CARBONATE HETEROGENEITY BASED ON LITHOFAcies AND PETROGRAPHY OF THE JURASSIC TWIN CREEK LIMESTONE IN PINVIEW FIELD, NORTHERN UTAH THRUST BELT

Regional Overview

PINWEN FIELD GENERAL OVERVIEW

TWIN CREEK LIMESTONE POROSITY/PERMEABILITY CROSS PLOT, UPRR

Core through the mid-Watton Canyon Member: 8738–8763 ft. Porosity/permeability cross plot with dolomites, micropores, pyrite and calcite dissolution. The black specks are sulfide minerals. Core closeup: Oblique open fractures (in blue between the red arrows). A common feature of Twin Creek Limestone reservoirs is the presence of healed fractures. Natural and syn-sedimentary porosity pathways through these tension fractures.

No. 3-3 Well, Pineview Field, Summit County, Utah Geophysical Well Log of the Twin Creek Limestone, UPRR

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Porosity/Permeability Cross Plot

Watton Canyon Member

Silt- and fine sand-sized carbonate and siliciclastic grains surrounded by dense lime muds. The black specks are sulfide minerals. Core closeup: Oblique open fractures (in blue between the red arrows). A common feature of Twin Creek Limestone reservoirs is the presence of healed fractures. Natural and syn-sedimentary porosity pathways through these tension fractures.

North Map of the Watton Canyon Member, Pineview Field, Summit County, Utah

Panel I

The Middle Jurassic Twin Creek Limestone in the Utah/Wyoming thrust belt has been a major producing formation for many years. The Twin Creek was developed horizontally by several operators within the Thrust Belt. This development has yielded significant volumes of hydrocarbons from sub-Cretaceous source rocks. Seals, barriers, and baffles for the production of hydrocarbons in Twin Creek Limestone reservoirs were generated from both horizontal and vertical formations. Seismic data and structural interpretation provide good reservoir characterization within these very heterogeneous reservoirs.
Core through the Rich Member: 8974 – 9018 ft.

**Lithofacies and Petrography**

**LOWER WATTON CANYON MEMBER**

- Core composite from 8888-8924 ft., covering the lower Watton Canyon Member. 
- Upper Boundary Ridge Member
- Lower Watton Canyon Member
- Permeability = 0.01 mD.

**Rich Member.**

- Porosity/Permeability Cross Plot
- Core Description

- Oolitic and oncolitic grainstone: shows low matrix porosity but significant fracture pore space. Note the vertical fracture segment is filled with white calcite. Open space within a replacement anhydrite nodule (see red arrows). (8910.5 ft., porosity = 2.4%, permeability = 0.01 mD).
- Tight silty oolitic grainstone: displays solution-enlarged sub-horizontal microfractures. The black cemented quartz-rich siltstone to fine-grained sandstone displays pin-stripe quartz-filled desiccation cracks. Note the mineralized vertical and oblique fractures: (1) a tensional fracture swarms healed with anhydrite (in white). (8990 ft., porosity = 1.5%, permeability = 0.22 mD).
- Tight quartz- and carbonate grain-rich siltstone: shows incomplete filling with white anhydrite. (9005.6 ft., porosity = 0.5%, permeability = 0.01 mD).
- Lime mudstone: has been disrupted by silt-filled desiccation cracks. Note the vertical fractures (in white). (9008 ft., porosity = 1.6%, permeability = 0.01 mD).
- Microbial boundstone: shows incomplete filling with white calcite. Note the mineralized vertical and oblique fractures healed with the replacement anhydrite (An) as well as the vertical fractures healed with anhydrite (in dark gray) are highly deformed by burial-tectonic fracturing. (9015.5 ft., porosity = 2.6%, permeability = 0.22 mD).

**Panel II**

- Exposure surface marked by dolomitic mudstone and the upper Boundary Ridge Member. 
- Possible solution-collapse breccia and a thrombolitic texture. Note the mineralized vertical and oblique fractures: (1) a tensional fracture swarms healed with anhydrite (in white). (8978.5 ft., porosity = 4.2%, permeability = 14 mD).
- Microbial boundstone: displays solution-collapse breccia and a limy to dolomitic mudstone. (8993 ft., porosity = 4.8%, permeability = 0.01 mD).
- Oolitic grainstone bound by wackestone: shows scalloped margins. Note the two types of ooids are the result of radial to concentric replacement anhydrite (An) nodules as well as the cements that occluded all matrix pores. A calcite-filled microfracture shows scalloped margins (see red arrows). This is a "cerebroid ooid" showing scalloped margins) and the wire" fabric within a dolomitic mudstone. (9018 ft., porosity = 1.6%, permeability = 0.01 mD).
- Microbial boundstone: shows incomplete filling with white calcite. Note the mineralized vertical and oblique fractures healed with the replacement anhydrite (An) as well as the vertical fractures healed with anhydrite (in dark gray) are highly deformed by burial-tectonic fracturing. (9018 ft., porosity = 1.6%, permeability = 0.01 mD).
Core Description

Sliderock Member

grainstone with several sub-vertical

Base

permeability = 0.01 mD). 

stair-step surfaces that 

displays bioturbation and small 

detrital quartz grain (Q) that show 

pressure-solution contacts without 

Close-up view of various skeletal 

Crinoidal wackestone that 

fragments, hard peloids and 

carbonate grains. 

Low porosity silty peloidal mudstone 

orientations. Both insoluble residues 

across carbonate grains and cements. 

that displays possible open 

(calcite fracture lining. Note 

(impregnated with blue-dyed epoxy 

light brown oil staining. 

Mineralized fracture surface 

the light brown oil staining. 

of black and red oil stains. 

Black oil-stained fracture lining. 

mineralized fractures (in 

dense, micritic limestone, Devils Slide 

section. Closely spaced rectilinear fracturing in 

Planes, Devils Slide section. 

Devils Slide section. 

the Watton Canyon Member, Peoa section. Pencil weathering, Peoa section. 

section. Closely spaced rectilinear fracturing, 

of the overlying Boundary Ridge 

Contact between fractured Rich 

planes, Devils Slide section. 

Devils Slide section. 

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References Reservoir and Production 

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Morgan and Summit Counties, Utah 

Canyon Member caused by thin-bedded 

top of the Watton Canyon Member, 

planes, Peoa section. 

Devils Slide section. 

Devils Slide section.