Subsurface Characterization of the Depositional System for the Paleocene Raton Formation, New Mexico and Colorado, USA*

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Abstract

The Raton Formation lies within the Raton Basin, which spans the Colorado-New Mexico border within the foreland of the Sangre De Cristo Range. The formation consists of sandstone, shale, coal, and conglomerates that were deposited within a closed intermountain basin and is now an important target for coal bed methane within the region. Foreland subsidence in the Raton Basin accommodates the deposition of four key formations; the Cretaceous Trinidad Sandstone, the Upper Cretaceous Vermejo Formation; the Paleocene Raton and Poison Canyon Formations. The Raton Formation is notable for the discovery by C. Pillmore who found that the formation contains the global K-T boundary iridium layer. The development of coal bed methane within the Raton Formation has provided a great deal of new subsurface data, which is the basis of this research. The goal is complete high-resolution correlations between available data to evaluate the influence of orogenic uplift to the west on sedimentation patterns as well as the extent and importance of a regional unconformity that persists within the western part of the basin. To the east, the section is conformable, which could be interpreted as a shifting and east directed broadening of the Raton Basin as a function of the growing orogenic wedge to the west. Alternatively, uplift of the western margin of the basin may have been driven by eastward migration of the deformation front. In the case of the latter one would expect to see evidence of sedimentary bypass and erosion that varies at a local scale. For the former, the western basin may have been abandoned entirely over regional scales producing a uniform progression of depositional facies. To evaluate these models we are conducting a high-resolution correlation study of electrofacies throughout the available data. The results of which can identify key stratigraphic events to test these models. A primary issue concerning the data is that many of the sand bodies within the system are arkosic and have a strong gamma response similar to shale. This will require that we consider a range of petrophysical characteristics to accurately differentiate sand from shale.
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Abstract

Geologic Setting

The Raton Formation is a key element within the foreland basin depositional system for the Paleocene Raton Formation. Four major zones are recognized: the Raton Formation.

Stratigraphic Column

Microphotographs

Depositional Environment

Log Data

Methods

Neutron Porosity Curve

Zone Data

Vitrinite reflectance

- Black Shale and Coal: Vitrinite reflectance in Track 2 is logarithmic, over 1.0%.
- Bituminous material in core: 0.8% to 1.0%.

Bulk Complement

- The Raton Formation is divided into three main units:
  - Top of Basal Conglomerate
  - Top of Lower Coal Zone
  - Top of Barren Zone

Resistivity Curve

- Conductivity curve is plotted on Track 3 with a linear scale of 0 to 800 ohm-m.
- GRLog curve is plotted on Track 2 with a linear scale of 0 to 275 ohm-m.

Gross coal was calculated with the bulk density log where the bulk density cutoff of less than 2.0 g/cc identified a coal bed.

Neutron porosity data in Track 1 was a logarithmic scale, 1.0% to 10.0%.

- The red shaded areas identify zones of higher porosity in the well log.
- Gross sand was calculated for all zones using a conductivity cutoff with a gamma ray cutoff maximum of 90 API.

Bulky and Carbon

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**Cross Sections**

**Isopach Maps**

**Results**

Cross Sections

**Verbano Park Field, New Mexico**

<table>
<thead>
<tr>
<th>Results</th>
<th>Vermejo Park Field</th>
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<tr>
<td>Sandstone and Mudstone Geometries</td>
<td>Coal 1</td>
</tr>
<tr>
<td>Coal Geometry</td>
<td>Overlapping Relationships</td>
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**Depositional Environment**

The Vermejo Park field has a rich history of coal deposits, which can be attributed to the distinct tectonic and stratigraphic settings of the region. The field is characterized by thick coal seams, indicating a period of high peat production. The Tectonic Model suggests that the basin underwent a series of tectonic events, including thrust faulting and flexural subsidence, which played a significant role in the deposition of coal.

**Acknowledgements**

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