High-resolution stratigraphy and facies architecture of the Upper Cretaceous (Cenomanian–Turonian) Eagle Ford Group, Central Texas

Fairbanks, M., Ruppel. S., & Rowe. H., (2016). High-resolution stratigraphy and facies architecture of the Upper Cretaceous (Cenomanian–Turonian) Eagle Ford Group, Central Texas. *AAPG Bulletin* ; 100 (3): 379–403.

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Eagle Ford Formation

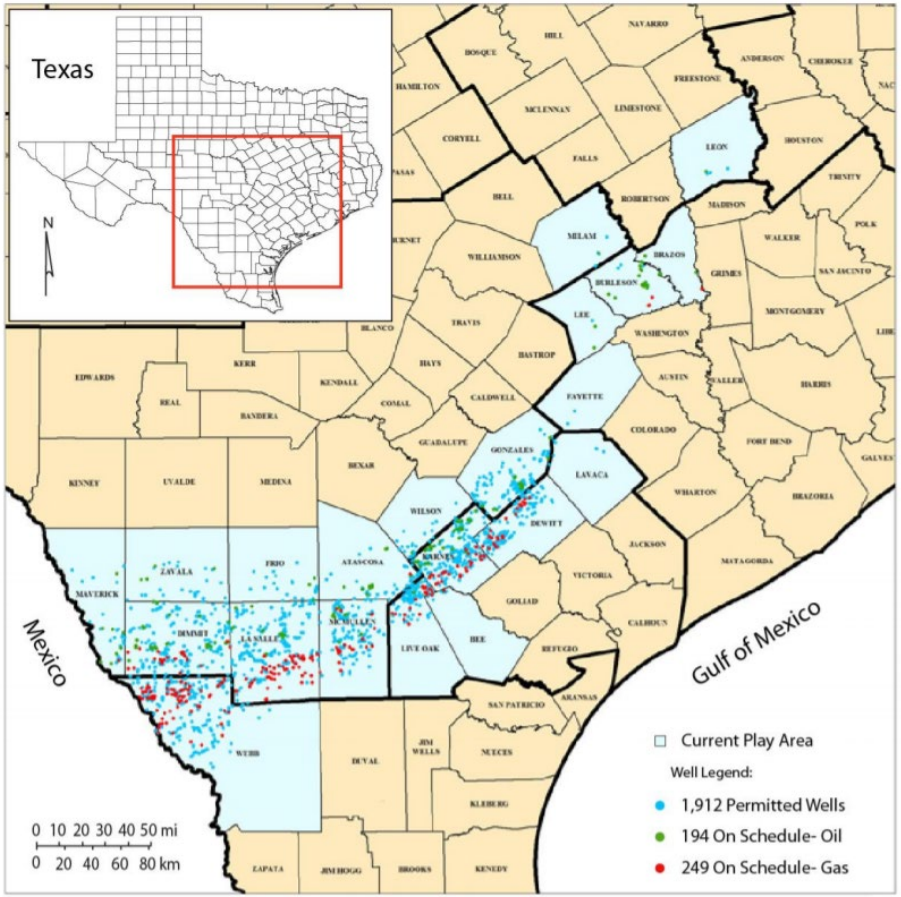
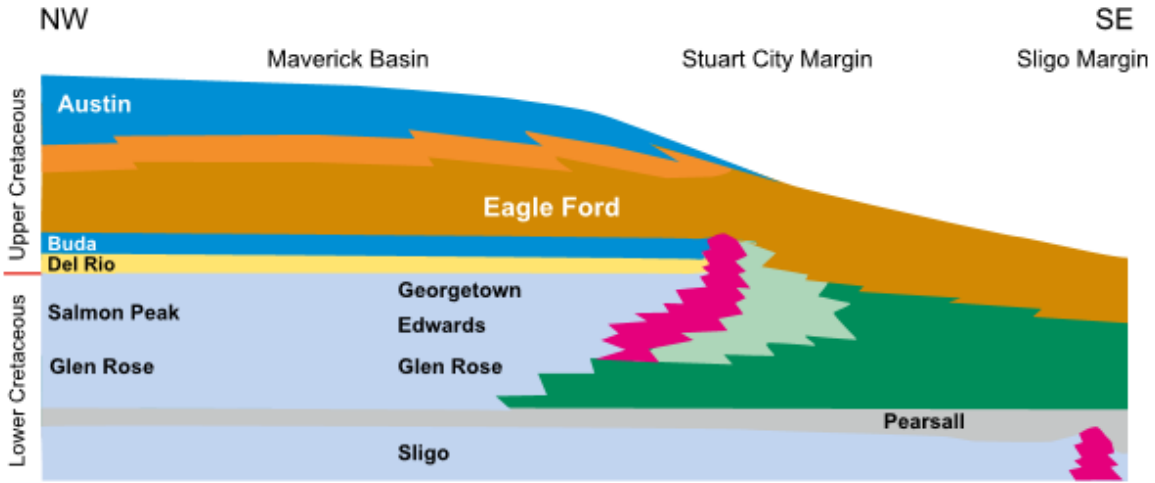


Figure 1. Eagle ford Map (Harbor ,2011)

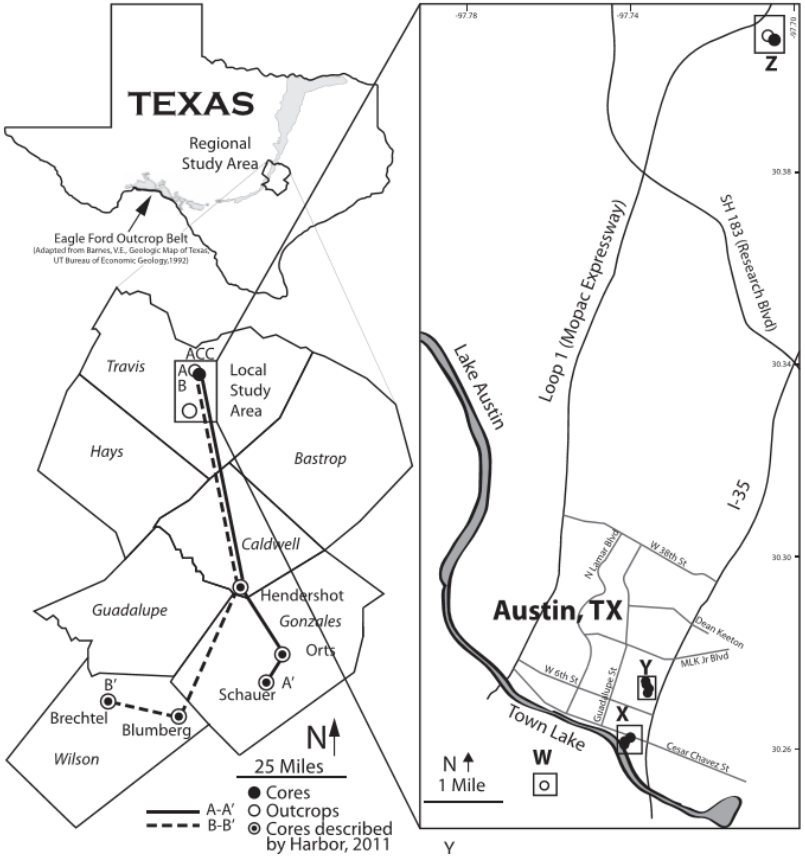
Eagle Ford Formation



- Formed in middle to late cretaceous period
- Overlain by Austin chalk

Figure 2. Regional Geology map (Fairbanks, Ruppel & Rowe, 2016)

Study Area



- Facies study is conducted in the Eagle ford:
- To determine facies variability
- To Correlate
- To determine TOC to eventually optimize production
- And to understand the distribution of reservoir properties

Figure 3. Study Area (Fairbanks, Ruppel & Rowe, 2016)

Study Area

Austin Area Cores*			
Core Number	Name in Study	Eagle Ford Depths (ft [m])	County
BT-222-PTPZ	222	51–88 (16–27)	Travis
BI-500-PT	500	55–94 (17–29)	Travis
BI-514-PTPZ	514	52–89 (16–27)	Travis
BT-204	204	80–116 (24–35)	Travis
BO-302-PT	302	52–90 (16–27)	Travis
BO-301-PTPZ	301	51–88 (16–27)	Travis
BT-221	221	52–88 (16–27)	Travis
ACC 1	ACC	80–125 (24–38)	Travis

Regional Cored Wells					
Wells	Name in Study	Eagle Ford Depths (ft [m])	County	API	Operator
C. J. Hendershot 1	Hendershot	4734–4774 (1443–1455)	Caldwell	4217730218	Tesoro Petroleum
W. Brechtel 1	Brechtel	3280–3315 (1000–1010)	Wilson	4249330208	Prairie Producing Co.
H. P. Orts 2	Orts	7684–7757 (2342–2364)	Gonzales	4217730203	Transocean Oil, Inc.
F. T. Schauer et al. 1	Schauer	8093–8159 (2467–2487)	Gonzales	4217730394	Geological Res Corp.
J. W. Blumberg 1-B	Blumberg	4175–4225 (1273–1288)	Wilson	4218730532	Prairie Producing Co.
Burkland 1	Burkland	935–977 (285–298)	Caldwell	4205534144	Vista Energy Corp.

*Outcrop: West Bouldin Creek, approximate coordinates: N30°15′9.8886″ and W97°45′41.3166″; Walnut Creek, approximate coordinates: N30°24′28.2594″ and W97°42′31.7952″.

- 8 cores (7 close)
- 2 outcrops
- 6 Regional Cored wells from Harbor (2011)
- Core Analysis using, XRD, XFR, and logs

Table1. Data Set (Fairbanks, Ruppel & Rowe, 2016)

Results (facies)

(1) massive argillaceous mudrock,

(2) massive foraminiferal calcareous mudrock,

(3) laminated calcareous foraminiferal lime mudstone,

(4) laminated foraminiferal wackestone,

(5) cross- laminated foraminiferal packstone – grainstone,

(6) massive bentonitic claystone, and

(7) nodular foraminiferal packstone –grainstone.

Results (facies)

- Eagle ford divided into 4 units
- 1. Pepper shale
- 2. Unnamed unit
- 3. Bouldin Member
- 4. South Bosque Formation

Figure 4. Stratigraphic Sequence(Fairbanks, Ruppel & Rowe, 2016)

Results (facies and Stratigraphy)

(1) massive argillaceous mudrock,

(2) massive foraminiferal calcareous mudrock,

(3) laminated calcareous foraminiferal lime mudstone,

(4) laminated foraminiferal wackestone,

(5) cross- laminated foraminiferal packstone – grainstone,

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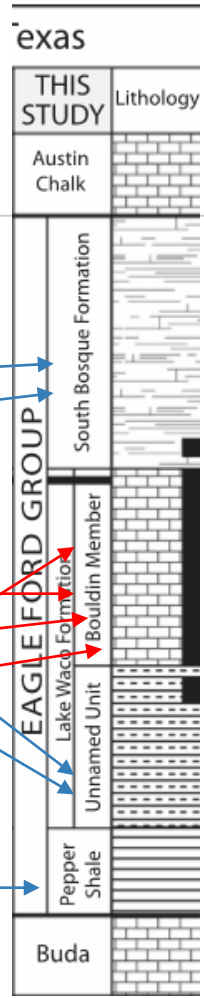


Figure 4. Stratigraphic Sequence(Fairbanks, Ruppel & Rowe, 2016)

Cyclicity and Facies Continuity

- Analyze continuity of facies in the cores
- High degree of facies discontinuity even in close spacing
- Core 514 (nodular foraminifera packstone-grainstone vs Core 500
- Core204 (Argillaceous mudrock) vs Core 302
- Cyclicity in Bouldin Member

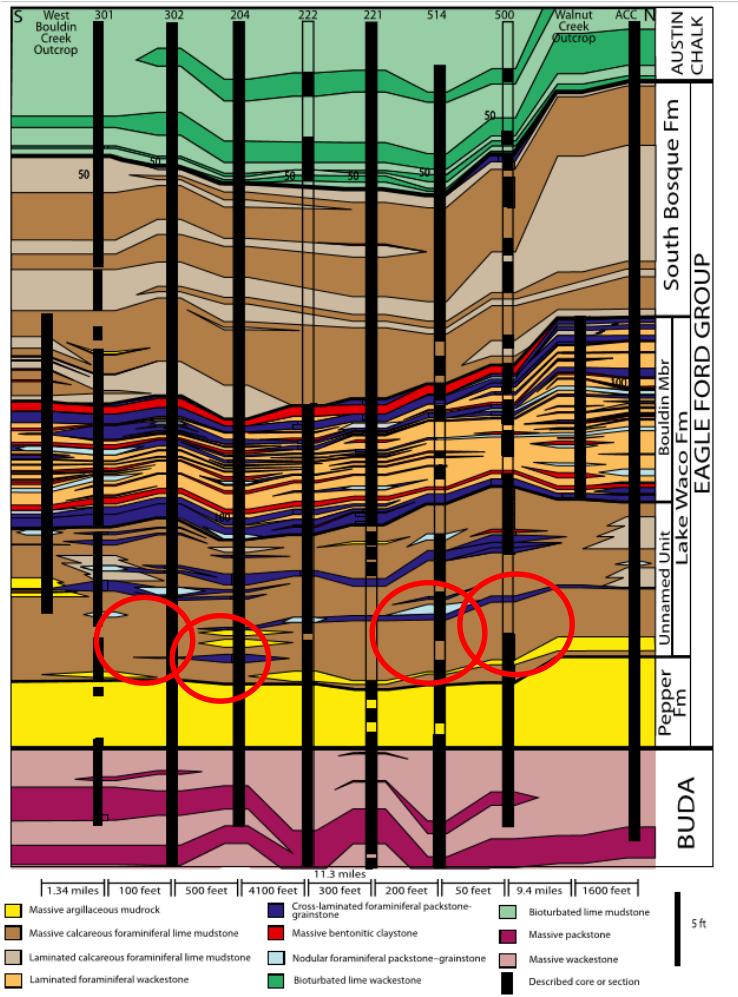
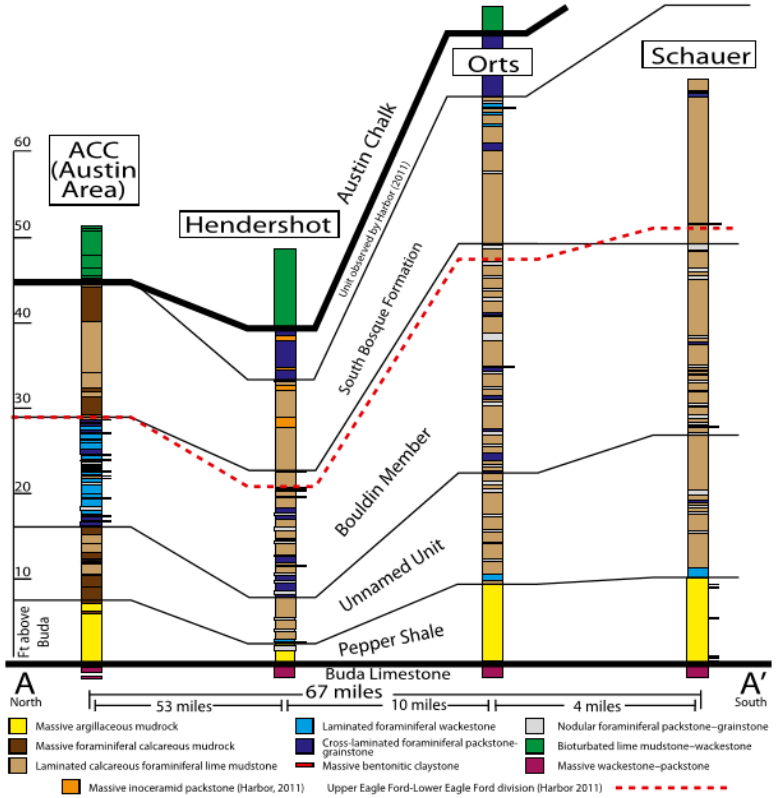


Figure 5. Correlation chart(Fairbanks, Ruppel & Rowe, 2016)

Chemostratigraphic Analysis

- Trace elements tells ocean chemistry and are used as proxies for water anoxia and are immobile
- Mo (molybdenum is used for the study) because of its high enrichment in organic facies
- Mo is high in anoxic marine systems and its found in high concentration in Bouldin Member of the Eagle ford.

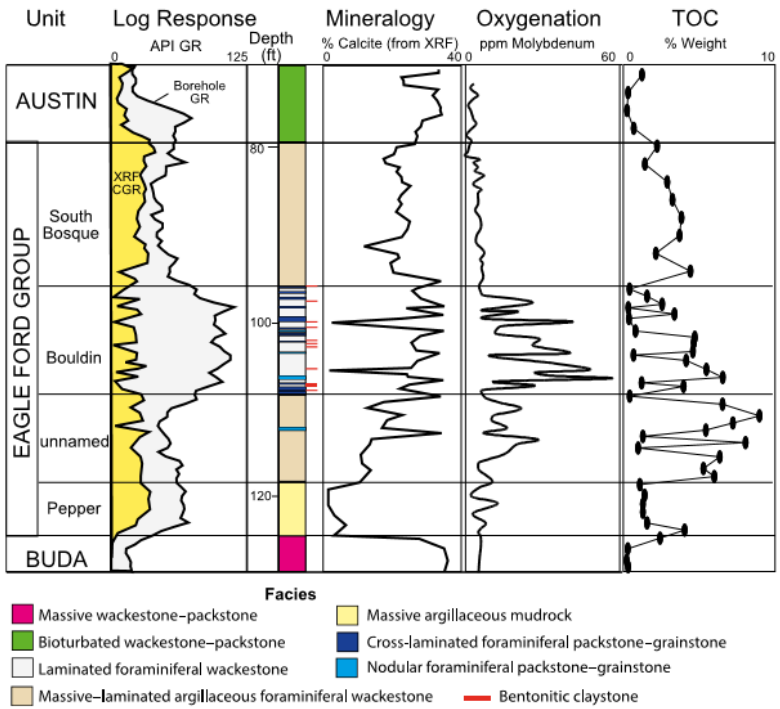
Regional cored surface wells correlation

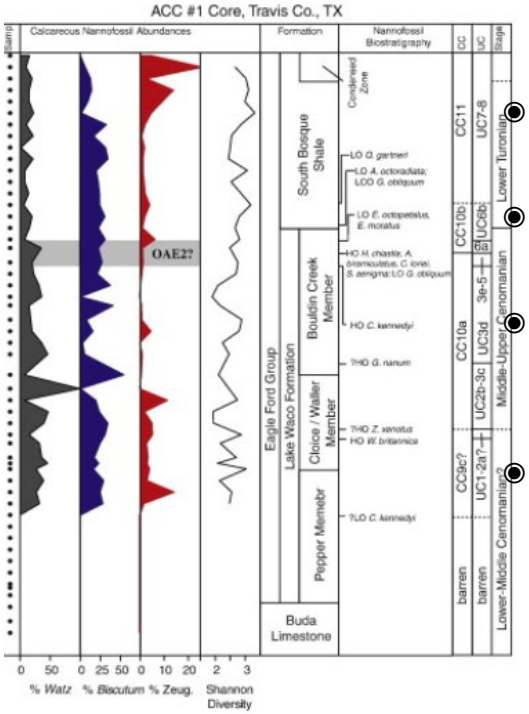


- The units thicken as we go shallow towards San Marcos arch
- There is a facies change in the units
- Bouldin member contains low energy facies
- Reduce of planktonic activity as we go Shallow
- Unconformity becomes conformity as we go towards Austin, Texas

Figure 6. Correlation chart(Fairbanks, Ruppel & Rowe, 2016)

Gama Ray and TOC Correlations





- Discrepancy between GR and CRG in Bouldin
- TOC content high in unnamed unit
- CRG tell high carbonate in Bouldin vs unnamed unit but looking at GR its incorrect
- Spectral GR log are important

Figure 7. GR and TOC chart (Fairbanks, Ruppel & Rowe, 2016)

*Figure 8: TOC chart in Eagle ford (*Corbett &Watkins 2013)

Discussion:

- Bouldin member has greatest degree of anoxic environment when deposited but they have high energy facies
- High U content but low TOC
- Study demonstrates that This is due to carbonate dilution where high supply of planktonic sediments and bottom reworking has caused increased amount of carbonate due to which TOC is only preserved a little

Definitions:

- **Thermohaline** circulation (THC) is a part of the large-scale ocean circulation that is driven by global density gradients created by surface heat and freshwater fluxes.
- **Coriolis forces** an effect whereby a mass moving in a rotating system experiences a force (the *Coriolis force*) acting perpendicular to the direction of motion and to the axis of rotation

Thermohaline circulation. (2019, March 25). Retrieved from https://en.wikipedia.org/wiki/Thermohaline_circulation

Coriolis force. (2019, May 06). Retrieved from https://en.wikipedia.org/wiki/Coriolis_force

Relevance to Oil Industry

- Eagle ford Shale Deflation problem
- High-resolution facies studies can help find better spots to perforate and increase production

Figure 9. Facilities in Eagle ford shale(DiLallo, 2016)

References

Primary Paper

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Two Required Additional Refereed Journal Articles

Harbor, R. L., (2011). Facies characterization and stratigraphic architecture of organic- rich mudrocks, Upper Cretaceous Eagle Ford Formation, South Texas, M.S. thesis, The University of Texas at Austin, Austin, Texas, 184 p.

Corbett, J. M., and D. K. Watkins, (2013). Calcareous nannofossil paleoecology of the mid- Cretaceous Western Interior Seaway and evidence of oligotrphic surface waters during OAE2: Palaeogeography, Palaeoclimatology, Palaeoecology, v. 392, p. 510–523.

One Required Events Reference

DiLallo, M., (2019). Top Oil Stocks for the Coming Boom in the Eagle Ford Shale. *The Motley Fool*, 2019. Retrieved from https://www.fool.com/investing/2019/04/13/3-top-oil-stocks-for-the-coming-boom-in-the-eagle.aspx

Additional References

DiLallo, M., (2019). Top Oil Stocks for the Coming Boom in the Eagle Ford Shale. *The Motley Fool*, 2019. Retrieved from https://www.fool.com/investing/2019/04/13/3-top-oil-stocks-for-the-coming-boom-in-the-eagle.aspx

Thank you