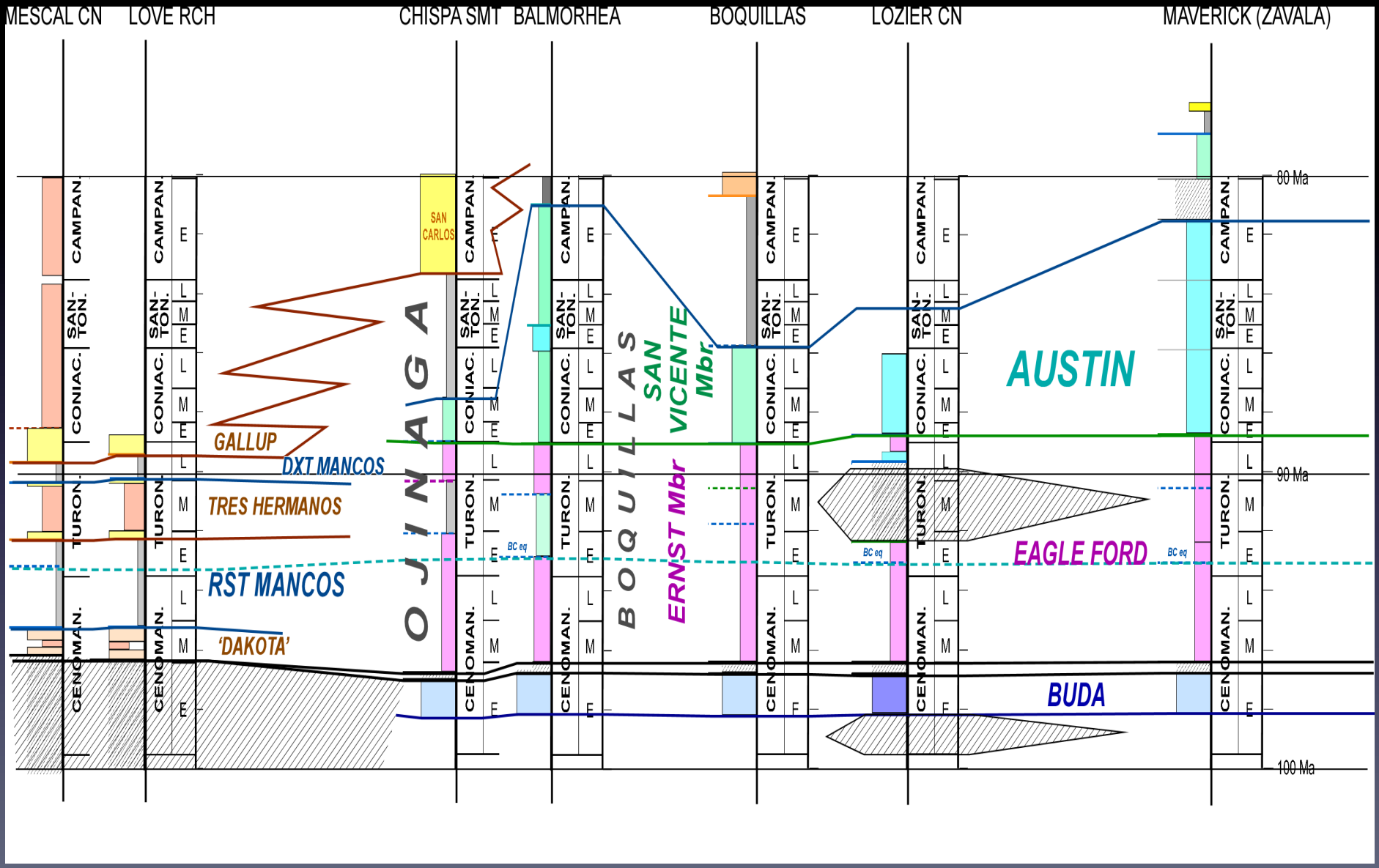
S-N SECTION, JORNADA



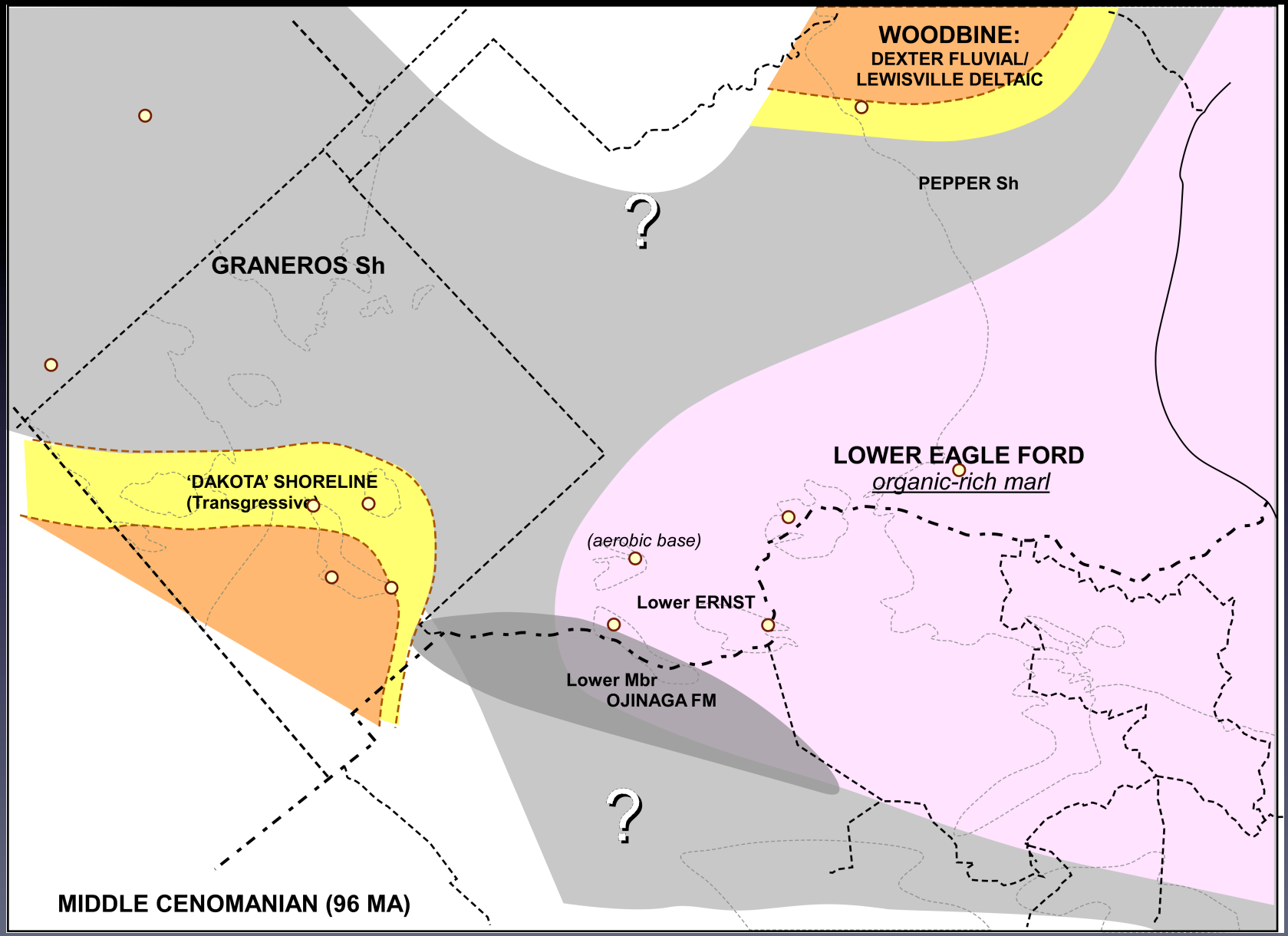
CORRELATION - DEPTH



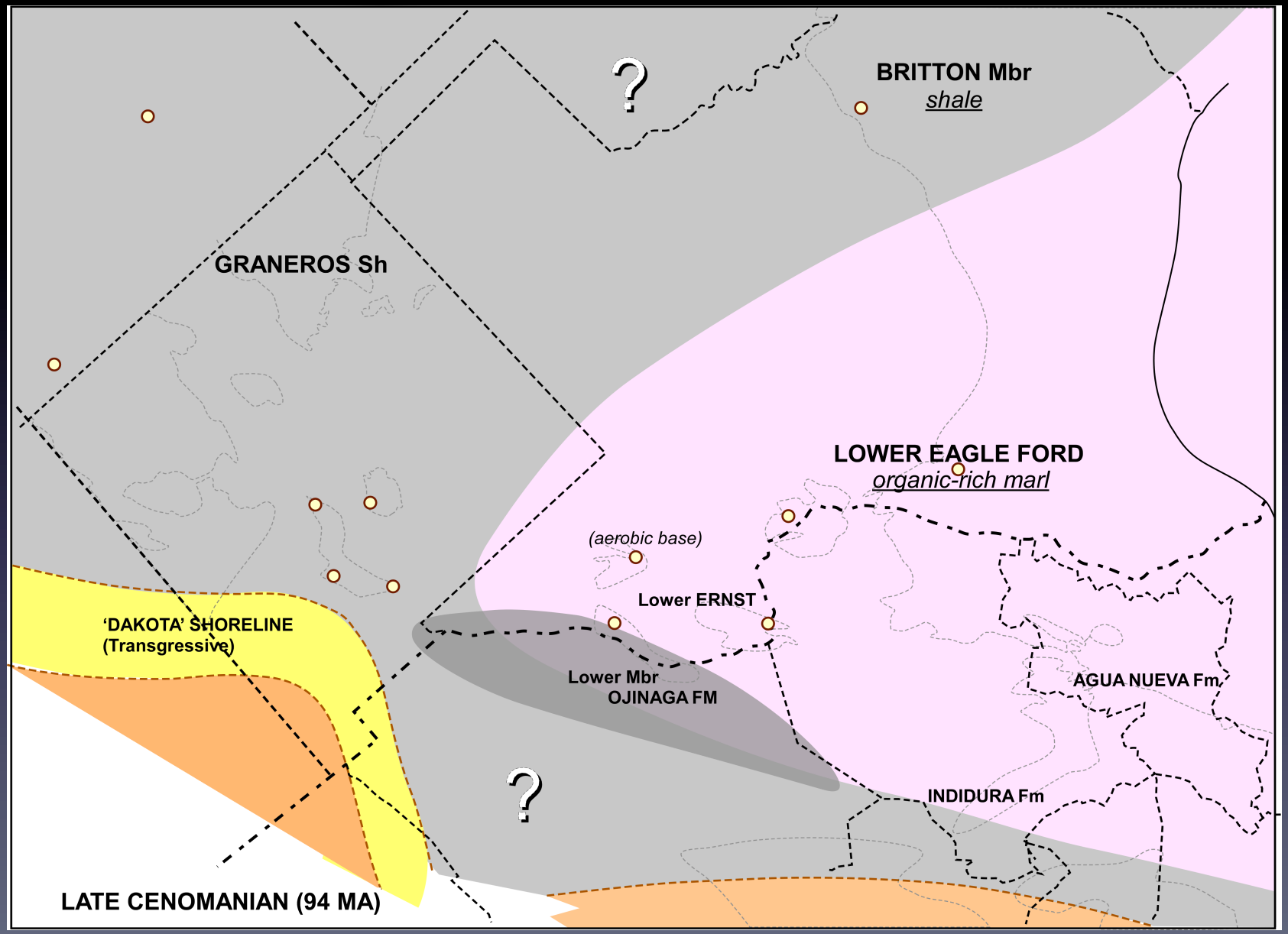
CORRELATION - TIME



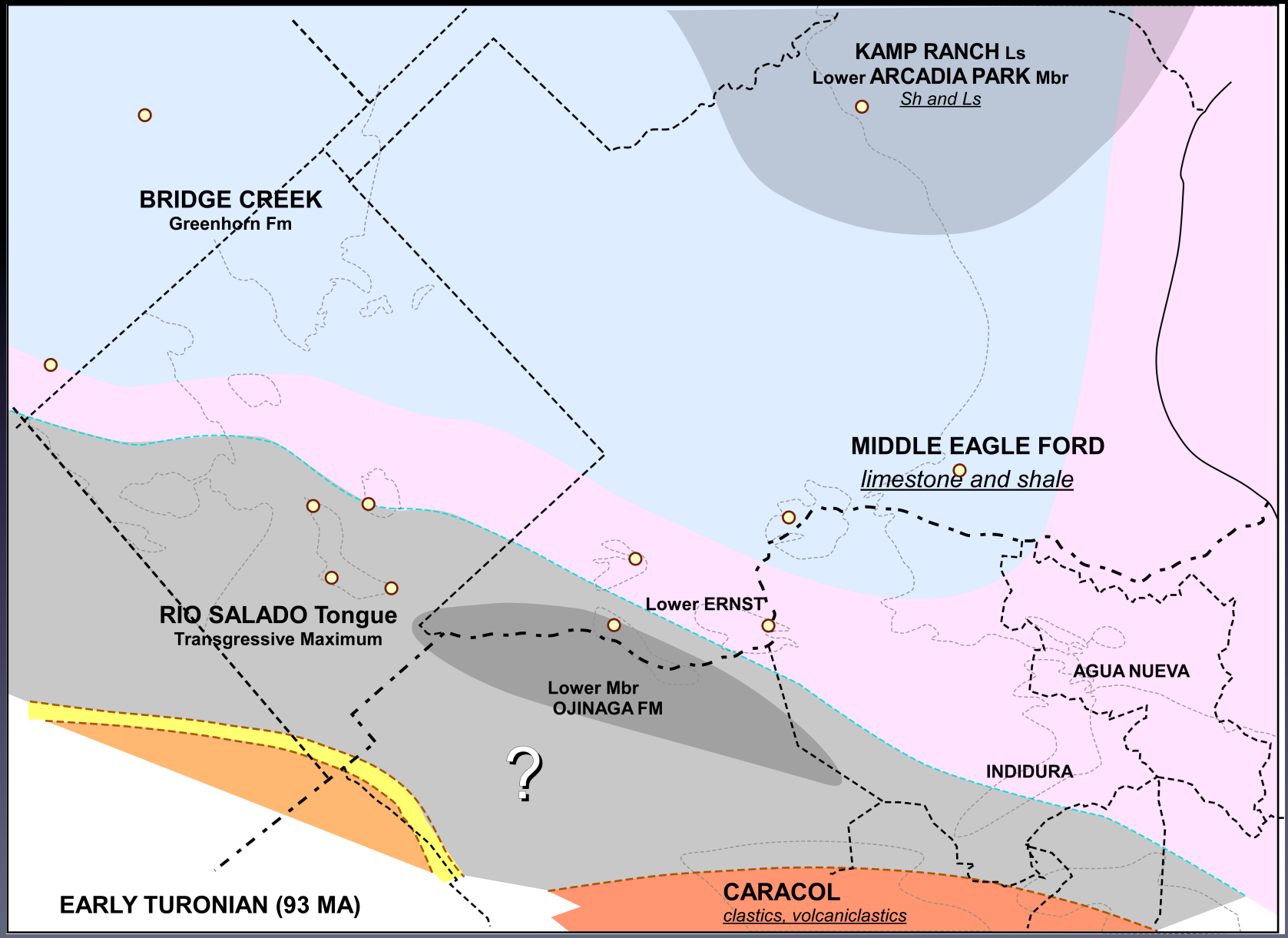
MIDDLE CENOMANIAN



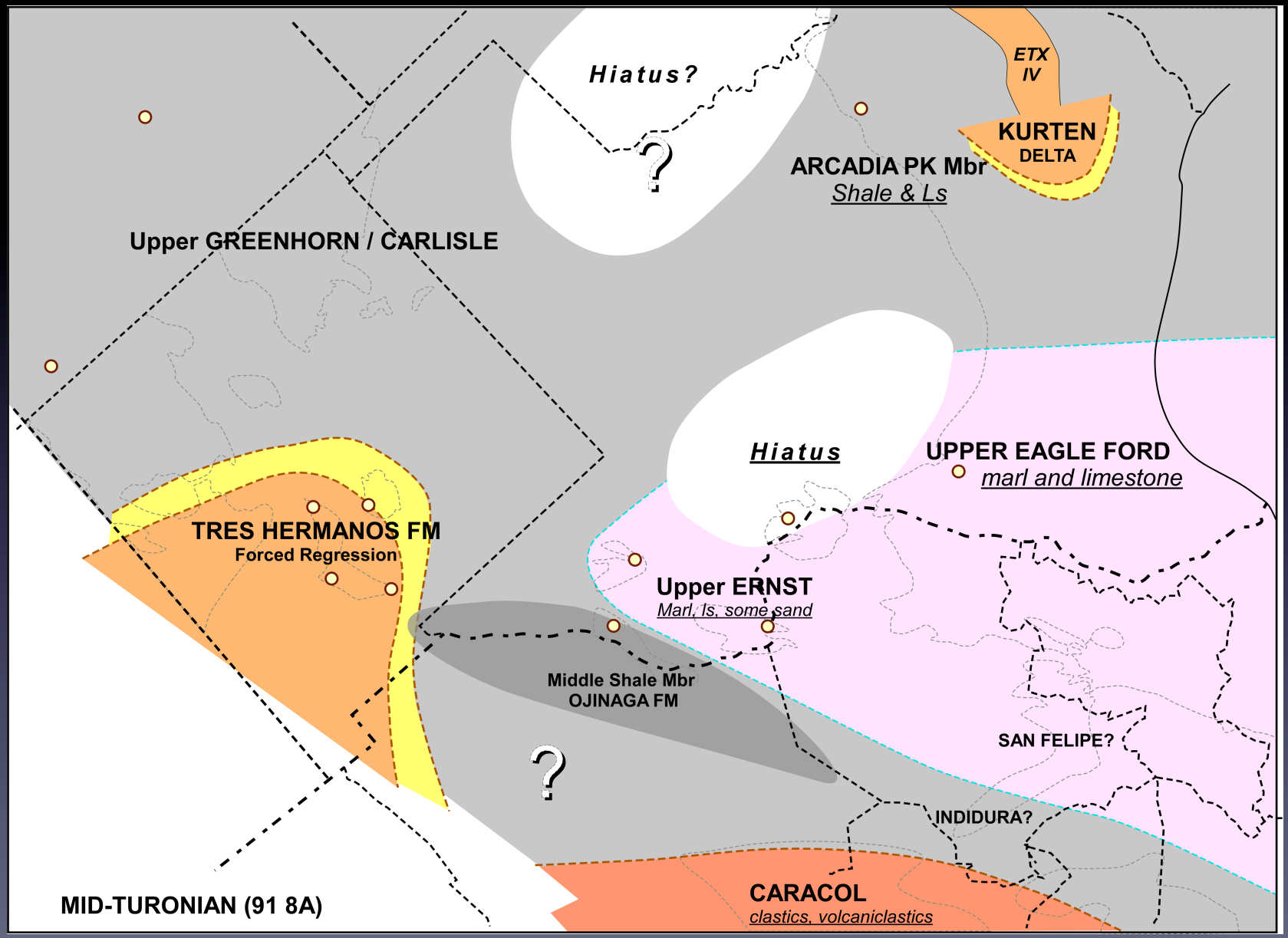
LATE CENOMANIAN



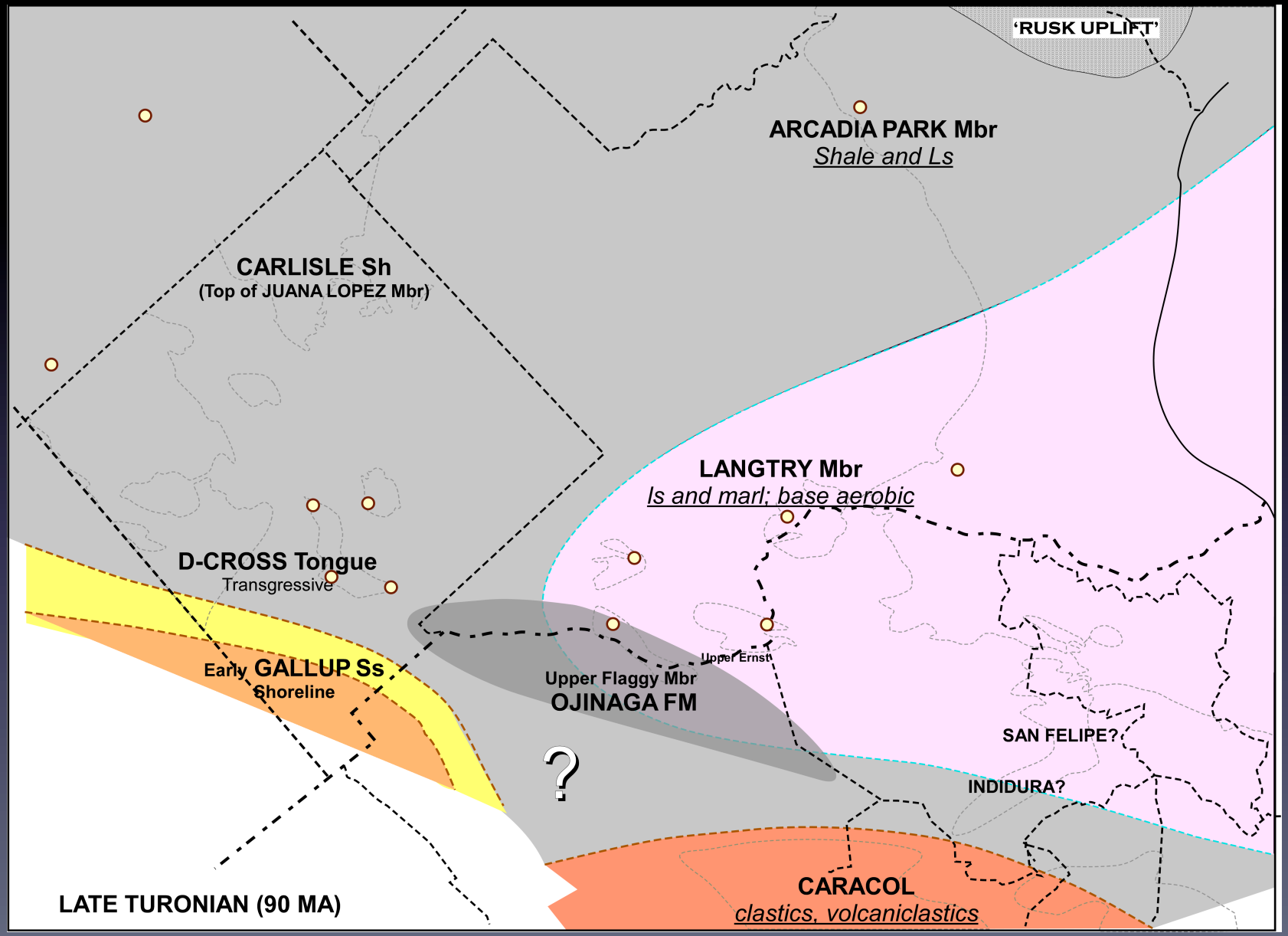
EARLY TURONIAN



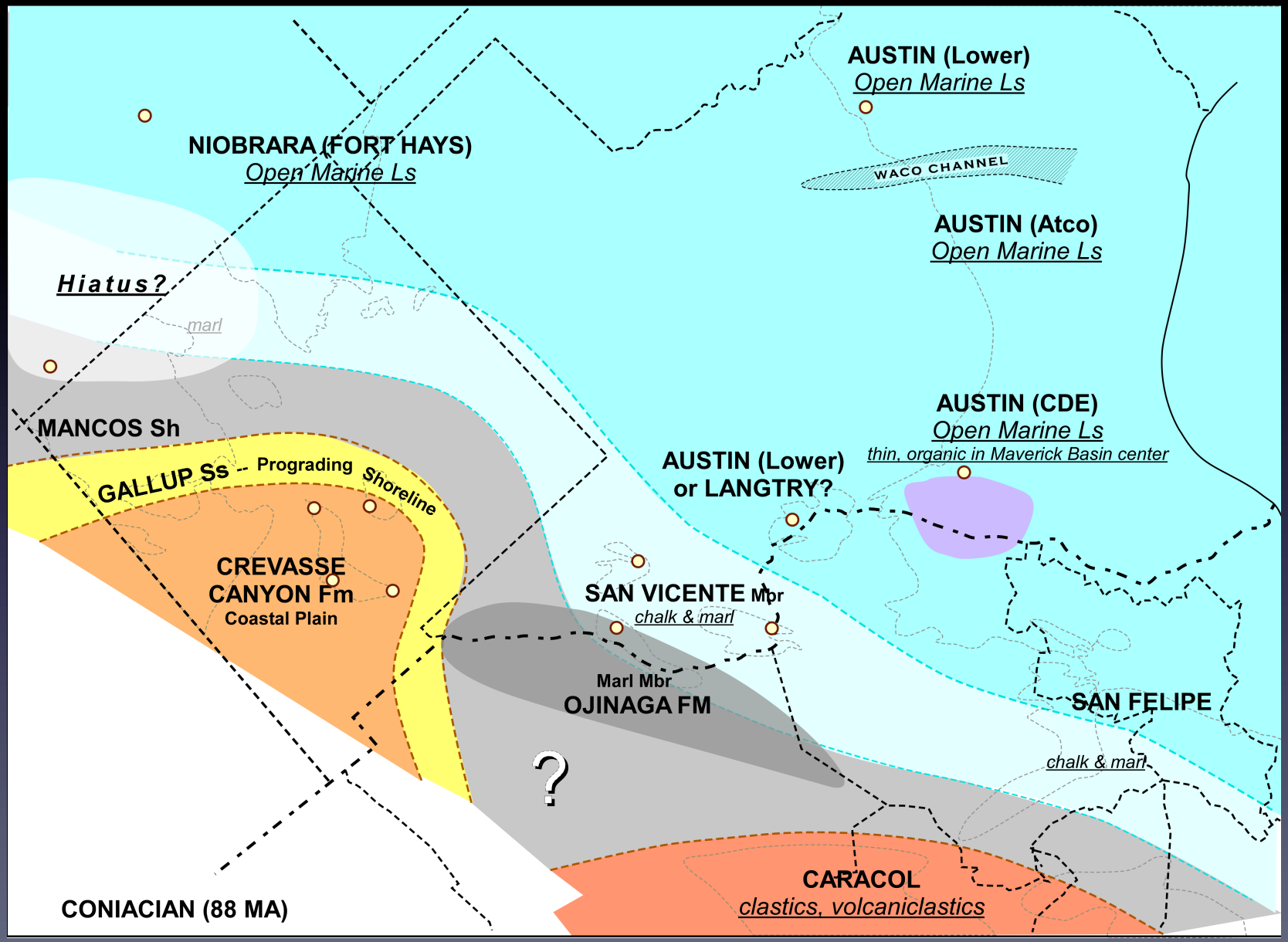
MIDDLE TURONIAN



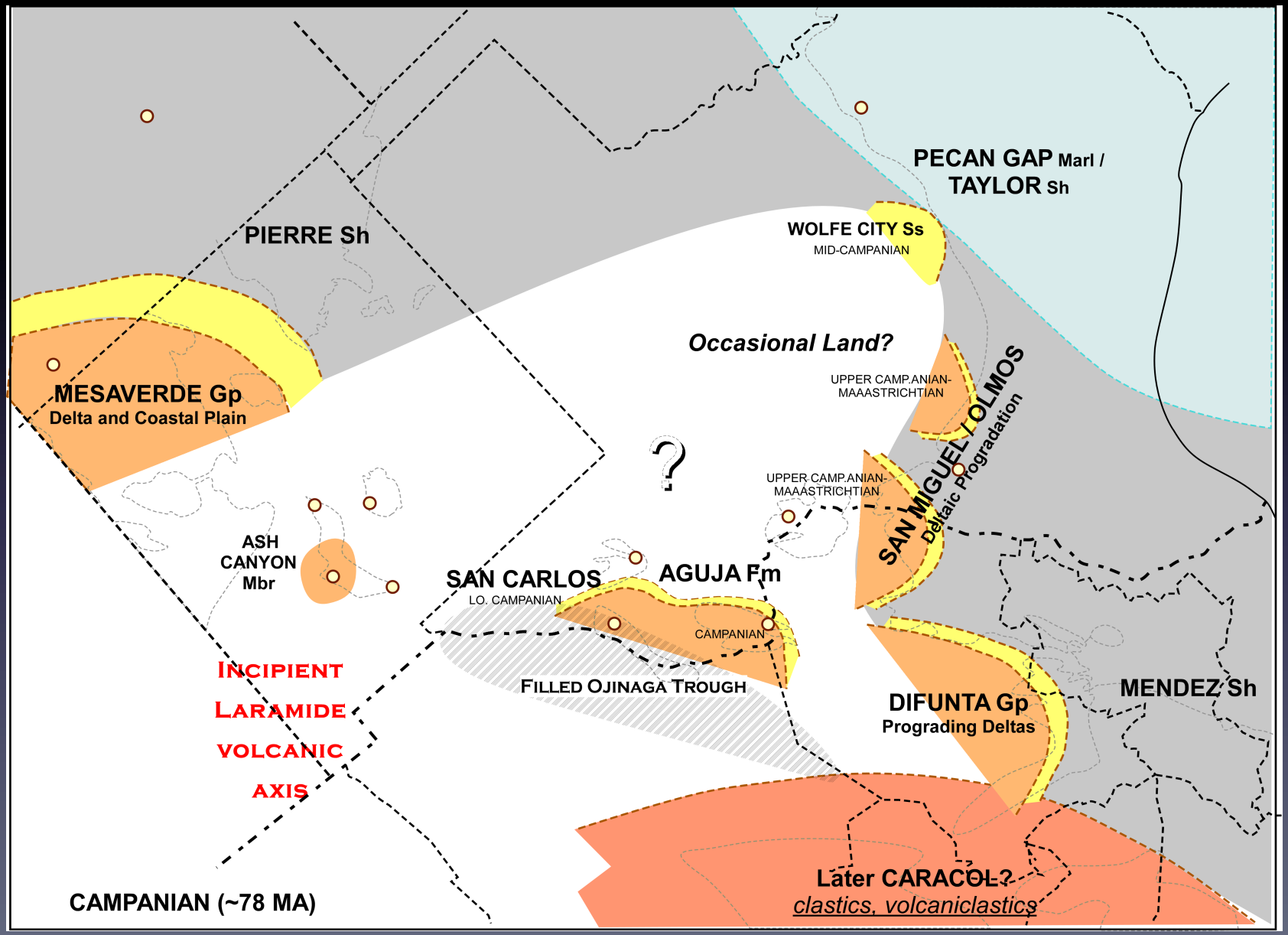
LATE TURONIAN



CONIACIAN


AUSTIN (Lower)
Open Marine Ls
NIOBRARA (FORT HAYS)
Open Marine Ls
WACO CHANNEL
AUSTIN (Atco)
Open Marine Ls
Hiatus?
marl
MANCOS Sh
AUSTIN (CDE)
Open Marine Ls
thin, organic in Maverick Basin center
GALLUP Ss -- Prograding Shoreline
AUSTIN (Lower)
or LANGTRY?
CREVASSE
CANYON Fm
Coastal Plain
SAN VICENTE Mbr
chalk & marl
Marl Mbr
OJINAGA FM
SAN FELIPE
chalk & marl
?
CARACOL
clastics, volcaniclastics
CONIACIAN (88 MA)

CAMPANIAN


PECAN GAP Marl /
TAYLOR Sh
PIERRE Sh
WOLFE CITY Ss
MID-CAMPANIAN
Occasional Land?
UPPER CAMPANIAN-
MAAASTRICHTIAN
SAN MIGUEL / OLMOS
Deltaic Progradation
MESAVERDE Gp
Delta and Coastal Plain
?
UPPER CAMPANIAN-
MAAASTRICHTIAN
ASH
CANYON
Mbr
SAN CARLOS
LO. CAMPANIAN
AGUJA Fm
CAMPANIAN
INCIPIENT
LARAMIDE
VOLCANIC
AXIS
FILLED OJINAGA TROUGH
DIFUNTA Gp
Prograding Deltas
MENDEZ Sh
Later CARACOL?
clastics, volcaniclastics
CAMPANIAN (~78 MA)

CONCLUSIONS

- Deep ***Ojinaga Trough*** traps Cordilleran clastics from entering Texas Cretaceous section until Campanian time
  - -Need modern integrated study of Ojinaga!
- Falling RSL in ***mid-Turonian*** forces Tres Hermanos delta in southern NM, unconformity in parts of Texas, Kurten Delta (ETX incised valley) in East Texas
- Major ***Gallup/Crevasse Canyon delta*** in latest Turonian seals north end of Ojinaga Trough, helps to fill trough (but doesn't make it into Texas)
  - Trough finally fills at beginning of Campanian
- GCC delta breaks ocean currents on deeper western margin and entrance to Ojinaga Trough
  - Does this help TOC accumulation in Niobrara?

REFERENCES

- W.A. Cobban, S.C. Hook, and K.C. McKinney, 2008, Upper Cretaceous molluscan record along a transect from Virden, NM to Del Rio, TX: New Mexico Geology, v.30, no.3, p. 75-92.
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