**Regional Overview**

- The Jurassic (Juralic) Twin Creek Limestone in the Uplain/Yawning trough has produced over 1 million Bbl of oil and 100 Bcf of gas. The Twin Creek Field is located in Summit County, Utah, and is part of the larger Pineview Field.
- The Twin Creek Limestone is a significant source rock for the productive oil and gas reservoirs in this area.

**Carbonate Heterogeneity Based on Lithofacies and Petrography of the Jurassic Twin Creek Limestone in Pineview Field, Northern Utah Thrust Belt**

- Lithofacies include open marine, low- to high-energy middle shelf, micro-belt revealed complex heterogeneity due to a variety of carbonate lithofacies.
- The Twin Creek Limestone is overlying argillaceous and clastic beds, and non-fractured Cretaceous source rocks. Seals, barriers, and baffles for the productive reservoirs were generated from sub-anticlines where the low-porosity Twin Creek is extensively fractured.

**Pineview Field General Overview**

- **Twin Creek Limestone Discovery Well**
  - **Location:** Summit County, Utah
  - **Well:** 1-3-3
  - **Completion:** 1975
  - **Producing Reservoir:** Twin Creek Limestone

- **Production of Reserves**
  - **Crude Oil**:
    - **Initial**: 3.0 x 10^9 Bbl
    - **Cumulative**: 3.0 x 10^7 Bbl
    - **Estimated Ultimate**: 3.0 x 10^9 Bbl
  - **Gas**:
    - **Initial**: 7.5 x 10^11 Mcf
    - **Cumulative**: 7.5 x 10^11 Mcf
    - **Estimated Ultimate**: 7.5 x 10^11 Mcf

- **Depositional Systems**
  - **Source Rocks**: Mid-Jurassic marine mudstones and siltstones, with some clastics.
  - **Reservoir Rocks**: Twin Creek Limestone, a shallow marine limestone deposited in a embayment south of the main body of a Mid-Jurassic carbonate platform.

- **Field Characteristics**
  - **Oil Composition**:
    - Methane: 75%
    - Ethane: 16%
    - Propane: 4%
  - **Gas Composition**:
    - Methane: 50%
    - Ethane: 40%
    - Propane: 10%
  - **GOR**: 1000 ft³/bbl
  - **Water Saturation**: 20%
  - **Average Porosity**: 20%
  - **Average Permeability**: 200 md
  - **Oil Driving Force**: Solution gas drive
  - **Type of Drive**: Solution gas drive

**Lithofacies and Petrography**

- **Watton Canyon Member**
  - **Core Description**:
    - Core through the mid-Watton Canyon Member: 8738 – 8763 ft.
    - Porosity/Permeability Cross Plot
    - Core through the mid-Watton Canyon Member: 8743 ft., porosity = 3.0%, permeability = 10 mD.
    - Core through the mid-Watton Canyon Member: 8738 ft., porosity = 1.6%, permeability = 3.5 mD.
  - **Panel I**: Fractures with other orientations (red arrows) within a lime mudstone that form conjugate sets (between red arrows), a common post-burial feature of this rock type. Some fractures are filled with a variety of minerals.
  - **Panel II**: Oil staining and drilling mud from an undrilled area that was subsequently drilled. Some fractures are large, and others are smaller, indicating a complex fracture network.

**Horizontal Wells, Pineview Field**

- **Geophysical Well Log of the Twin Creek Limestone, UPRR**
  - **No. 3-3 Well, Pineview Field, Summit County, Utah**
  - **Horizontal Wells**
  - **Dipmeter Projections**
  - **Interval**: 8738 – 8763 ft.
  - **Porosity**: 3.0% - 1.6%
  - **Permeability**: 10 mD - 3.5 mD
  - **Fractures**: Fractures with other orientations (red arrows) within a lime mudstone that form conjugate sets (between red arrows), a common post-burial feature of this rock type. Some fractures are filled with a variety of minerals.
  - **Oil Staining**: Oil staining and drilling mud from an undrilled area that was subsequently drilled. Some fractures are large, and others are smaller, indicating a complex fracture network.

**Oil & Gas Characteristics**

- **API Gravity**: 30 - 32° API
- **Oil Composition**:
  - Methane: 75%
  - Ethane: 16%
  - Propane: 4%
- **Gas Composition**:
  - Methane: 50%
  - Ethane: 40%
  - Propane: 10%
- **GOR**: 1000 ft³/bbl
- **Water Saturation**: 20%
- **Average Porosity**: 20%
- **Average Permeability**: 200 md
- **Oil Driving Force**: Solution gas drive
- **Type of Drive**: Solution gas drive
**Lithofacies and Petrography**

### LOWER Watton Canyon MEMBER

**Core Description**

- Member and the upper Boundary Ridge Member.
- Rock appears clean and porosity is moderate. Large holes correspond to large pores within the rock. Highly magnified view of a nodular lime mudstone with well-developed subhorizontal microfractures.
- Core composite from 8888-8924 ft., covering the lower Watton Canyon Member.

### UPPER Boundary Ridge MEMBER

**Core Description**

- Core composite from 8891-8894 ft., covering the lower Watton Canyon Member.
- Nodular lime mudstone with subhorizontal microfractures.
- Porosity = 0.01 mD).

### Rich Member

**Core Description**

- Core composite from 8904-8907 ft., covering the upper Watton Canyon Member.
- Oolitic and oncolitic grainstone with fracture pore space. Note the vertical fractures that have healed with white anhydrite.
- Porosity = 0.01 mD).

**Porosity/Permeability Cross Plot**

- Porosity/Permeability Cross Plot showing the relationship between porosity and permeability for the Rich Member.
- The plot includes data points for various intervals, with permeability values ranging from 0.01 to 0.08 mD.

**Panel II**

- Close-up view of a replacement anhydrite (An) nodule.
- Anhydrite displaying white anhydrite (An) nodules within a very low porosity quartz-rich siltstone.
- Porosity/Permeability Cross Plot showing the relationship between porosity and permeability for the Rich Member.

**Panel III**

- Core composite from 8910-8913 ft., covering the upper Watton Canyon Member.
- Wide aperture fracture that is healed with anhydrite (see red arrows).

**Panel IV**

- Core composite from 8918-8921 ft., covering the upper Watton Canyon Member.
- Highly magnified view of an anhydrite replacement anhydrite (An) nodule.

**Panel V**

- Core composite from 8926-8929 ft., covering the upper Watton Canyon Member.
- Subhorizontal microfractures shown in blue.

**Panel VI**

- Core composite from 8934-8937 ft., covering the upper Watton Canyon Member.
- Swarm of solution-enlarged subhorizontal microfractures shown in blue.
Lithofacies and Petrography

Sliderock Member

Core through the Sliderock Member: 9200 – 9260 ft.

- Microfractures (between red arrows) that porosity = 3.5%, permeability = 23 mD.

- Grainstone with several sub-vertical packstone. Note the absence of any surface in a massive silty lime mudstone. The red stair-step surfaces that displays bioturbation and small detrital quartz grain (Q) that show perforated interval. (9203 ft., porosity = 1.8%, permeability = 2.5 mD).

- Low porosity silty peloidal mudstone and oil staining give these "stylolites"
fractures" their dark color in the mudstone matrix.

- Well-displayed rectilinear fracturing on bedding surface with silt-filled fractures, closely spaced rectilinear fracturing in steeply dipping limestone, large-scale, open fractures on bedding, heterogeneity within the Watton Member limestone and basal siltstone of North canyon, Pineview field: Cause No. 167-8, Exhibit Panel III.

Outcrop Analogies

Devils Slide, Water Canyon, Utah

Geologic Map of the Devils Slide Area, Morgan and Summit Counties, Utah

Characteristics of the Water Canyon Member of the Twin Creek Limestone

Geologic Map of the Peav Area, Summit County, Utah

Characteristics of the Rich Member of the Twin Creek Limestone

Conclusion & Summaries

References

Data Sources

Peoa section. Modified from Coogan, 1999 Special Publication 9, 225 p.

Modified from Coogan, 1999 Special Publication 9, 225 p.

Modified from Coogan, 1999 Special Publication 9, 225 p.

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