A preliminary study on the depositional history of the Cretaceous, Goshen County, Wyoming

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(2) Sunshine Valley Petroleum
Cretaceous events

- Western interior seaway - deposition
- Farralon Plate subduction
- Laramide orogenic event
- Hartville Uplift

http://dinosaurjungle.com
Research indicates study location submerged Early Cretaceous but intermittent by Late Cretaceous.

Distribution of the Western Interior Seaway based on Smith et al. (1994) and the paleogeography maps of Ron Blakey, NAU Geology (http://jan.ucc.nau.edu/~rcb7/nam.html).
Farallon Plate Subduction / Laramide Orogeny – Mid Cretaceous (~90 Ma)

http://geoscience.wisc.edu/~chuck/Classes/Mtn_and_Plates/mtns_westernUS.html
Farallon Plate Subduction / Laramide Orogeny

• Seaway present due to two major factors
  – Subsiding foreland trough
  – Eustatic rise in sea level
• The Farallon Plate was an ancient oceanic plate, which began subducting under the west coast of the North American Plate—then located in modern Utah—as Pangaea broke apart during the Jurassic Period. It is named for the Farallon Islands which are located just west of San Francisco, California.
Farallon Plate Subduction / Laramide Orogeny – Late Cretaceous (~75 Ma)

http://geoscience.wisc.edu/~chuck/Classes/Mtn_and_Plates/mtns_westernUS.html
Cretaceous outcrops in Wyoming
Stratigraphy

UNCONFORMITY - Erosional

- Dakota: It consists of sandy, shallow-marine deposits with intermittent mud flat sediments, and occasional stream deposits
- Mowry/Graneros: Thick shale formation- Cumulative Mowry-sourced petroleum production is about 1.2 BBO (billion barrels of oil) and 2.2 TCFG (trillion cubic feet of gas)
- Greenhorn: Limestone bed, deeper marine
Stratigraphy

- **Carlile**: Shales
- **Codell**: Dark gray sandstones, Initial producing GOR's vary from less than 1,000 to more than 15,000 scf/bbl
  
  **UNCONFORMITY - Erosional**
- **Niobrara**: Mostly chalks and marls with abundant fossils. Considered an open marine environment. Niobrara-sourced oil production is about 520 MMBO (million barrels of oil) and 0.95 TCFG
  
  **UNCONFORMITY - Erosional**
- **Pierre**: Dark/ Black shale with occasional bentionite (ash) beds
  
  **UNCONFORMITY - Erosional**
Stratigraphy

UNCONFORMITY - Erosional

• Niobrara: Mostly chalks and marls with abundant fossils. Considered an open marine environment. Niobrara-sourced oil production is about 520 MMBO (million barrels of oil) and 0.95 TCFG

UNCONFORMITY - Erosional

• Pierre: Dark/ Black shale with occasional bentionite (ash) beds

UNCONFORMITY – Erosional

• The Fox Hills Formation consists of marginal marine yellow sandstone with shale interbeds
Stratigraphy

- Laramie Formation: divided into a lower unnamed member containing bedded sandstone, clay and coal and an upper unnamed member composed predominately of 90 to 190 m of drab-colored mudstone, some sandstone, and thin coal beds.
- Arapaho Formation: conglomerate comprised of older formations surrounding formation locations
Stratigraphy

<table>
<thead>
<tr>
<th>Time</th>
<th>Formation</th>
<th>Thickness (ft)</th>
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<tbody>
<tr>
<td>Paleogene</td>
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<tr>
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<td>Denver</td>
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<tr>
<td></td>
<td>Arapahoe</td>
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<td></td>
<td>Laramie</td>
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<td></td>
<td>Fox Hills</td>
<td>0 - 145</td>
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<td></td>
<td>Pierre</td>
<td>980 - 8,000</td>
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<tr>
<td></td>
<td>Codell</td>
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<td>Carlile</td>
<td>40 - 100</td>
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<tr>
<td></td>
<td>Greenhorn</td>
<td>195 - 280</td>
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<td></td>
<td>Mowry/Graneros</td>
<td>165 - 215</td>
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<td>Morrison</td>
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<td>Entrada/Sundance</td>
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<td>Jelm</td>
<td>0 - 140</td>
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<td>Lykins</td>
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Cretaceous Cross-Section

Liu S, and Nummedal D Geology 2004;32:397-400
Cretaceous Cross-Section

Liu S., and Nummedal D. Geology 2004;32:397-400
Study Location
• 23 Wildcat wells drilled between 1921 and 1981
• 18 had data on WYOGCC website allowing for cross sections to be built
• Target formations from Late Jurassic Sundance to Mid-Cretaceous Codell
• WYOGCC states none have ever produced
• WYOGCC also has lithological descriptions, total/effective porosity, water saturation values
Study Location – Cross-Sections
Cross-Section A-A’
Cross-Section B-B’
Cross-Section C-C’
Cross-Section D-D’
Cross-Section E-E’
Cross-Section G-G’
Cross-Section H-H’

White River
Pierre
Niobrara
Codell Carlile
Cross-Section I-I’
Fault Locations

(Love and Coe-Christensen, 1985)
Conclusions / Additional Work

- Substantial structural features
- Cretaceous subcrop located towards the northwest of study area
- Isopach maps need to be made illustrating this subcrop more readily
- Continued mapping along fault location
Acknowledgements

BLACKSTONE and ASSOCIATES

Sunshine Valley Petroleum Corporation
Works Cited

• Dinosaur photo - http://dinosaurjungle.com
• Distribution of the Western Interior Seaway based on Smith et al. (1994) and the paleogeography maps of Ron Blakey, NAU Geology (http://jan.ucc.nau.edu/~rcb7/nam.html) – the interior seaway pictures
• http://geoscience.wisc.edu/~chuck/Classes/Mtn_and_Plates/mtns_westernUS.html - the tectonic slides
• Dakota Sandstone: - McLaughlin, Thad G. (1942) "Water-bearing Formations, continued: Cretaceous System: Dakota Group" Geology and Ground-Water Resources of Morton County, Kansas
• Liu S, and Nummedal D Geology 2004;32:397-400 – The cross section of Wyoming slides
• Mowry / Niobrara reserve estimates - Assessment of the Mowry Shale and Niobrara Formation as Continuous Hydrocarbon Systems, Powder River Basin, Montana and Wyoming, By Lawrence O. Anna and Troy A. Cook