***(Not for distribution.***
***Please leave with the core.)***

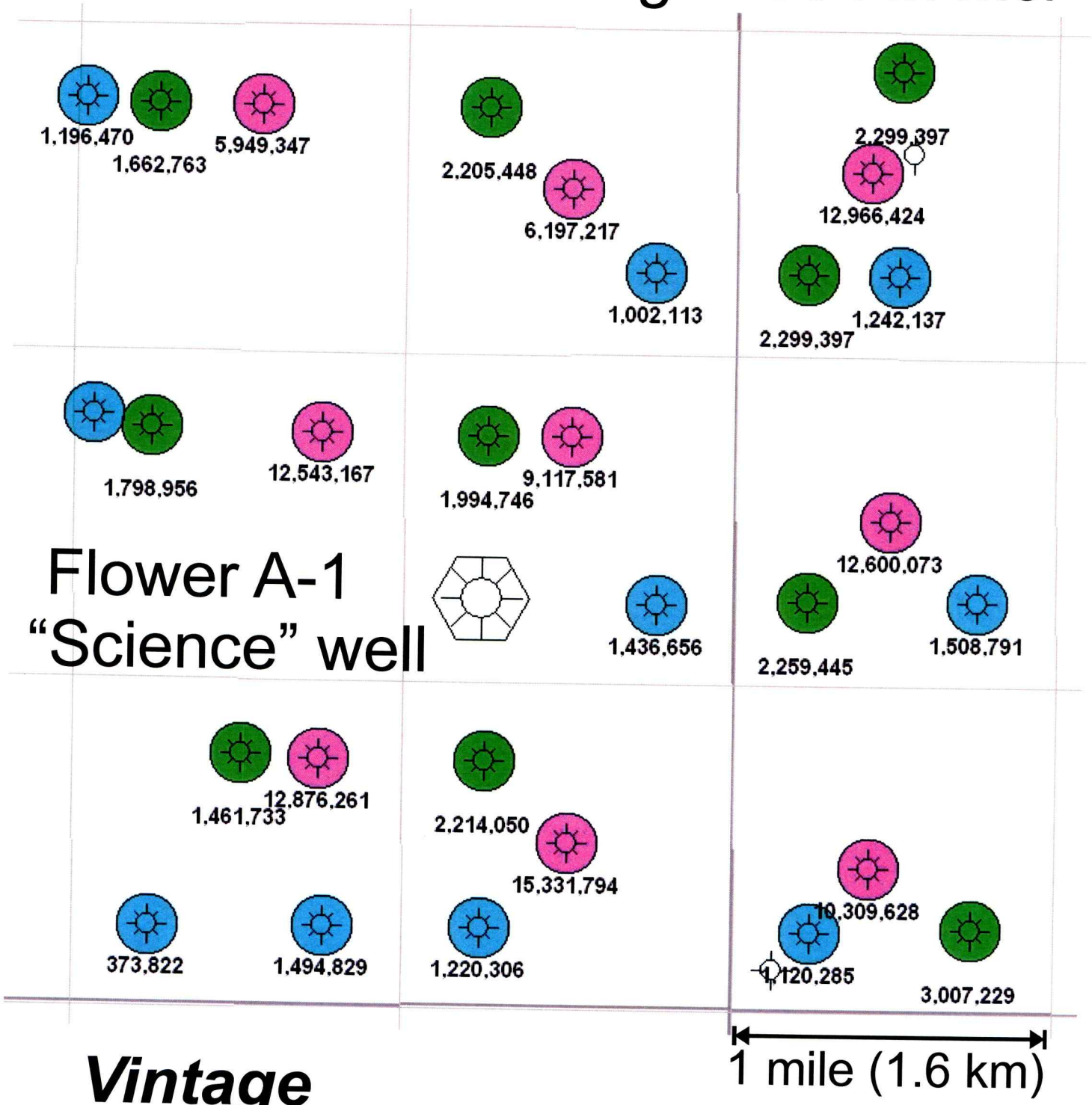
# Anadarko Petroleum Corporation
# Flower A-1 well
# Stevens County, Kansas

## Thin Section Photomicrographs
## Chase and Council Grove Groups
## Hugoton Field

SEPM / AAPG Core Workshop
Giant Hydrocarbon Reservoirs of the World: From Rocks to Reservoir Characterization and Modeling

Houston, TX – April 8-9, 2006

# Cumulative Gas through 2004 in mcf




***Vintage***

- Hugoton Parent (Chase)
- Panoma (Council Grove)
- Hugoton Infill (Chase)

# FIGURE 5

## THIN SECTION PHOTOMICROGRAPHS

## ANADARKO PETROLEUM CORPORATION FLOWER A-1 WELL

Depth: 2473.6 feet

Average Grain Size: Lower Very Fine Sand (0.080 mm)
Sorting: Well Sorted

Porosity: 11.5%
Permeability: 2.43 md

Stratigraphic Unit: Herington
Dep. Facies: Tidal Flat

This rock contains subequal amounts of quartz sand/silt, dolomite and anhydrite. The dolomite is present in several phases, including: 1) very finely crystalline dolomite cement, 2) dolomitized micrite matrix, and 3) dolomitized carbonate grains (skeletal fragments and peloids (p)). The anhydrite (An) occurs as large, poikilotopic crystals that are heterogeneously distributed throughout the rock. The pore system consists of intergranular (Ig) pores, intercrystalline pores within the dolomitized matrix, and secondary pores (white arrow) from leached carbonate grains.

A - 40X

B - 160X

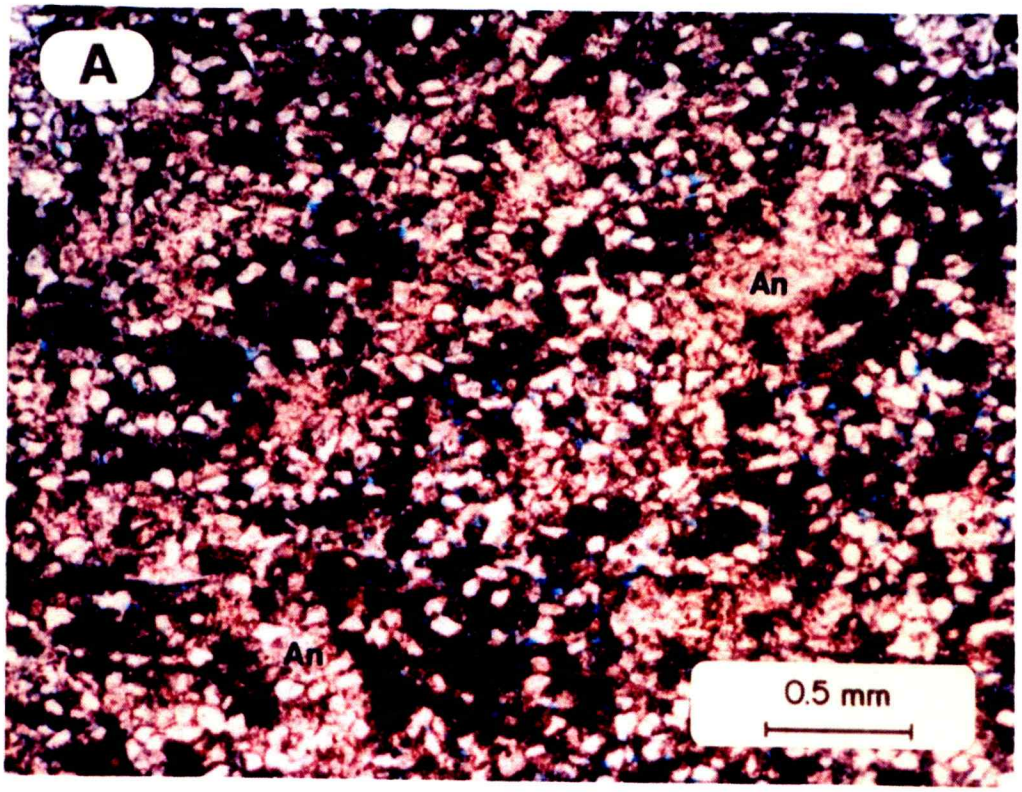
### X-ray Diffraction Data

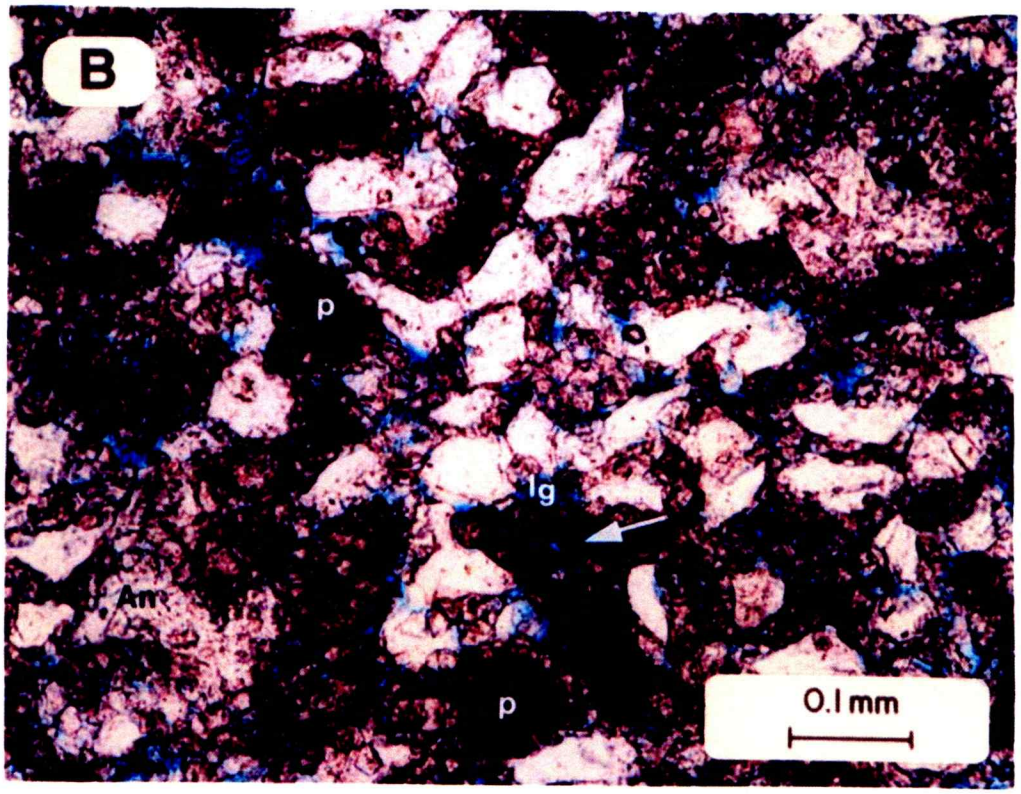
| | |
|---|---|
| Quartz | 31% |
| Dolomite | 39% |
| Anhydrite | 24% |
| Clay | 6% |

### Petrophysical Data

Cementation Exponent (m): 1.99
Saturation Exponent (n): *Test in Progress*

Figure 5



# FIGURE 6

## THIN SECTION PHOTOMICROGRAPHS

## ANADARKO PETROLEUM CORPORATION FLOWER A-1 WELL

Depth: 2485.2 feet

Average Grain Size: Coarse Silt (0.049 mm)
Sorting: Well Sorted

Porosity: 20.8%
Permeability: 48.2 md

Stratigraphic Unit: Herington
Dep. Facies: Tidal Flat

Patches of anhydrite (An) cement are scattered throughout this siltstone. Only minor amounts of other cementing agents are present, yielding a rock with a well preserved network of primary intergranular pores and rather good reservoir potential. Quartz and feldspar account for most of the framework grains.

A – 40X

B – 160X

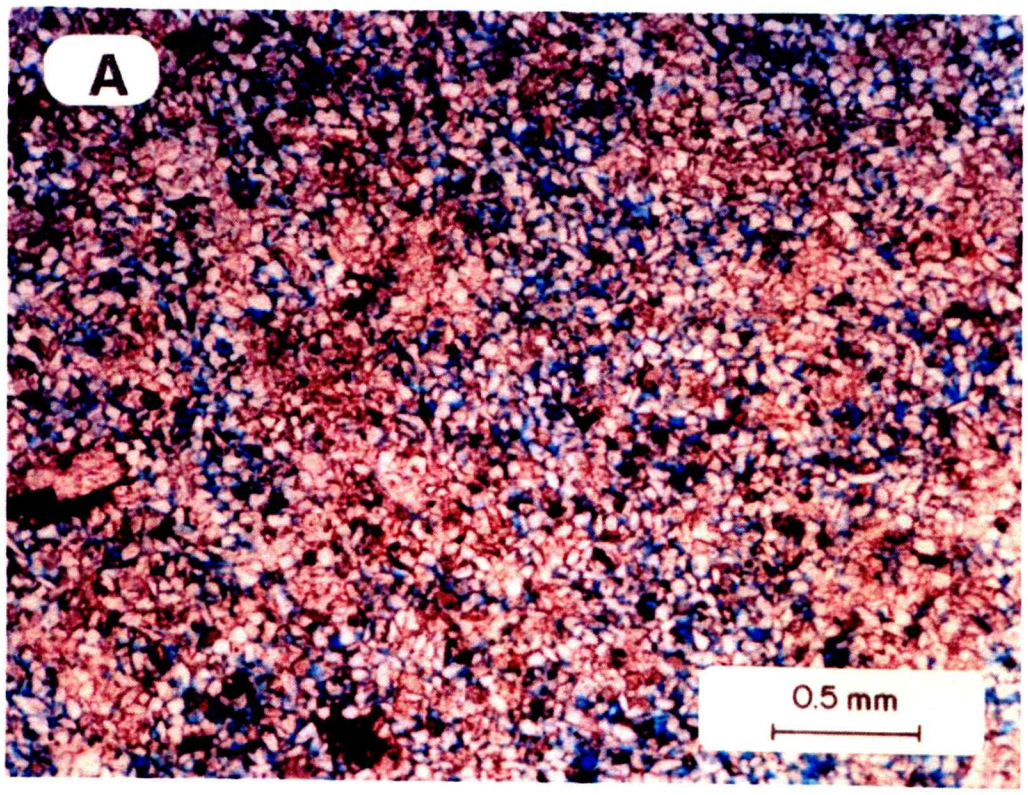
### X-ray Diffraction Data

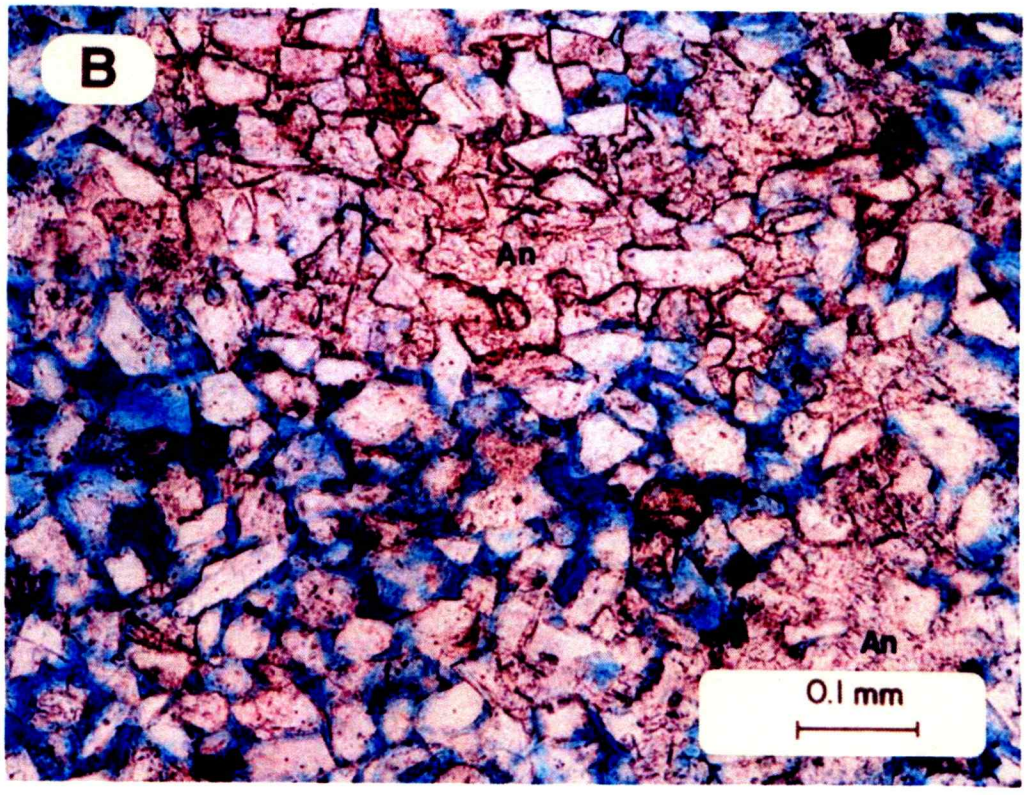
| | |
|---|---|
| Quartz | 69% |
| Potassium Feldspar | 4% |
| Plagioclase Feldspar | 5% |
| Dolomite | 1% |
| Anhydrite | 16% |
| Clay | 5% |

### Petrophysical Data

Cementation Exponent (m): 1.92
Saturation Exponent (n): *Test in Progress*

Figure 6



# FIGURE 7

## THIN SECTION PHOTOMICROGRAPHS

## ANADARKO PETROLEUM CORPORATION FLOWER A-1 WELL

Depth: 2505.4 feet

Rock Type: Dolomite
Depositional Texture: Grainstone
Porosity: 21.5%
Permeability: 122 md
Stratigraphic Unit: Krider
Dep. Facies: Shoal to Shoal Flank

Although dolomitization has obscured the grain types and fabric of this rock, the abundance of moldic (Mo) pores indicates a very grain-rich texture. The moldic pores account for a substantial portion of the total pore volume, but these larger pores are interconnected through a network of smaller intercrystalline pores (white arrows). Collectively, these moldic and intercrystalline pores combine to yield a rather effective pore network. Some of the intercrystalline pores could be relict intergranular pores preserved between the framework grains.

A - 40X

B - 160X

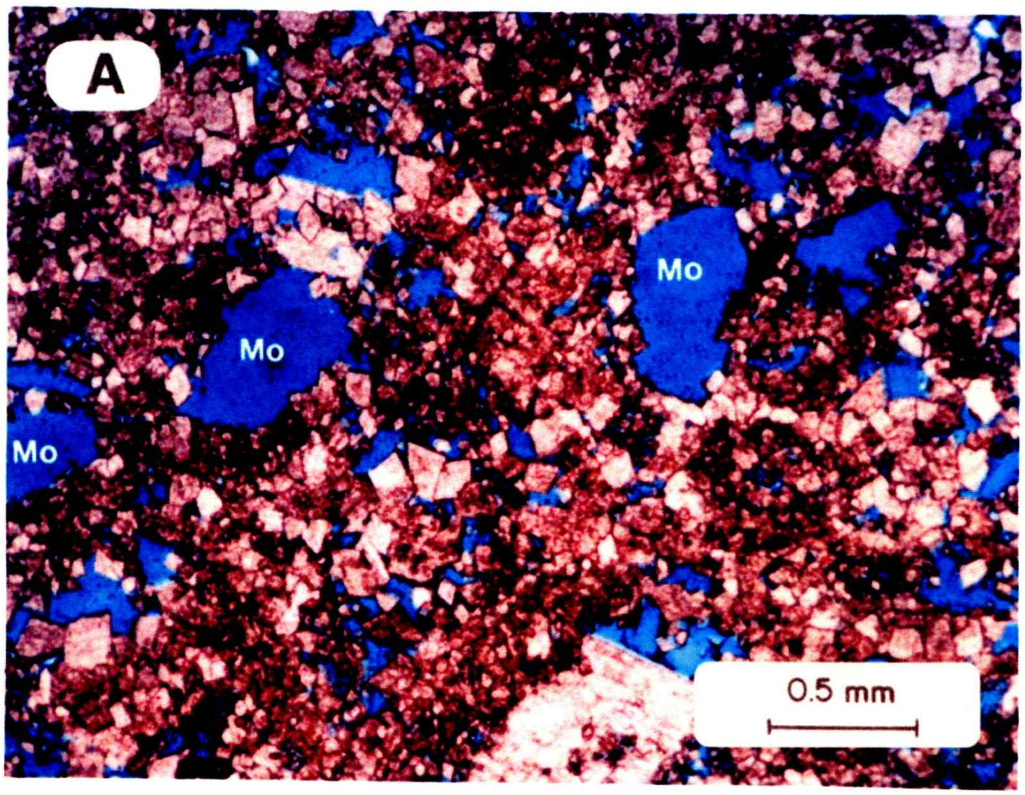
### X-ray Diffraction Data

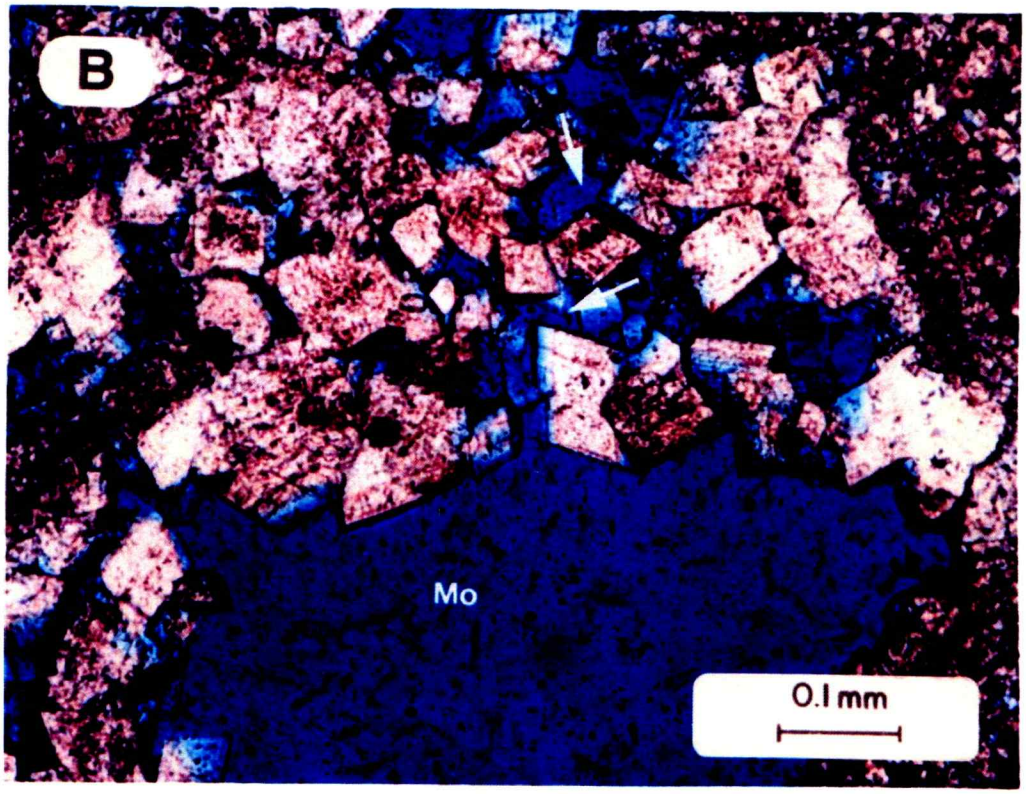
| | |
|---|---|
| Dolomite | 100% |

### Petrophysical Data

Cementation Exponent (m): 2.22
Saturation Exponent (n): *Test in Progress*

Figure 7



# FIGURE 8

## THIN SECTION PHOTOMICROGRAPHS

## ANADARKO PETROLEUM CORPORATION FLOWER A-1 WELL

Depth: 2515.8 feet

Rock Type: Dolomite
Depositional Texture: Grainstone
Stratigraphic Unit: Krider
Dep. Facies: Shoal to Shoal Flank

Porosity: 22.3%
Permeability: 275 md

Large moldic (Mo) pores and smaller intercrystalline pores (white arrows) are present in this dolomitized grainstone. These secondary pores combine to form an efficient pore network that results in high permeability. Scattered large crystals of anhydrite (An) cement locally occlude both moldic and intercrystalline pores. Although dolomitization obscured the grain types, based on the size and shape of many of the framework particles, it appears that oncoids, peloids and skeletal debris accounted for most of the allochems; a small number of ooids may also be present.

A – 40X

B – 160X

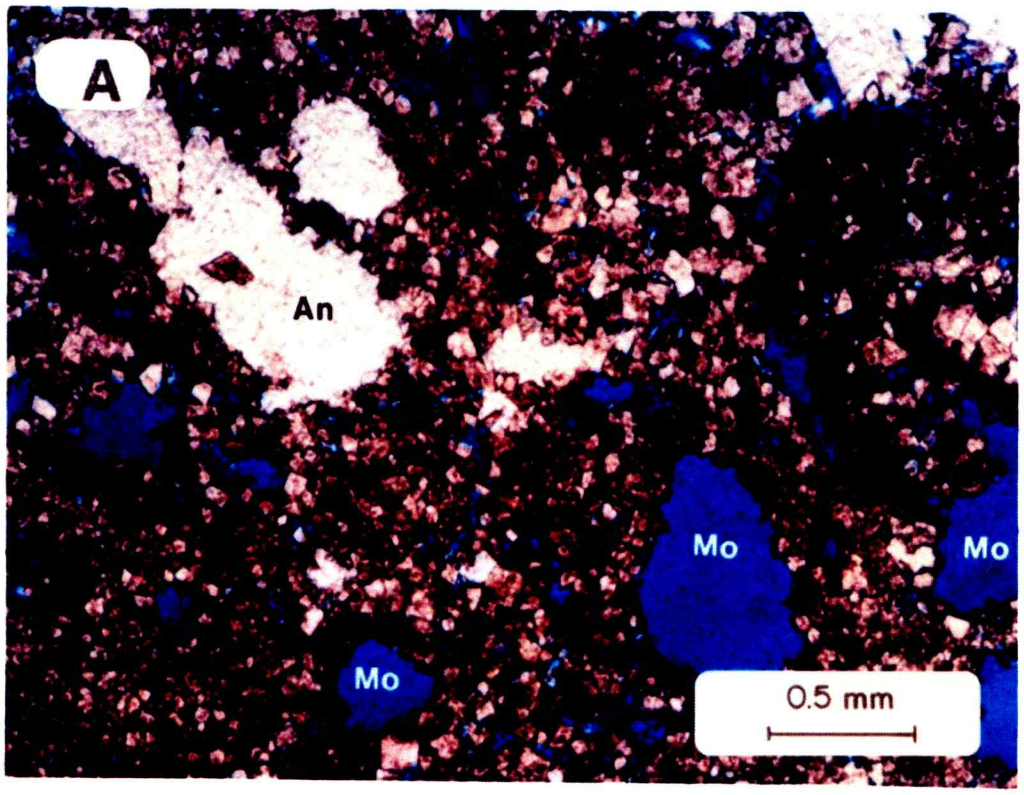
### X-ray Diffraction Data

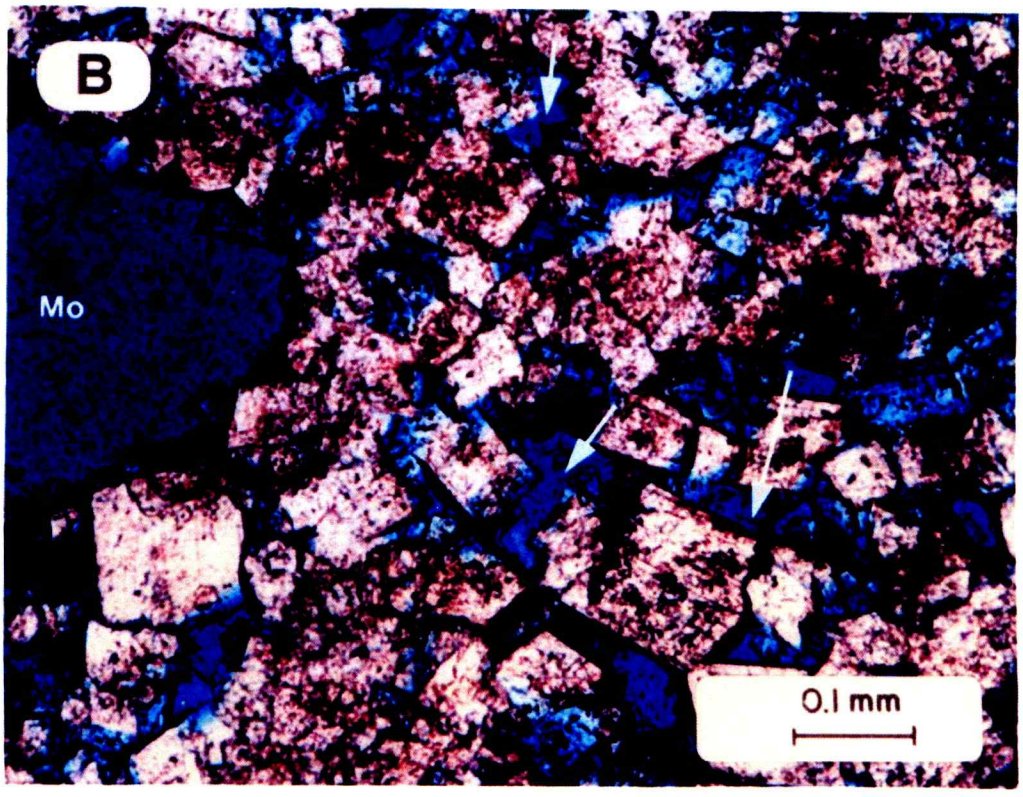
| | |
|---|---|
| Dolomite | 99% |
| Anhydrite | 1% |

### Petrophysical Data

Cementation Exponent (m): 2.20
Saturation Exponent (n): *Test in Progress*

Figure 8



# FIGURE 9

## THIN SECTION PHOTOMICROGRAPHS

## ANADARKO PETROLEUM CORPORATION FLOWER A-1 WELL

Depth: 2526.1 feet

Rock Type: Dolomite
Depositional Texture: Packstone/Wackestone
Stratigraphic Unit: Krider
Dep. Facies: Shoal to Shoal Flank

Porosity: 24.7%
Permeability: 128 md

Compare this sample to the dolomite samples shown in Figures 7 and 8. This rock has fewer moldic pores, and the dolomite is more finely crystalline. This is interpreted to reflect a more micritic (packstone/wackestone) depositional texture in this rock. Dolomitization enhanced reservoir potential by creating intercrystalline pores in what had been low porosity, low permeability micrite matrix. Dissolution of framework grains added some molds (Mo) to the pore structure. Scattered patches of anhydrite (An) cement have occluded pore space, but overall this rock is judged to have good to very good reservoir potential.

A – 40X

B – 160X

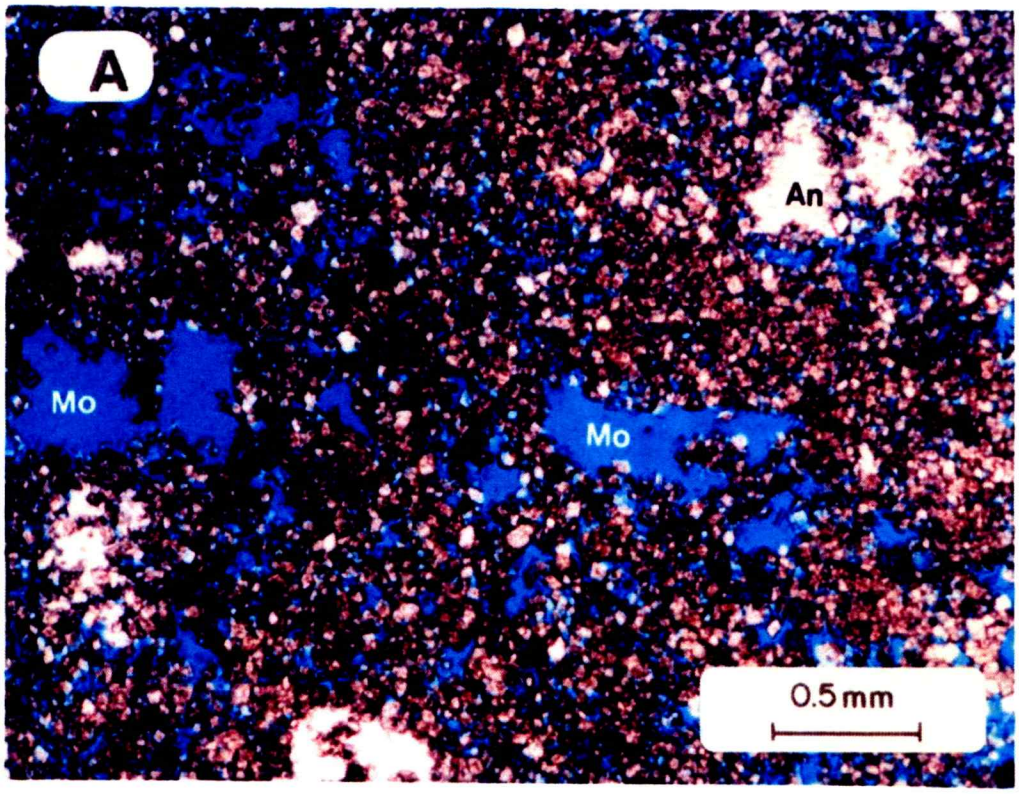
### X-ray Diffraction Data

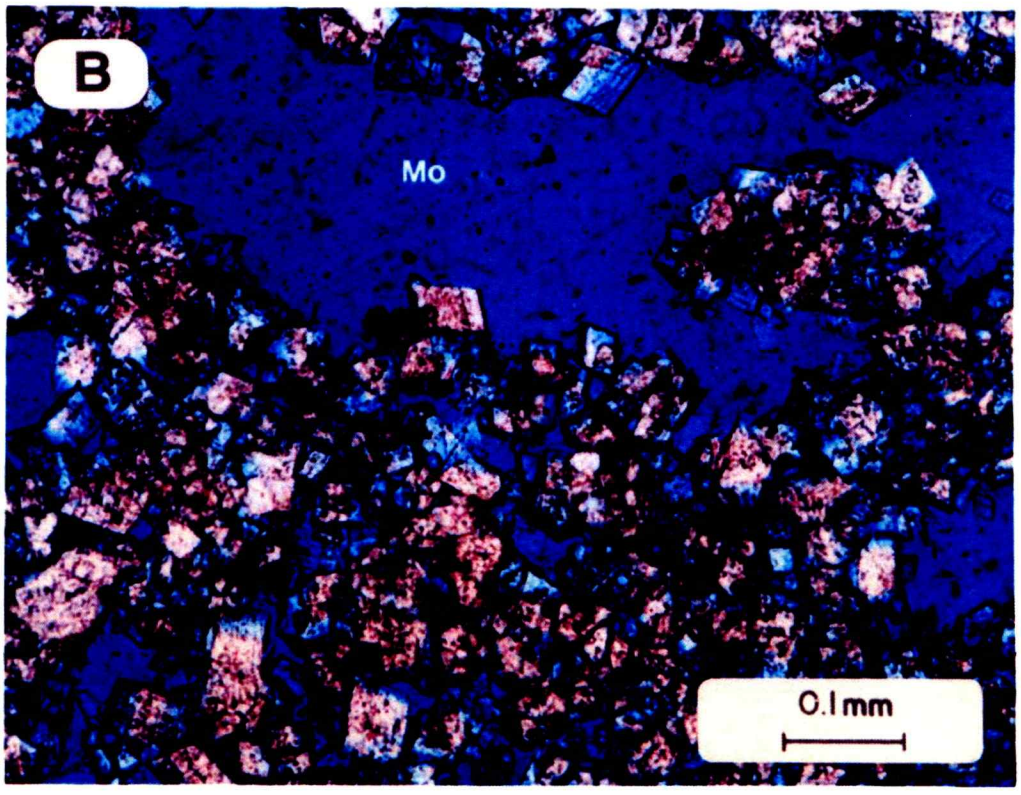
| | |
|---|---|
| Dolomite | 89% |
| Anhydrite | 11% |

### Petrophysical Data

Cementation Exponent (m): 2.05
Saturation Exponent (n): *Test in Progress*

Figure 9



# FIGURE 10

## THIN SECTION PHOTOMICROGRAPHS

## ANADARKO PETROLEUM CORPORATION FLOWER A-1 WELL

Depth: 2531.1 feet

Rock Type: Calcareous Dolomite
Depositional Texture: Wackestone/Mudstone
Stratigraphic Unit: Krider
Dep. Facies: Shoal Flank

Porosity: 17.5%
Permeability: 1.11 md

Although this rock has been extensively replaced by dolomite, the uniformly small crystal size and general lack of relict grain textures suggests a micrite-dominated (wackestone/mudstone) fabric. The dolomitization acted to create some intercrystalline pores within what had been a low porosity, low permeability micrite matrix. However, subsequent calcite (stained pink) cementation occluded pore space and reduced pore interconnection. This accounts for the relatively low permeability in this rock, compared to the more grain-rich sample from 2526.1 feet (Figure 9). A few crystals of authigenic pyrite (black) are scattered throughout this rock.

A - 40X

B - 160X

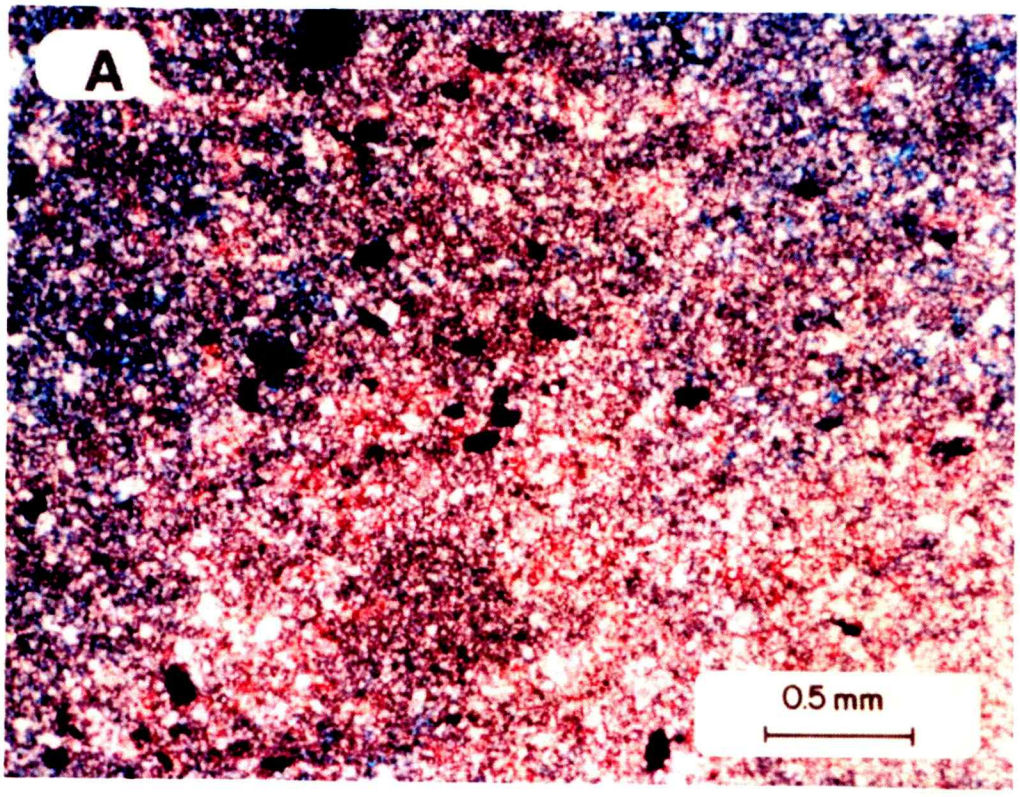
### X-ray Diffraction Data

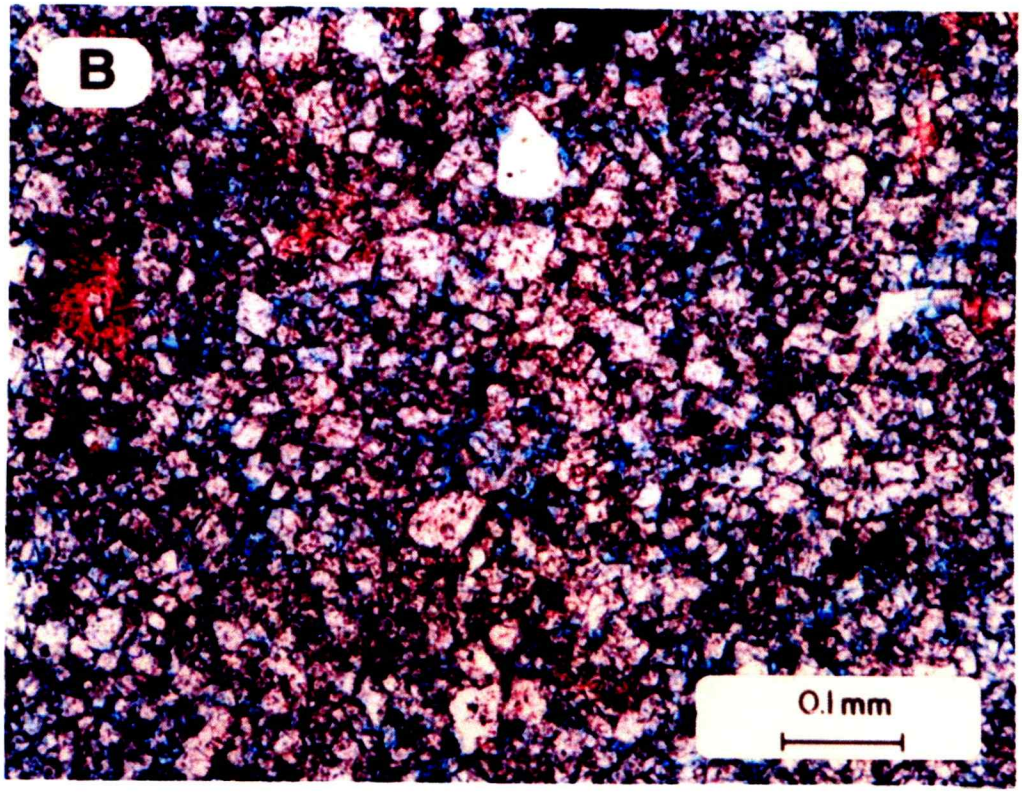
| | |
|---|---|
| Quartz | 9% |
| Potassium Feldspar | 2% |
| Plagioclase Feldspar | 1% |
| Calcite | 4% |
| Dolomite | 80% |
| Anhydrite | 1% |
| Pyrite | 1% |
| Clay | 2% |

### Petrophysical Data

Cementation Exponent (m): 2.05
Saturation Exponent (n): *Test in Progress*

Figure 10



# FIGURE 11

## THIN SECTION PHOTOMICROGRAPHS

## ANADARKO PETROLEUM CORPORATION FLOWER A-1 WELL

Depth: 2550.5 feet

Average Grain Size: Coarse Silt (0.055 mm)
Sorting: Very Well Sorted

Porosity: 24.3%
Permeability: 132 md

Stratigraphic Unit: Winfield Sand
Dep. Facies: Tidal Flat

This very well sorted siltstone contains an abundance of open intergranular pore space. Although patches of calcite (stained pink in view A) and anhydrite (not shown here) cements are present, most of the intergranular pores contain only a minor amount of iron-stained clay. These primary intergranular pores are well interconnected and yield an effective pore network with high permeability. In addition, some secondary pores (white arrow in view B) may contribute to the pore network. Quartz and feldspar grains account for most of the framework grains.

A - 40X

B - 160X

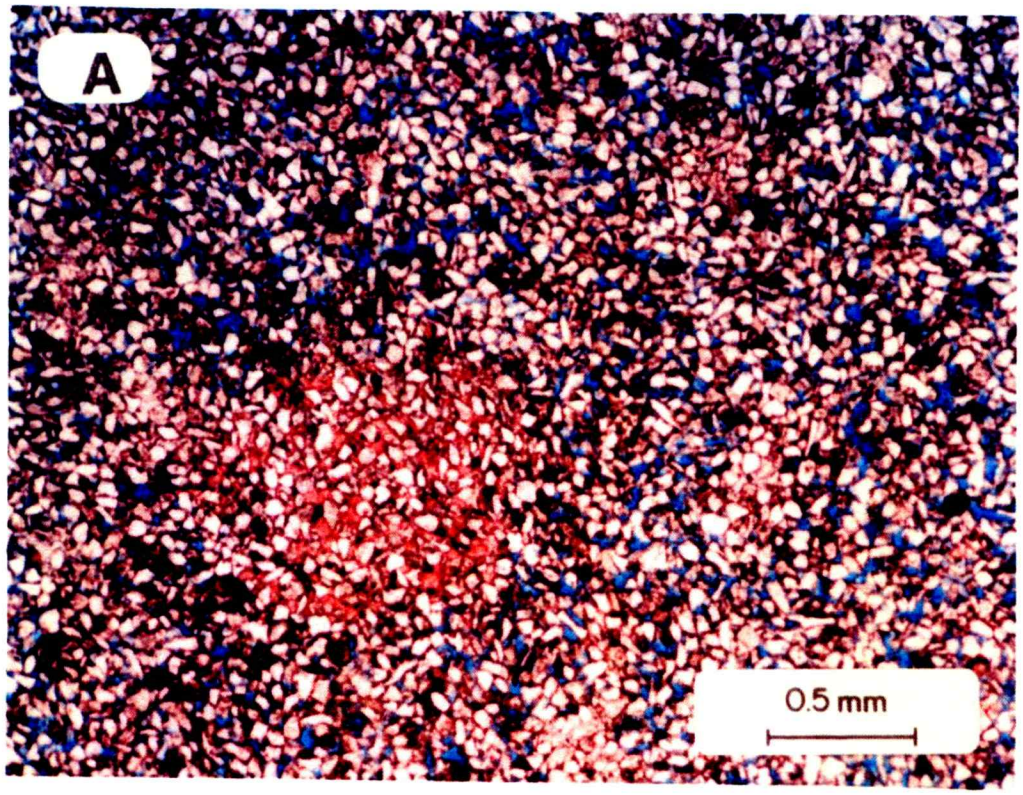
### X-ray Diffraction Data

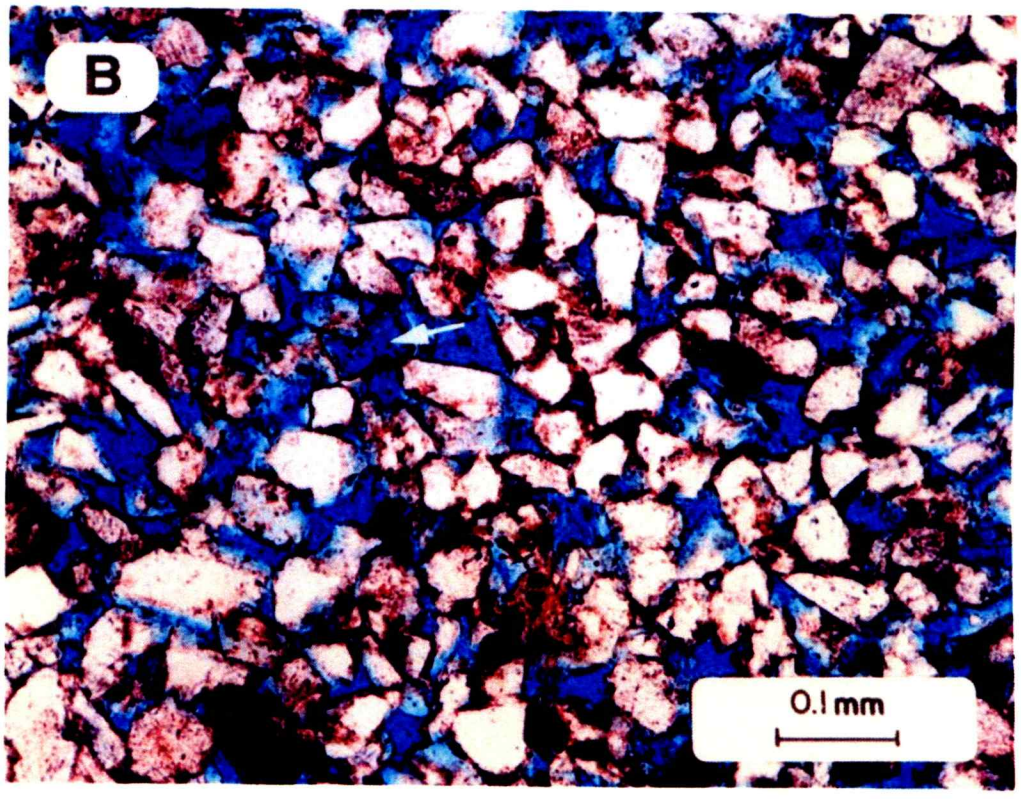
| | |
|---|---|
| Quartz | 58% |
| Potassium Feldspar | 7% |
| Plagioclase Feldspar | 16% |
| Calcite | 2% |
| Dolomite | 1% |
| Anhydrite | 13% |
| Clay | 3% |

### Petrophysical Data

Cementation Exponent (m): 1.88
Saturation Exponent (n): *Test in Progress*

Figure 11



# FIGURE 12

## THIN SECTION PHOTOMICROGRAPHS

## ANADARKO PETROLEUM CORPORATION FLOWER A-1 WELL

Depth: 2556.1 feet

Rock Type: Anhydritic, Sandy Limestone
Depositional Texture: Grainstone/Packstone
Stratigraphic Unit: Winfield Sand
Dep. Facies: Shoal/Shoal Flank

Porosity: 9.0%
Permeability: 0.129 md

This rock was deposited with a combination of carbonate grains (skeletal grains, intraclasts, oncoids, peloids and a few ooids), fine- to medium-grained siliciclastic sand and a minor amount of micrite. The siliciclastic sand is dominated by feldspar (F) and a subordinate amount of quartz (Q). Calcite cement (Ca) and anhydrite (An) cement/replacement occluded most of the intergranular pores. Only traces of the primary pore system remain. Secondary porosity developed due to grain dissolution of foraminifera and other bioclastic constituents. In addition, some of the micritic allochems were altered, resulting in the development of microporosity (white arrow in view B). Because the pore system is dominated by poorly interconnected moldic pores and microporosity, the rock has rather low permeability.

A – 40X

B – 160X

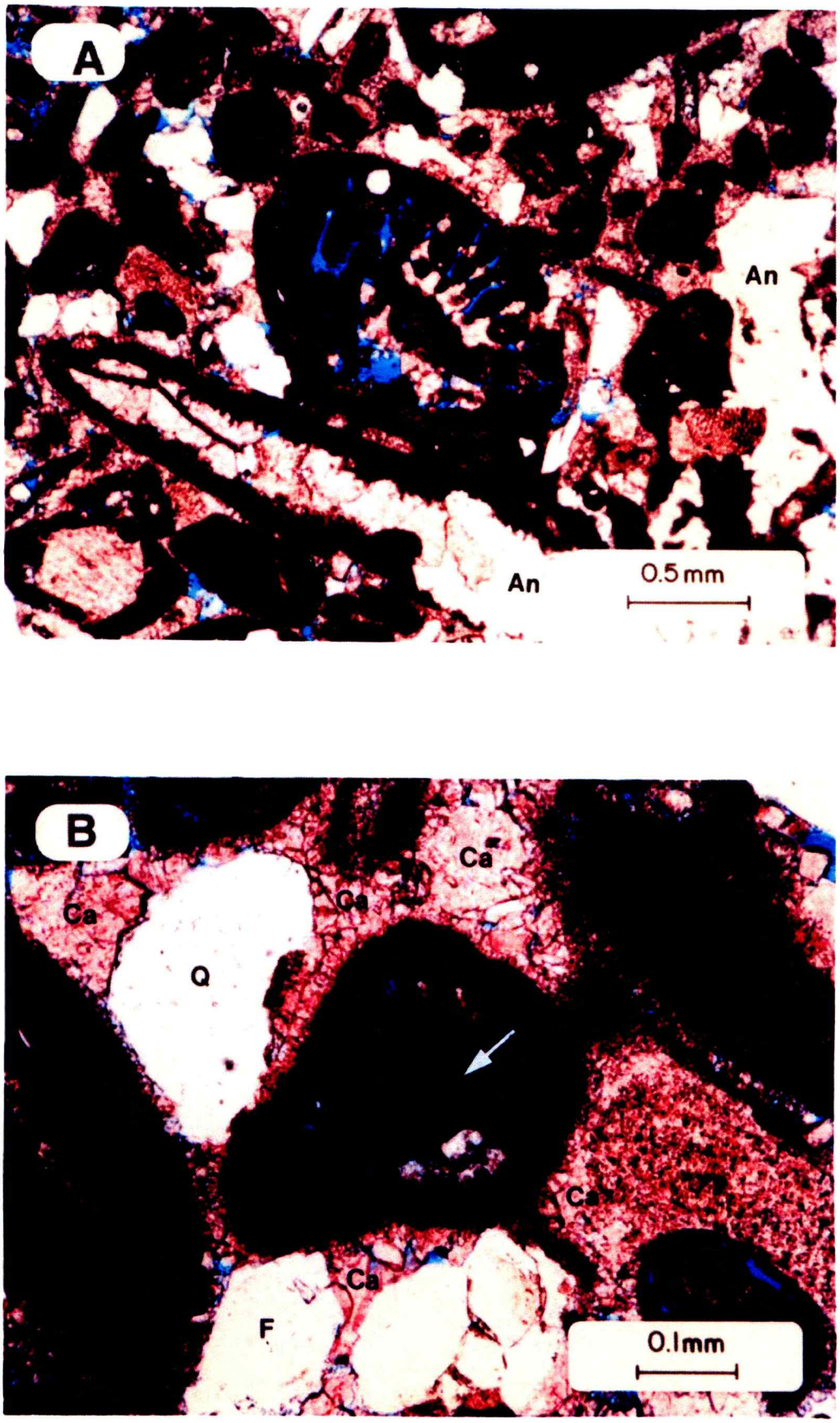
### X-ray Diffraction Data

| | |
|---|---|
| Quartz | 3% |
| Potassium Feldspar | 24% |
| Plagioclase Feldspar | 7% |
| Calcite | 31% |
| Anhydrite | 35% |

### Petrophysical Data

Cementation Exponent (m): 1.98
Saturation Exponent (n): *Test in Progress*

Figure 12



# FIGURE 13

## THIN SECTION PHOTOMICROGRAPHS

## ANADARKO PETROLEUM CORPORATION FLOWER A-1 WELL

Depth: 2579.4 feet

Rock Type: Anhydritic Limestone
Depositional Texture: Packstone
Porosity: 16.4%
Permeability: 5.98 md
Stratigraphic Unit: Winfield Dolomite
Dep. Facies: Shoal to Shoal Flank

Most of the pore space in this packstone is in the form of: remnant intergranular (Ig) pores, moldic (Mo) pores (where skeletal constituents in oncoids have been partially leached), and microporosity (white arrows) in altered micritic grains and matrix. The intergranular voids probably account for most of the effective pores; the microporosity and moldic pores contribute little to the effective pore network. Rocks with this type of pore structure can have rather high immobile water saturations.

A - 40X

B - 160X

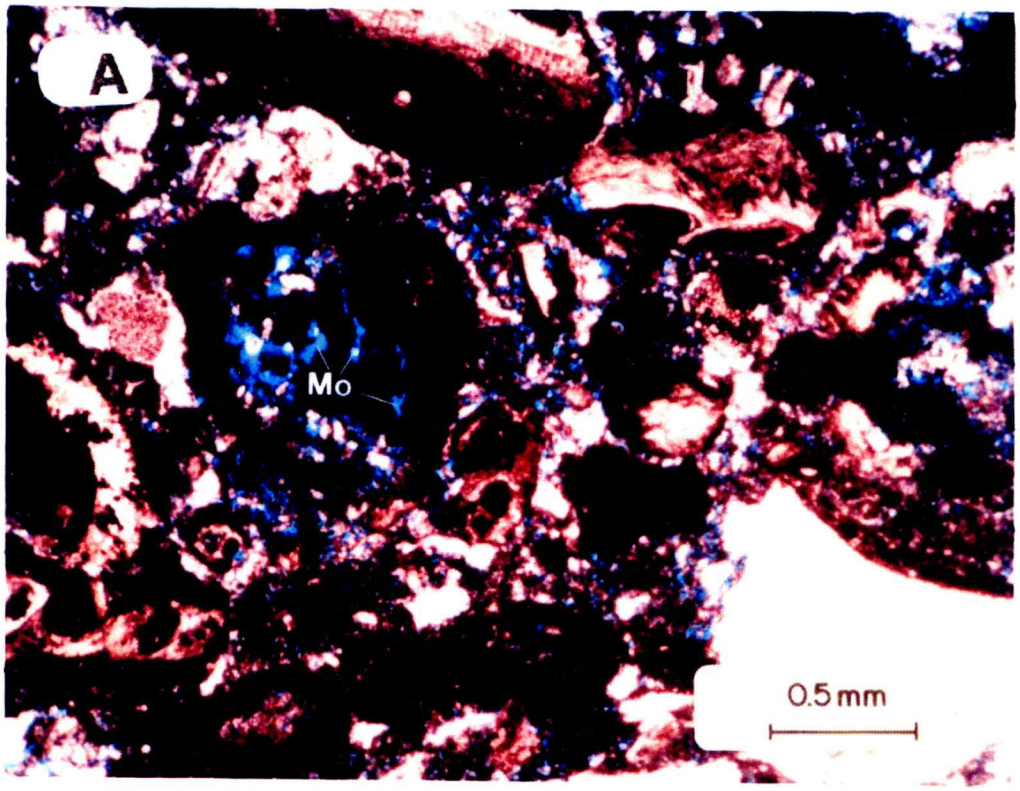
### X-ray Diffraction Data

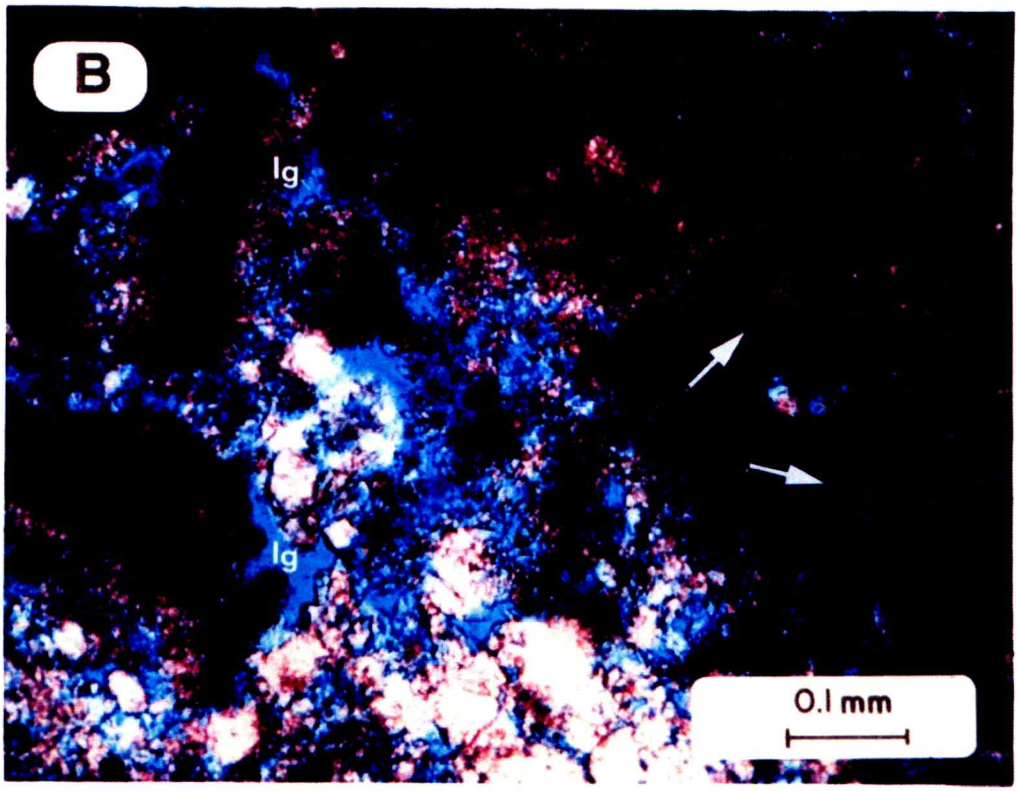
| | |
|---|---|
| Calcite | 61% |
| Dolomite | 1% |
| Anhydrite | 38% |

### Petrophysical Data

Cementation Exponent (m): 1.97
Saturation Exponent (n): *Test in Progress*

Figure 13



# FIGURE 14

## THIN SECTION PHOTOMICROGRAPHS

## ANADARKO PETROLEUM CORPORATION FLOWER A-1 WELL

Depth: 2618.1 feet

Average Grain Size: Coarse Silt (0.062 mm)
Sorting: Well Sorted

Porosity: 14.3%
Permeability: 1.96 md

Stratigraphic Unit: Towanda
Dep. Facies: Tidal Flat

The framework constituents in this siltstone consist of quartz, feldspar, peloids and skeletal fragments. The pore system has a combination of remnant intergranular voids (center of view B), and microporosity within peloids and other micritic grains. The microporous grains probably contribute little to the effective pore network. Calcite cement and carbonate matrix play roles in porosity reduction.

A – 40X

B – 160X

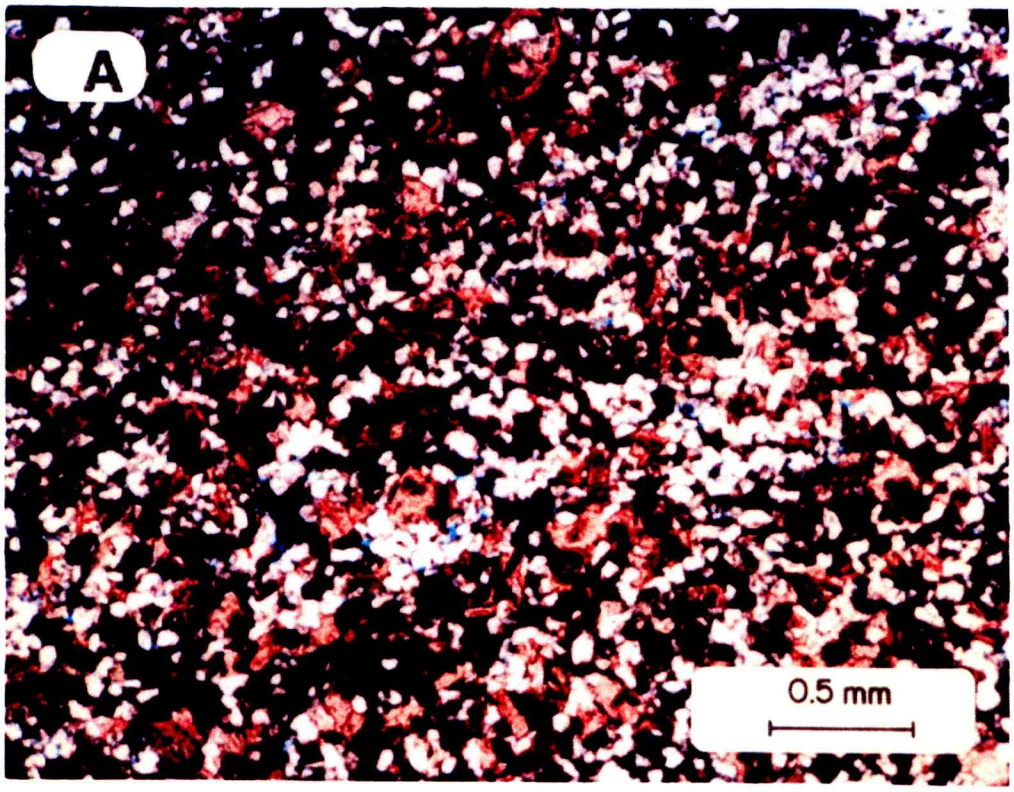
### X-ray Diffraction Data

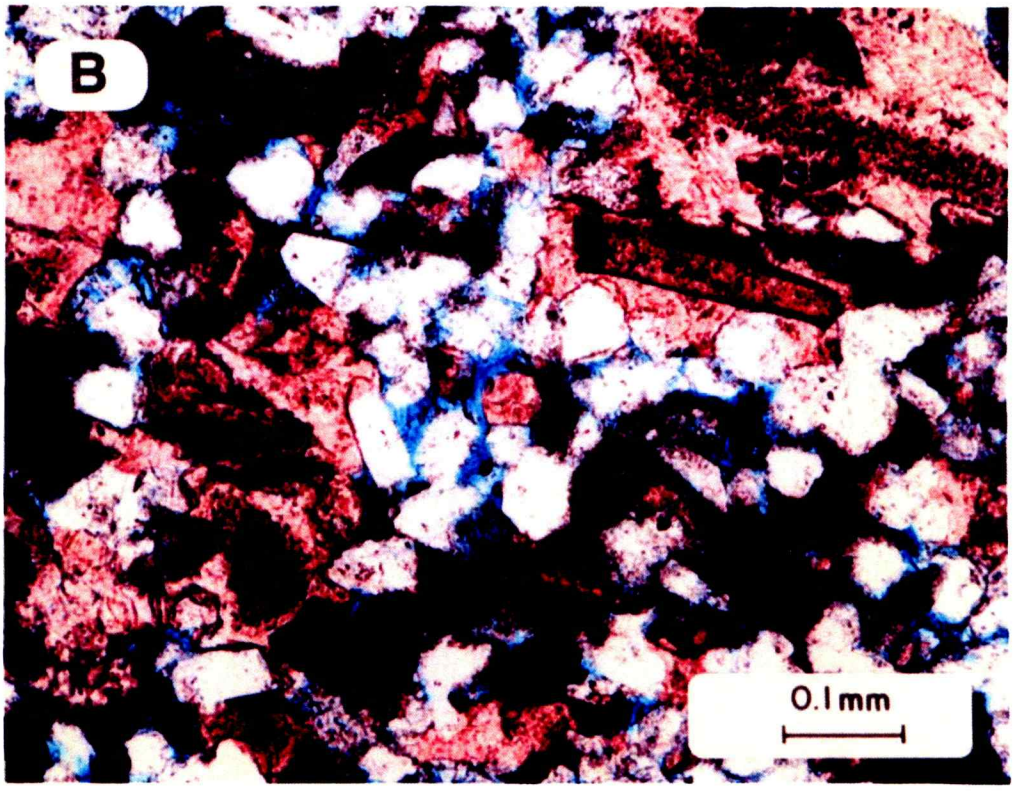
| | |
|---|---|
| Quartz | 60% |
| Potassium Feldspar | 6% |
| Plagioclase Feldspar | 7% |
| Calcite | 23% |
| Anhydrite | 2% |
| Clay | 2% |

### Petrophysical Data

Cementation Exponent (m): 1.98
Saturation Exponent (n): *Test in Progress*

Figure 14



# FIGURE 15

## THIN SECTION PHOTOMICROGRAPHS

## ANADARKO PETROLEUM CORPORATION FLOWER A-1 WELL

Depth: 2627.4 feet

Rock Type: Limestone
Depositional Texture: Grainstone
Porosity: 13.2%
Permeability: 0.894 md
Stratigraphic Unit: Towanda
Dep. Facies: Shoal to Shoal Flank

The pore system in this grain-rich limestone is dominated by scattered moldic pores, intraskeletal pores and microporous micritic grains (such as highlighted in the center of view B). Only a minor amount of preserved primary intergranular pore space is apparent, reflecting an abundance of calcite cement and minor detrital micrite matrix. The remnant pore structure yields a rock with poorly interconnected macropores and microporosity. This accounts for the relatively high measured porosity but low permeability.

A - 40X

B - 160X

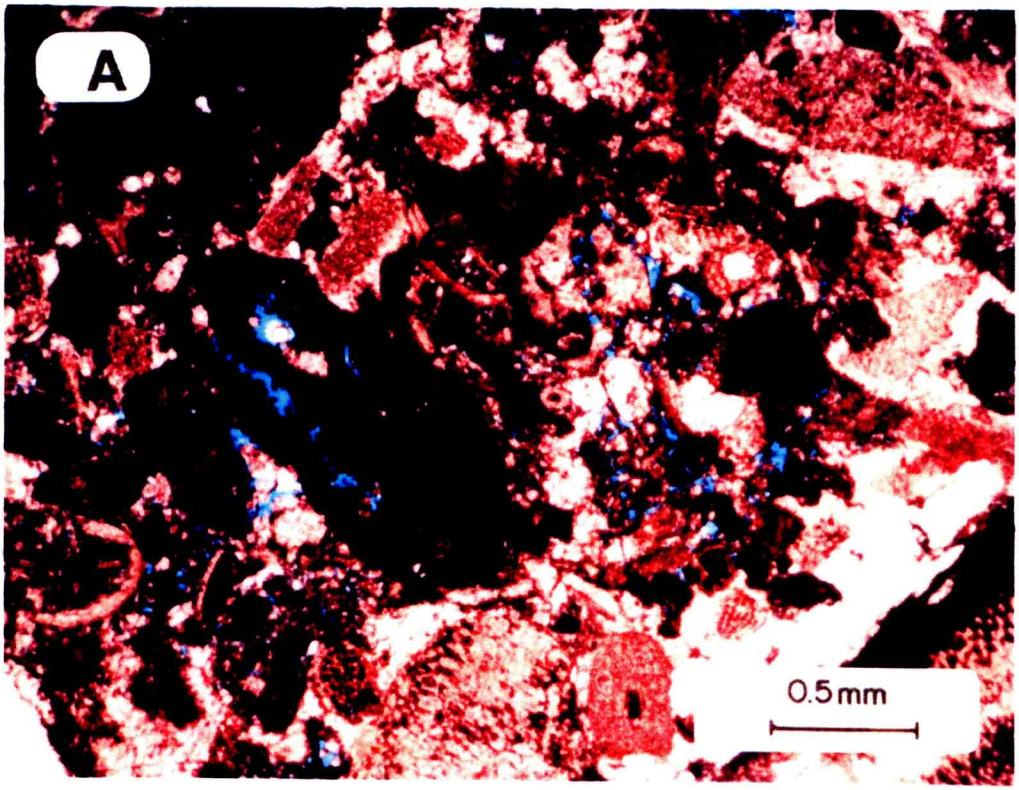
### X-ray Diffraction Data

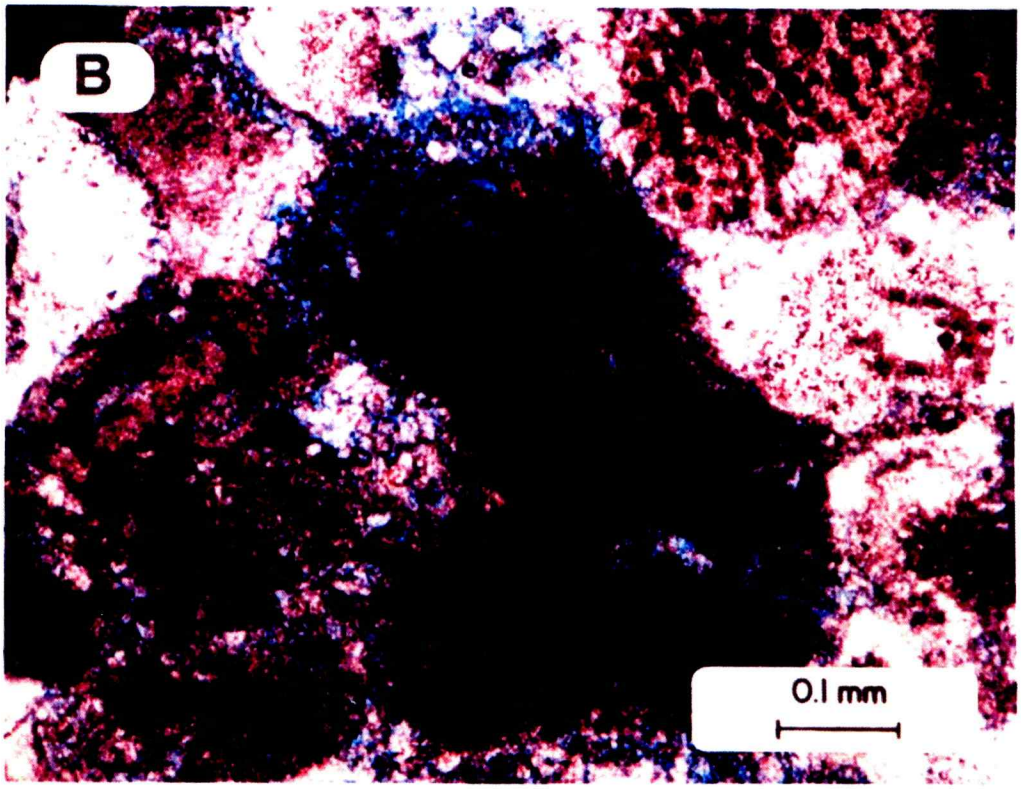
| | |
|---|---|
| Quartz | 4% |
| Potassium Feldspar | 7% |
| Calcite | 88% |
| Anhydrite | 1% |

### Petrophysical Data

Cementation Exponent (m): 2.00
Saturation Exponent (n): *Test in Progress*

Figure 15



# FIGURE 16

## THIN SECTION PHOTOMICROGRAPHS

## ANADARKO PETROLEUM CORPORATION FLOWER A-1 WELL

Depth: 2641.1 feet

Rock Type: Limestone
Depositional Texture: Grainstone/Packstone
Stratigraphic Unit: Towanda
Dep. Facies: Shoal to Shoal Flank

Porosity: 18.5%
Permeability: 10.1 md

Compare this sample with the sample shown in Figure 15. Although these rocks have similar textures and framework constituents, this sample has more preserved primary intergranular (Ig) pore space. This difference reflects subtle variations in compaction and calcite cementation. The relative abundance of remnant intergranular pore space results in a rock with comparatively high permeability. In addition to the intergranular pores, this rock also contains intraskeletal pores, moldic pores and microporosity in micritic grains and matrix.

A – 40X

B – 160X

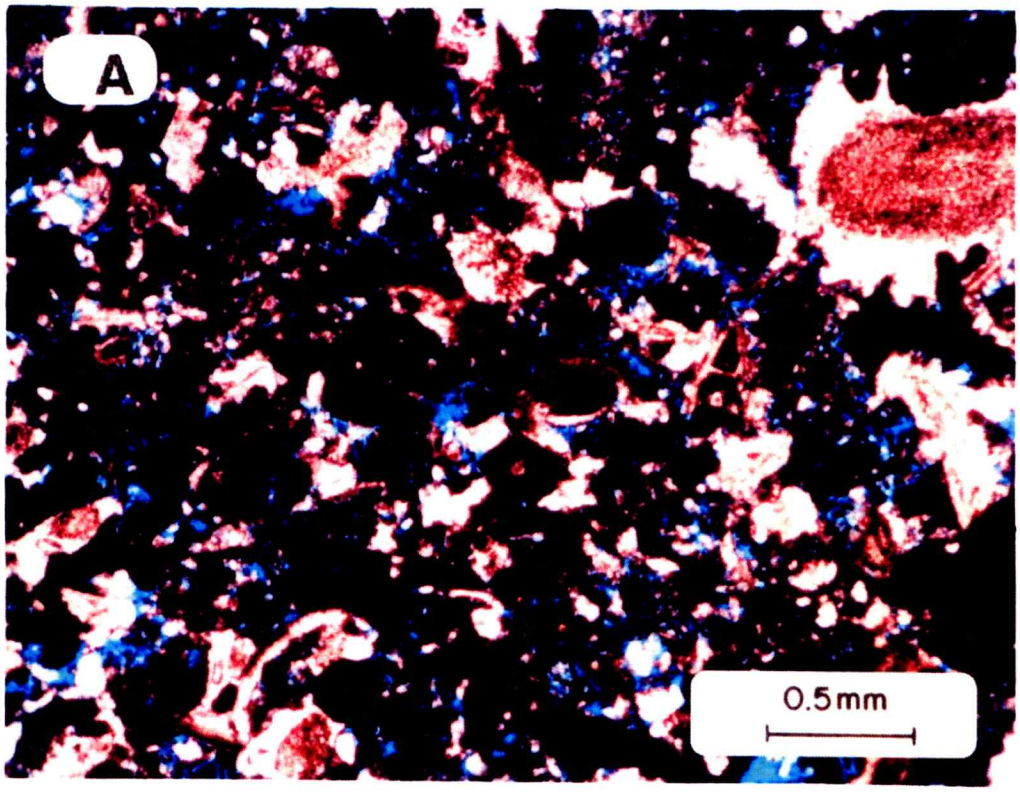
### X-ray Diffraction Data

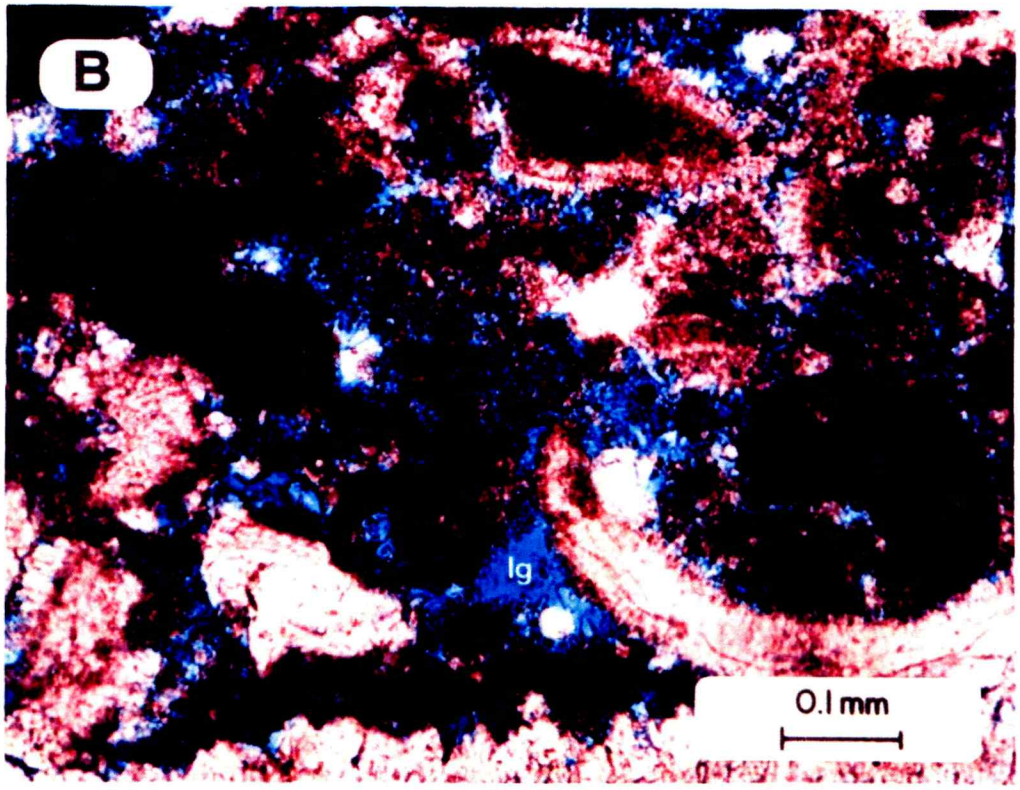
| | |
|---|---|
| Quartz | 3% |
| Calcite | 78% |
| Anhydrite | 19% |

### Petrophysical Data

Cementation Exponent (m): 2.01
Saturation Exponent (n): *Test in Progress*

Figure 16



# FIGURE 17

## THIN SECTION PHOTOMICROGRAPHS

## ANADARKO PETROLEUM CORPORATION FLOWER A-1 WELL

Depth: 2658.7 feet

Average Grain Size: Coarse Silt (0.039 mm)
Sorting: Well Sorted

Porosity: 17.9%
Permeability: 1.66 md

Stratigraphic Unit: Holmesville
Dep. Facies: Tidal Flat

Both carbonate (dolomite and calcite) and siliciclastic matrix are present as pore-filling constituents in this siltstone. Some of the matrix material is in the form of laminations; burrows have breached these laminations and reworked the matrix material, yielding a heterogeneous rock fabric. In addition to the preserved intergranular pores, a portion of the measured pore volume is in the form of microporosity associated with the matrix.

A - 40X

B - 160X

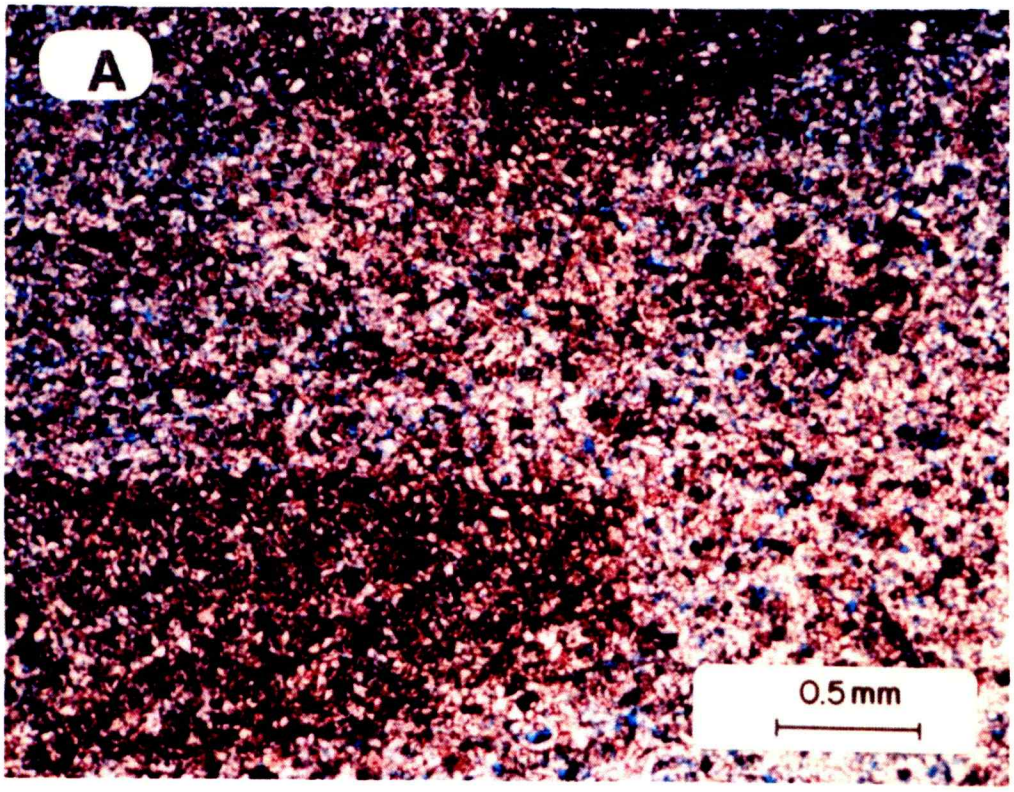
### X-ray Diffraction Data

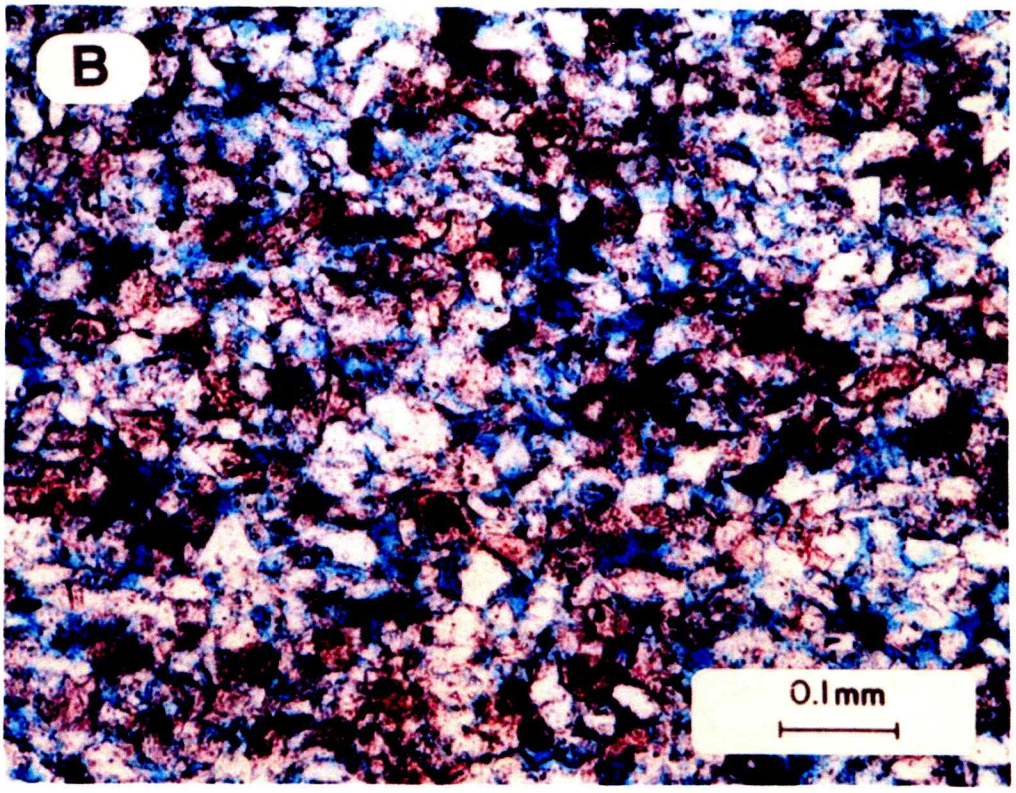
| | |
|---|---|
| Quartz | 73% |
| Potassium Feldspar | 9% |
| Plagioclase Feldspar | 8% |
| Dolomite | 5% |
| Clay | 5% |

### Petrophysical Data

Cementation Exponent (m): 1.93
Saturation Exponent (n): *Test in Progress*

Figure 17



# FIGURE 18

## THIN SECTION PHOTOMICROGRAPHS

## ANADARKO PETROLEUM CORPORATION FLOWER A-1 WELL

Depth: 2681.7 feet

Rock Type: Limestone
Depositional Texture: Packstone/Wackestone
Stratigraphic Unit: Upper Ft. Riley
Dep. Facies: Shoal to Shoal Flank

Porosity: 16.9%
Permeability: 2.28 md

Portions of this sample have a wackestone (micrite-dominated) texture and other parts have a packstone (grain-supported) texture. Only a minor amount of macropore space is present. The pore system consists of scattered intergranular pores, moldic pores, intraskeletal pores and microporosity (in micritic grains and matrix). The intergranular voids probably account for most of the effective pores. Rocks with this pore structure tend to have rather high immobile water saturations due to the large surface area to volume ratio.

A - 40X

B - 160X

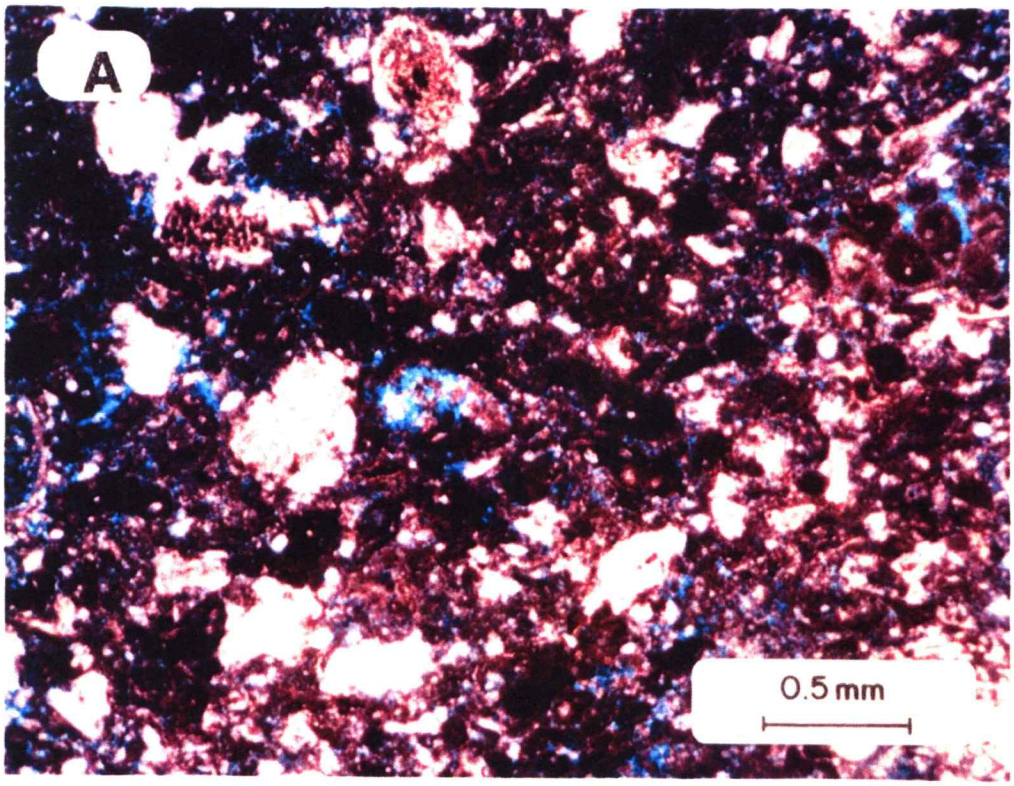
### X-ray Diffraction Data

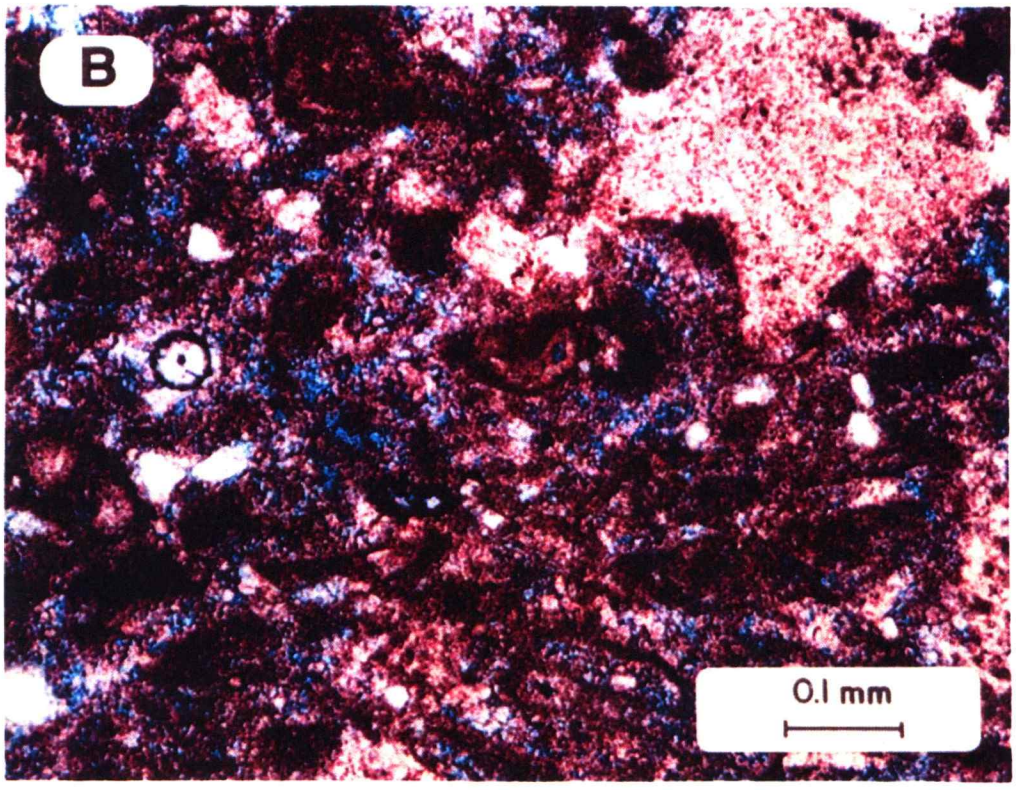
| | |
|---|---|
| Quartz | 4% |
| Calcite | 61% |
| Dolomite | 7% |
| Anhydrite | 28% |

### Petrophysical Data

Cementation Exponent (m): 2.02
Saturation Exponent (n): *Test in Progress*

Figure 18



# FIGURE 19

## THIN SECTION PHOTOMICROGRAPHS

## ANADARKO PETROLEUM CORPORATION FLOWER A-1 WELL

Depth: 2700.5 feet

Rock Type: Dolomitic Limestone
Depositional Texture: Wackestone
Porosity: 15.2%
Permeability: 0.413 md
Stratigraphic Unit: Upper Ft. Riley
Dep. Facies: Shoal to Shoal Flank

This sample is from a micritic portion of the shoal flank facies. The rock contains a mixture of carbonate grains and matrix. The matrix has undergone partial dolomitization, although the grains are mostly still composed of calcite (stained pink). The dolomitization created fine intercrystalline pores that can only be distinguished under high magnification (blue areas in view B). Scattered intraskeletal pores and moldic pores were also observed, but overall, most of the pore space is in the altered matrix. The small pores, narrow pore apertures and tortuous pore system result in rather low permeability.

A – 40X

B – 160X

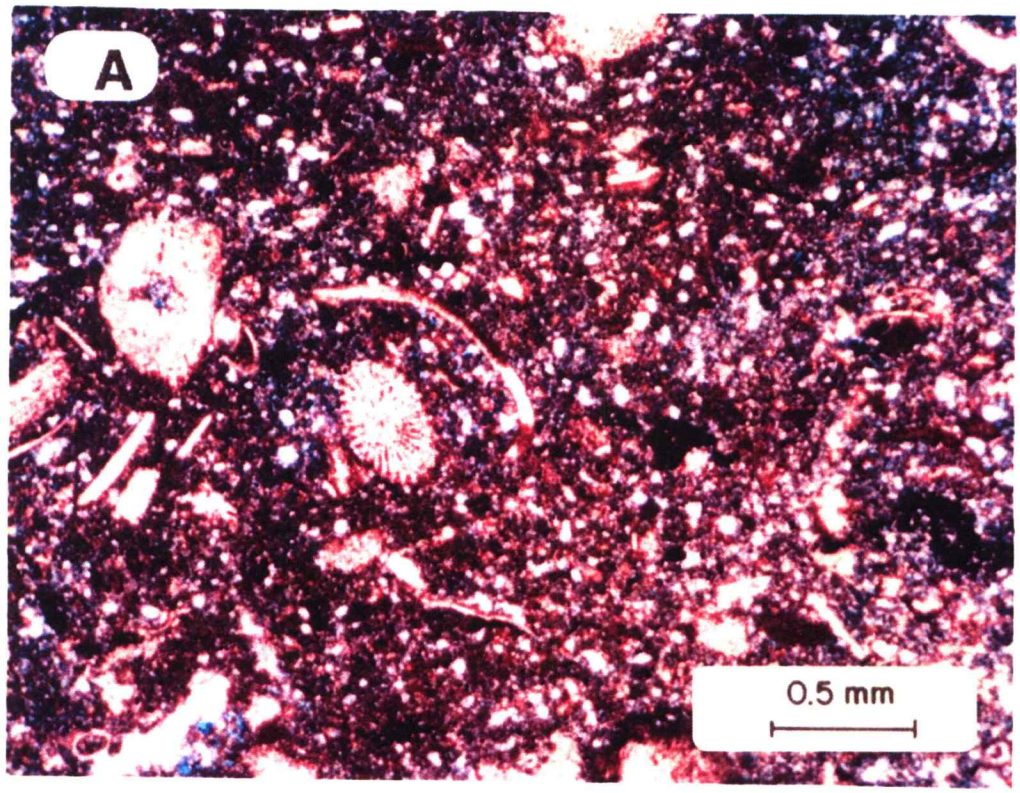
### X-ray Diffraction Data

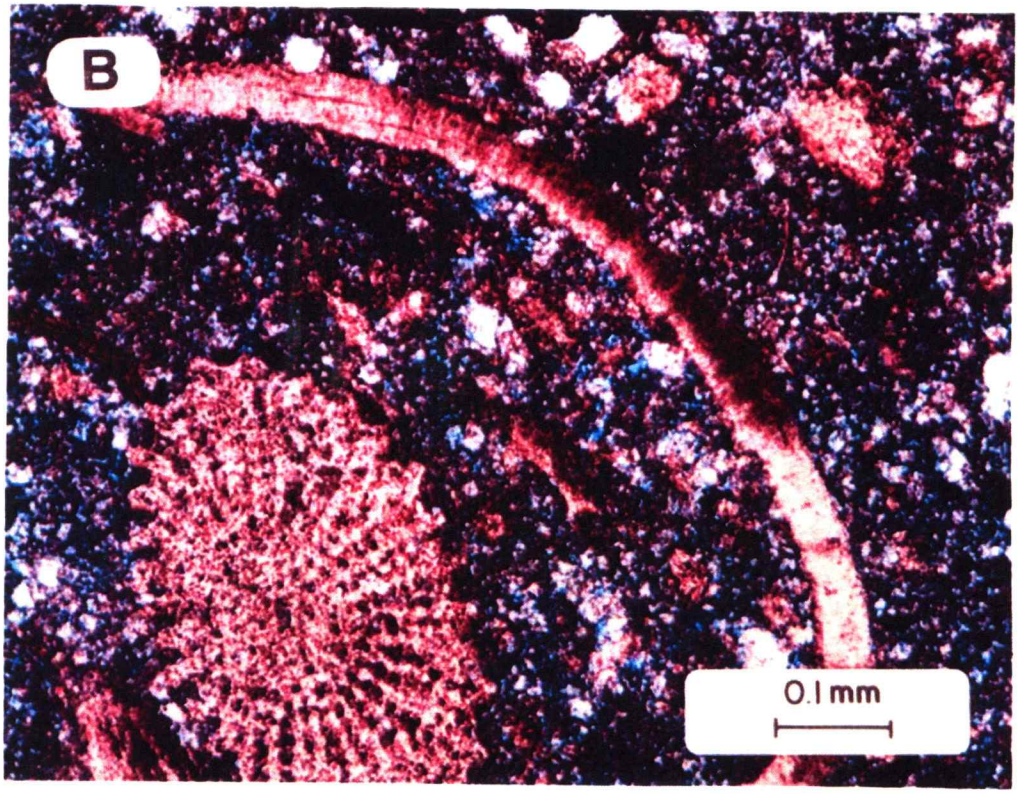
| | |
|---|---|
| Quartz | 6% |
| Potassium Feldspar | 5% |
| Plagioclase Feldspar | 1% |
| Calcite | 57% |
| Dolomite | 12% |
| Anhydrite | 19% |

### Petrophysical Data

Cementation Exponent (m): 1.95
Saturation Exponent (n): *Test in Progress*

Figure 19



# FIGURE 20

## THIN SECTION PHOTOMICROGRAPHS

## ANADARKO PETROLEUM CORPORATION FLOWER A-1 WELL

Depth: 2772.5 feet

Rock Type: Anhydritic Limestone
Depositional Texture: Grainstone
Stratigraphic Unit: Wreford
Dep. Facies: Shoal to Shoal Flank

Porosity: 17.4%
Permeability: 12.4 md

Oncoids, peloids and skeletal fragments are present in this grainstone. Calcite (Ca) cement is rather extensive. The remnant pore structure consists of: 1) moldic (Mo) pores, 2) scattered intraskeletal pores, 3) reduced intergranular (Ig) pores, and 4) microporosity within altered micritic grains (white arrows). The resultant pore structure forms a rock with heterogeneous porosity preservation and a tortuous pore system. The intergranular pores probably account for most of the effective pore network and microporosity probably contribute little to the measured porosity.

A – 40X

B – 160X

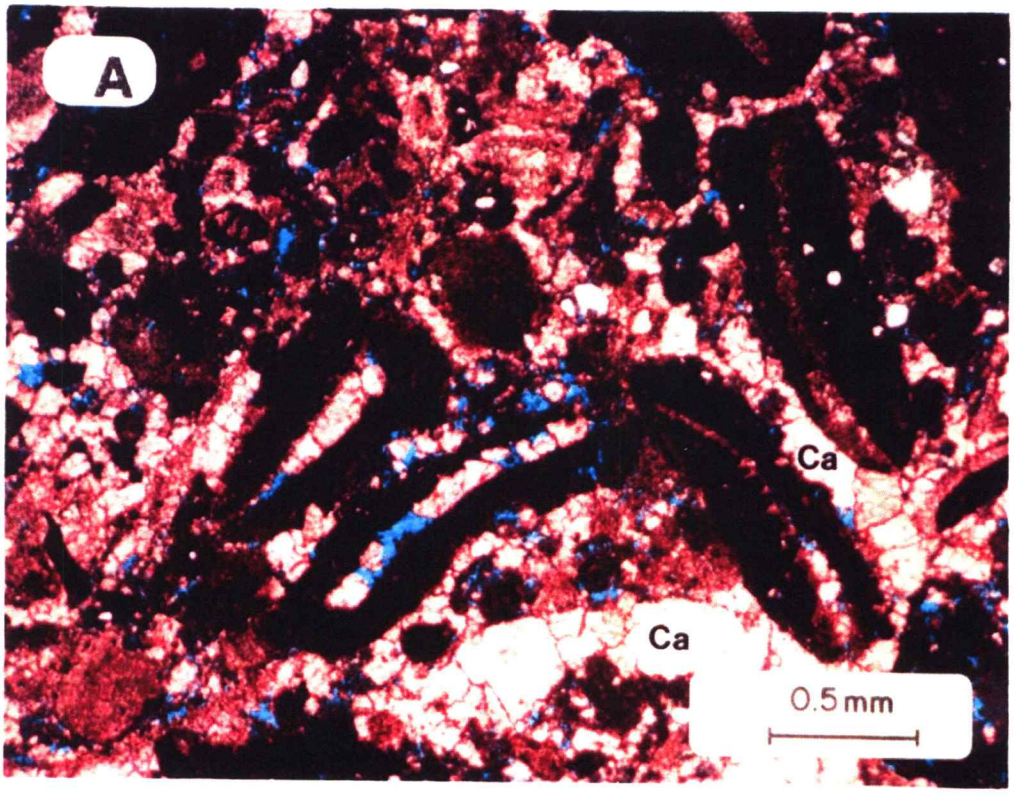
### X-ray Diffraction Data

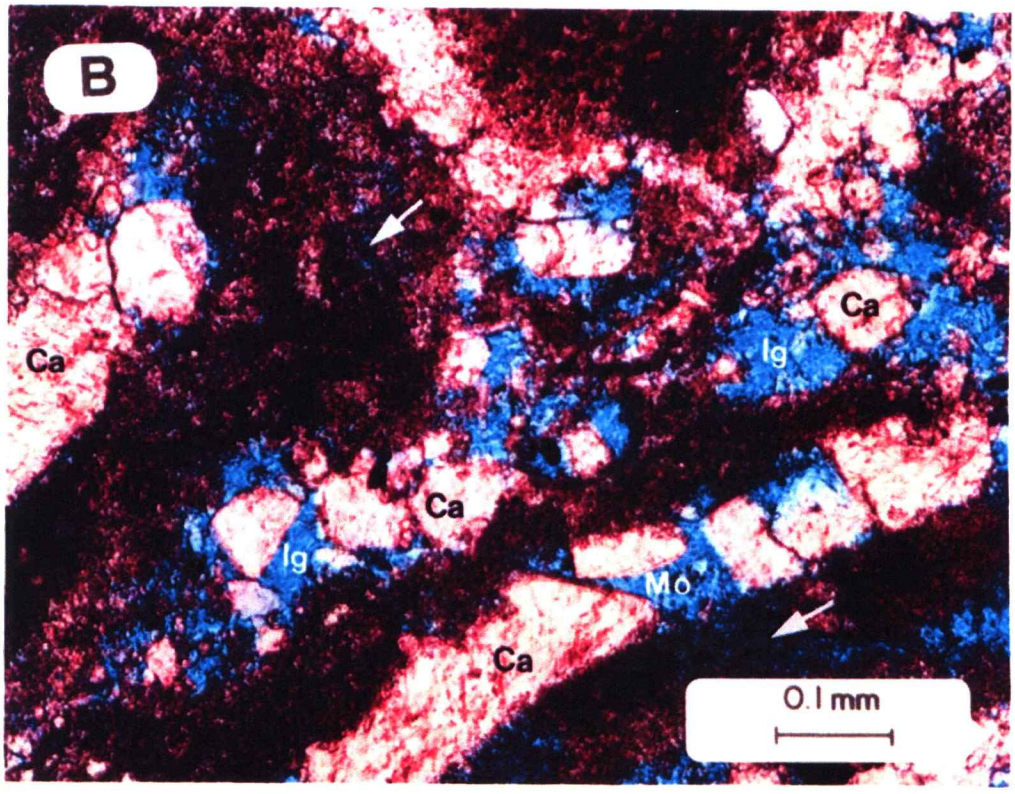
| | |
|---|---|
| Quartz | 4% |
| Calcite | 77% |
| Anhydrite | 19% |

### Petrophysical Data

Cementation Exponent (m): *Test in Progress*
Saturation Exponent (n): *Test in Progress*

Figure 20



# FIGURE 21

## THIN SECTION PHOTOMICROGRAPHS

## ANADARKO PETROLEUM CORPORATION FLOWER A-1 WELL

Depth: 2877.1 feet

Rock Type: Limestone
Depositional Texture: Grainstone/Packstone
Porosity: 12.5%
Permeability: 0.689 md
Stratigraphic Unit: Council Grove B1
Dep. Facies: Shoal to Shoal Flank

Throughout most of this sample, intergranular pore space has been occluded by a combination of calcite cement and detrital micrite matrix. Most of the remnant macropore space is in the form of scattered moldic, intraskeletal and reduced intergranular pores. In addition, alteration of micritic grains such as oncoids has led to the development of microporosity (white arrows in view B). This inefficient pore system results in rather low permeability.

A – 40X

B – 160X

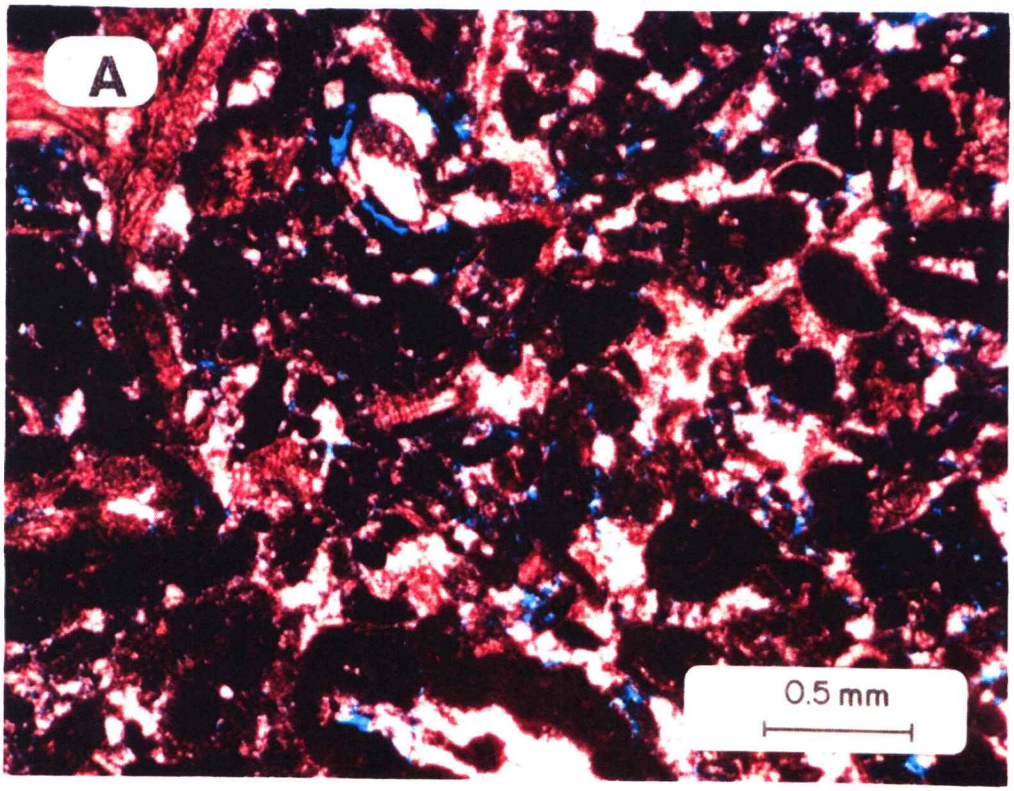
### X-ray Diffraction Data

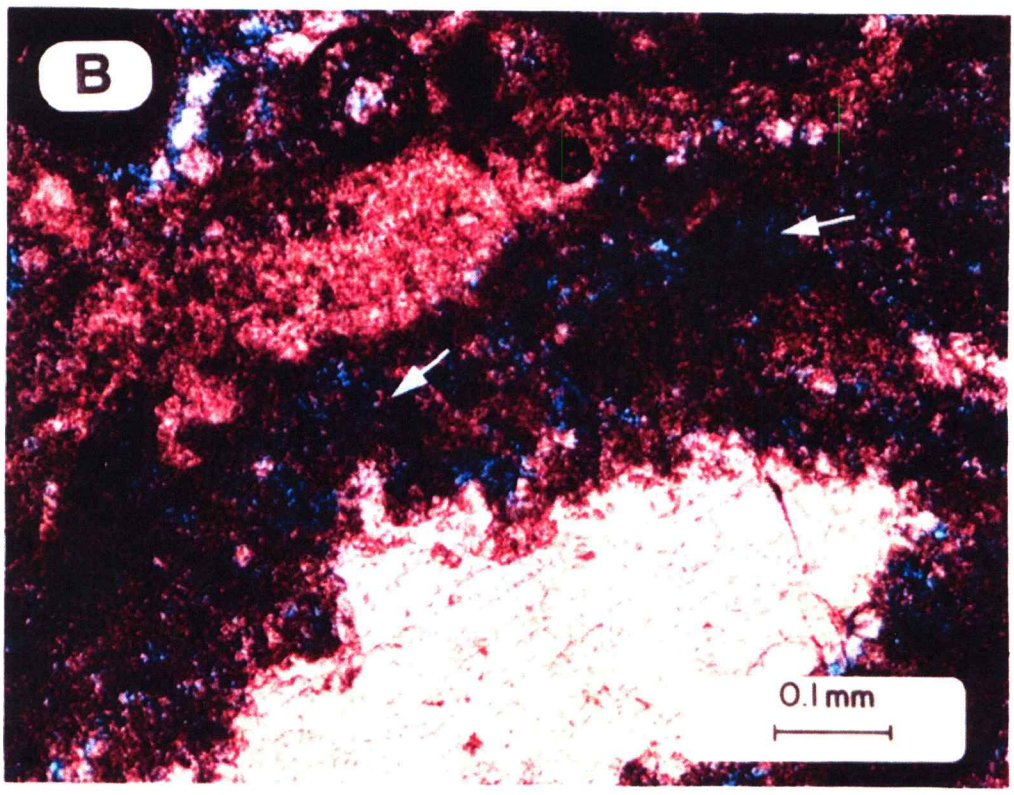
| | |
|---|---|
| Quartz | 3% |
| Calcite | 95% |
| Dolomite | 2% |

### Petrophysical Data

Cementation Exponent (m): 2.04
Saturation Exponent (n): *Test in Progress*

Figure 21



# FIGURE 22

## THIN SECTION PHOTOMICROGRAPHS

## ANADARKO PETROLEUM CORPORATION FLOWER A-1 WELL

Depth: 2891.4 feet

Rock Type: Limestone
Depositional Texture: Grainstone
Porosity: 13.2%
Permeability: 48.7 md
Stratigraphic Unit: Council Grove B2
Dep. Facies: Shoal to Shoal Flank

This grainstone is dominated by well sorted peloids and foraminifera. Overall, the rock has a well preserved network of intergranular (Ig) pores. At least two generations of calcite cement have acted to occlude pore space. An early generation of finely crystalline cement (white arrow) surrounds many of the grains. A later generation of blocky calcite (Bc) spar more completely occludes some intergranular areas. In view A, note how the blocky calcite spar has a patchy distribution. Although calcite cement has reduced the pore system, the remnant intergranular pore space provides for an effective pore network and good reservoir potential.

A – 40X

B – 160X

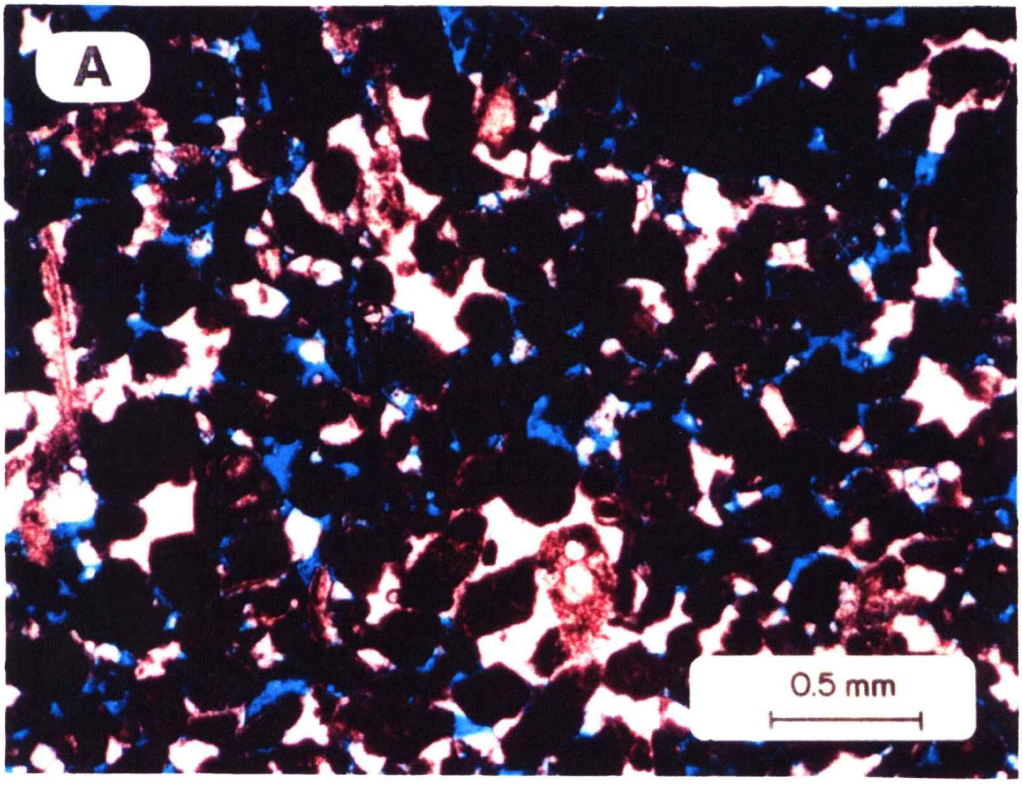
### X-ray Diffraction Data

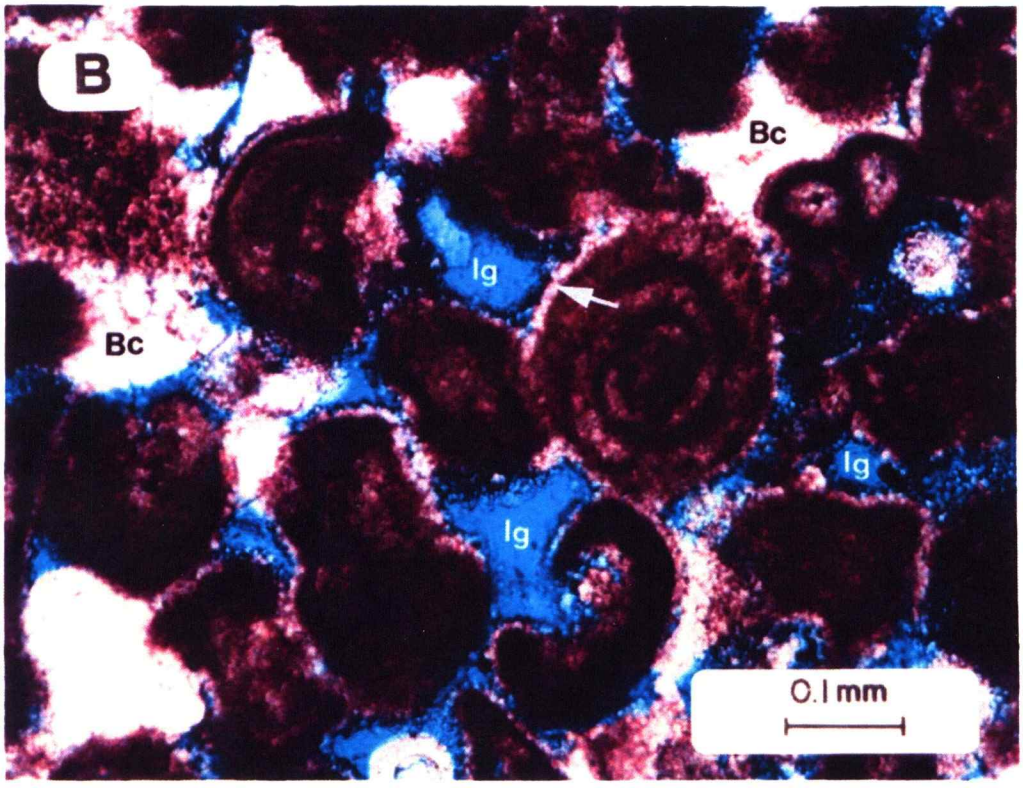
| | |
|---|---|
| Quartz | 1% |
| Calcite | 79% |
| Anhydrite | 20% |

### Petrophysical Data

Cementation Exponent (m): 2.09
Saturation Exponent (n): *Test in Progress*

Figure 22



# FIGURE 23

## THIN SECTION PHOTOMICROGRAPHS

## ANADARKO PETROLEUM CORPORATION FLOWER A-1 WELL

Depth: 2932.5 feet

Rock Type: Limestone
Depositional Texture: Grainstone
Porosity: 11.7%
Permeability: 17.2 md
Stratigraphic Unit: Council Grove B4
Dep. Facies: Shoal to Shoal Flank

In addition to preserved intergranular (Ig) pores, moldic and intraskeletal pores are present within foraminifera and calcareous algae. Patchy calcite (Ca) cement results in heterogeneous porosity distribution. However, the remnant network of intergranular pores still allow for efficient fluid movement throughout the rock.

A – 40X

B – 160X

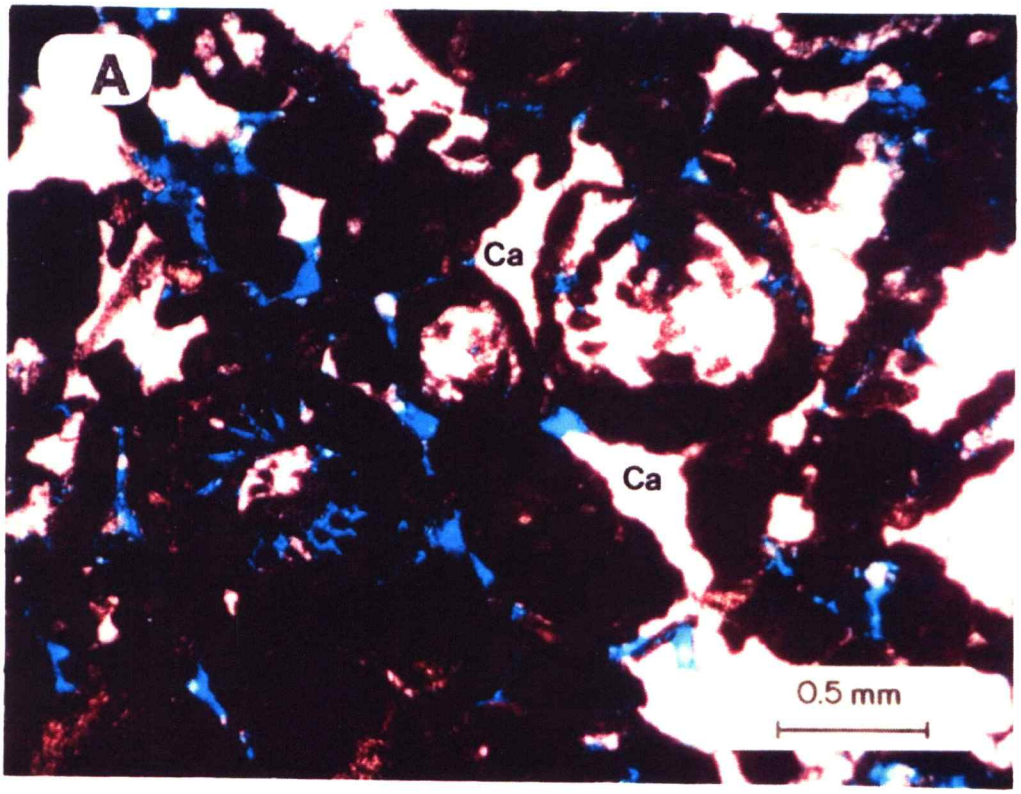
### X-ray Diffraction Data

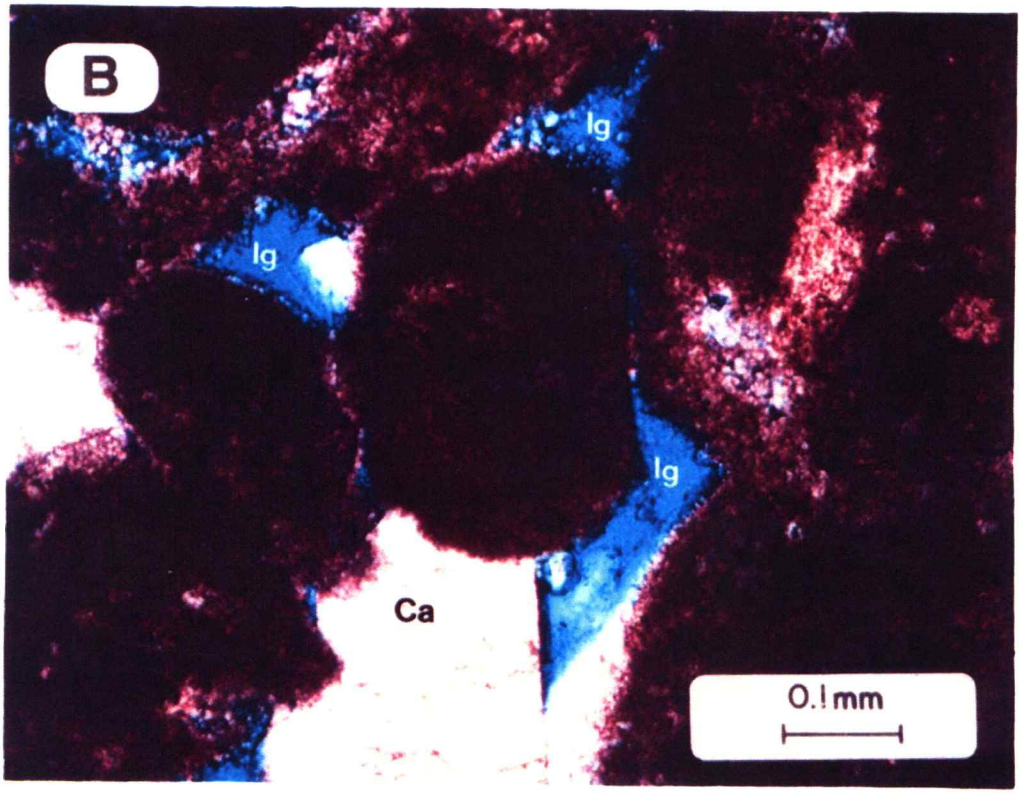
| | |
|---|---|
| Quartz | 3% |
| Calcite | 97% |

### Petrophysical Data

Cementation Exponent (m): 2.11
Saturation Exponent (n): *Test in Progress*

Figure 23



# FIGURE 24

## THIN SECTION PHOTOMICROGRAPHS

## ANADARKO PETROLEUM CORPORATION FLOWER A-1 WELL

Depth: 2949.8 feet

Rock Type: Limestone
Depositional Texture: Packstone
Porosity: 14.4%
Permeability: 177 md
Stratigraphic Unit: Council Grove B5
Dep. Facies: Algal Bank

The depositional texture of this phylloid algal-bearing rock is heterogeneous. Some parts of the sample contain an abundance of micrite and tightly packed peloids (dark areas in view A), while other areas contain little micrite and have preserved intergranular pores (view B). The depositional texture has been somewhat obscured by the brecciation and brittle deformation that resulted in the development of fractures (F). The brecciation may have initiated due to extensive dissolution of the phylloid algae. This created an unstable porous rock that probably "collapsed" in response to overburden stresses. Although some of the fractures are partially filled with calcite (Ca) cement, many remain open. These fractures play an important role in the high permeability of this rock.

A – 40X

B – 160X

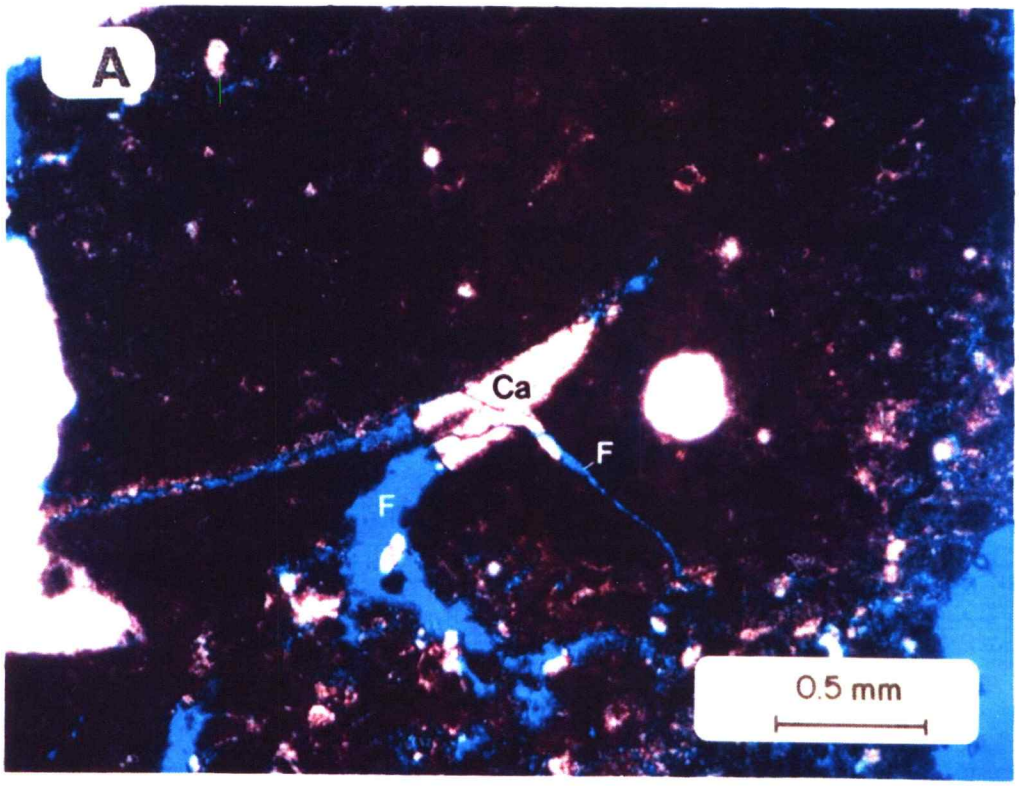
### X-ray Diffraction Data

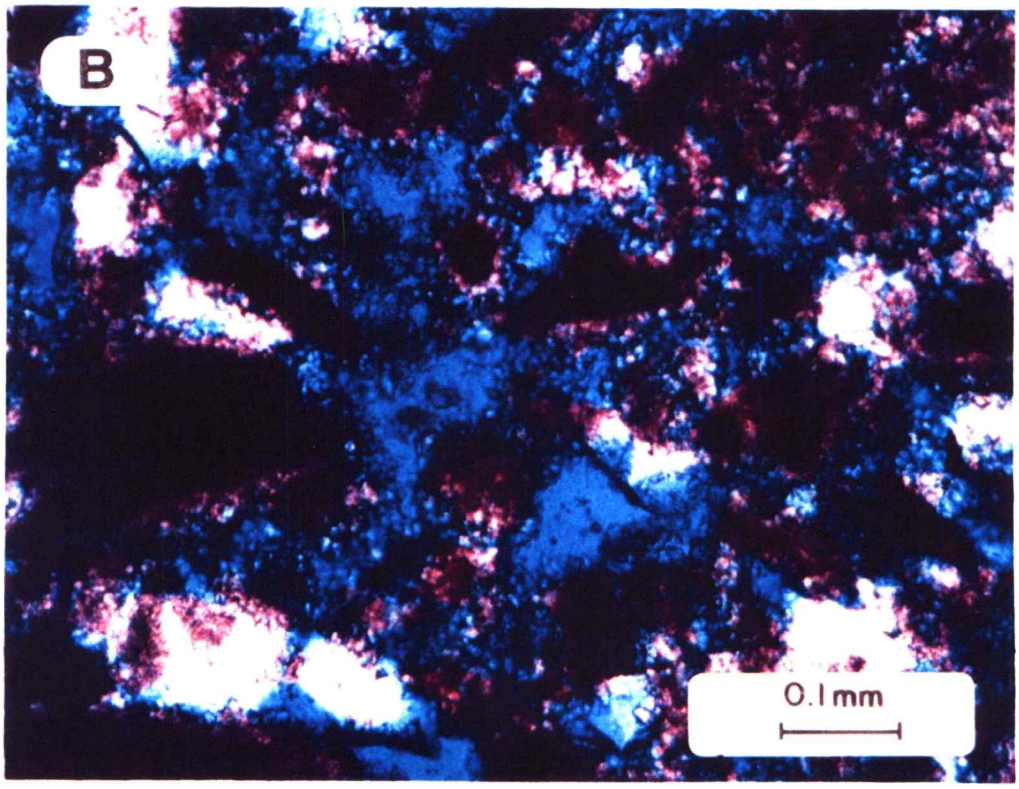
| | |
|---|---|
| Calcite | 100% |

### Petrophysical Data

Cementation Exponent (m): 2.06
Saturation Exponent (n): *Test in Progress*

Figure 24



# FIGURE 25

## WHOLE THIN SECTION PHOTOGRAPH

## ANADARKO PETROLEUM CORPORATION FLOWER A-1 WELL

Depth: 2515.8 feet

Rock Type: Dolomite
Depositional Texture: Grainstone

Porosity: 22.3%
Permeability: 275 md

Stratigraphic Unit: Krider
Dep. Facies: Shoal to Shoal Flank

Note the abundance of large moldic pores and smaller intercrystalline pores throughout this dolomite. Although dolomitization has somewhat obscured the depositional texture of this rock, the abundance of grain relicts indicates a grainstone texture. The intercrystalline pores and remnant intergranular pores provide access to the moldic pores. Together, these pores combined to yield a rock with high permeability and very good reservoir potential. A few patches of coarsely crystalline anhydrite (bright white) cement are present. The space between the black bars at the bottom of the photograph equals 1 mm.

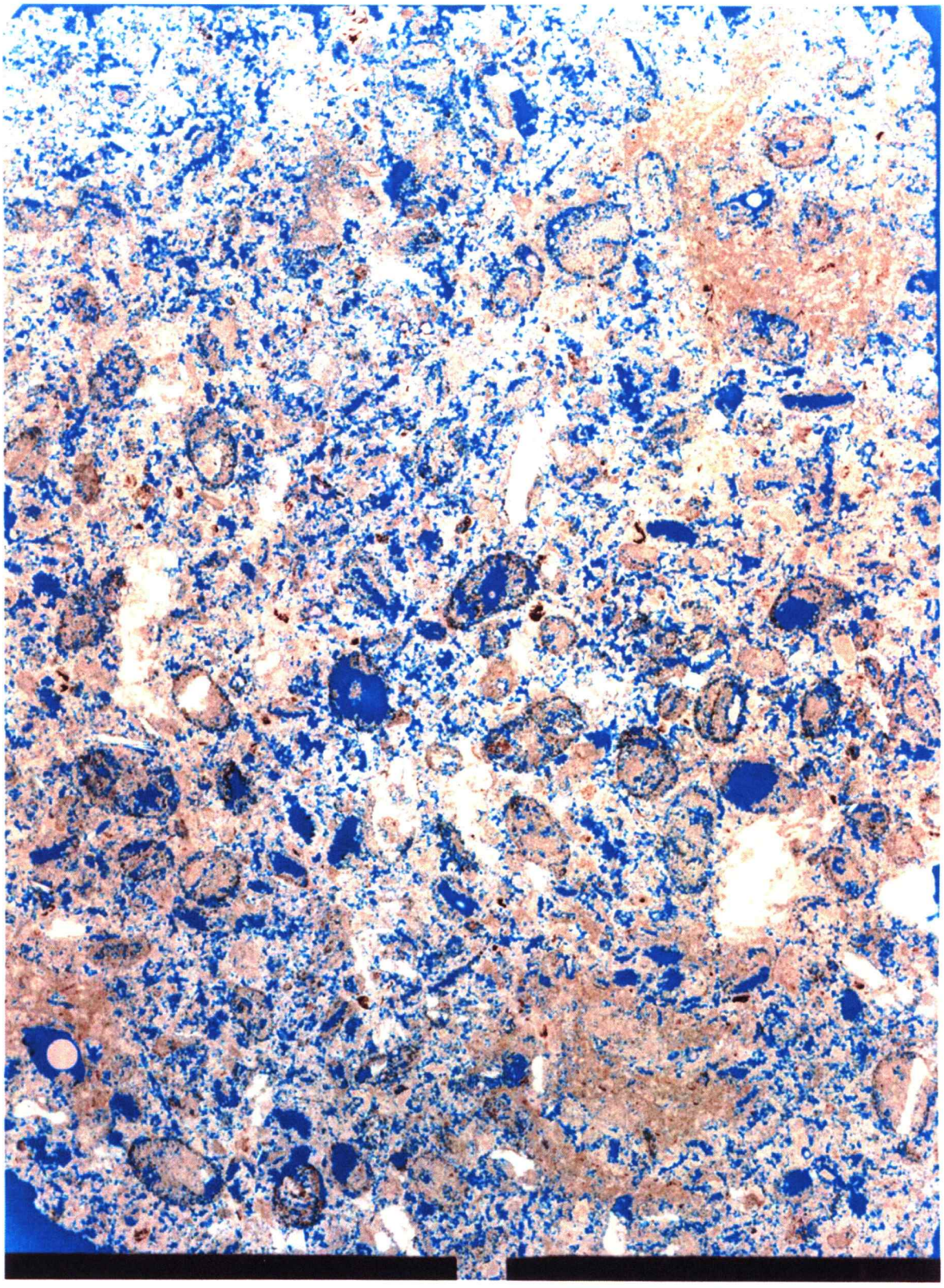
### X-ray Diffraction Data

| | |
|---|---|
| Dolomite | 99% |
| Anhydrite | 1% |

### Petrophysical Data

Cementation Exponent (m): 2.20
Saturation Exponent (n): *Test in Progress*

Figure 25



# FIGURE 26

## WHOLE THIN SECTION PHOTOGRAPH

## ANADARKO PETROLEUM CORPORATION FLOWER A-1 WELL

Depth: 2531.1 feet

Rock Type: Calcareous Dolomite
Depositional Texture: Wackestone/Mudstone
Porosity: 17.5%
Permeability: 1.11 md
Stratigraphic Unit: Krider
Dep. Facies: Shoal Flank

Compare this sample to the dolomitized grainstone shown in Figure 25. The uniformly finely crystalline fabric and paucity of relict framework grains indicate that this rock accumulated with a micritic (wackestone/mudstone) texture. Dolomitization apparently enhanced reservoir potential by creating small intercrystalline pores in what had been low porosity/permeability carbonate matrix. However, the small size of the pores, combined with the narrow pore throat apertures and tortuous pore system yield a rock with only fair reservoir potential. Calcite cement (stained pink), anhydrite replacement (white) and pyrite replacement (black) account for minor portions of this sample. The space between the black bars equals 1 mm.

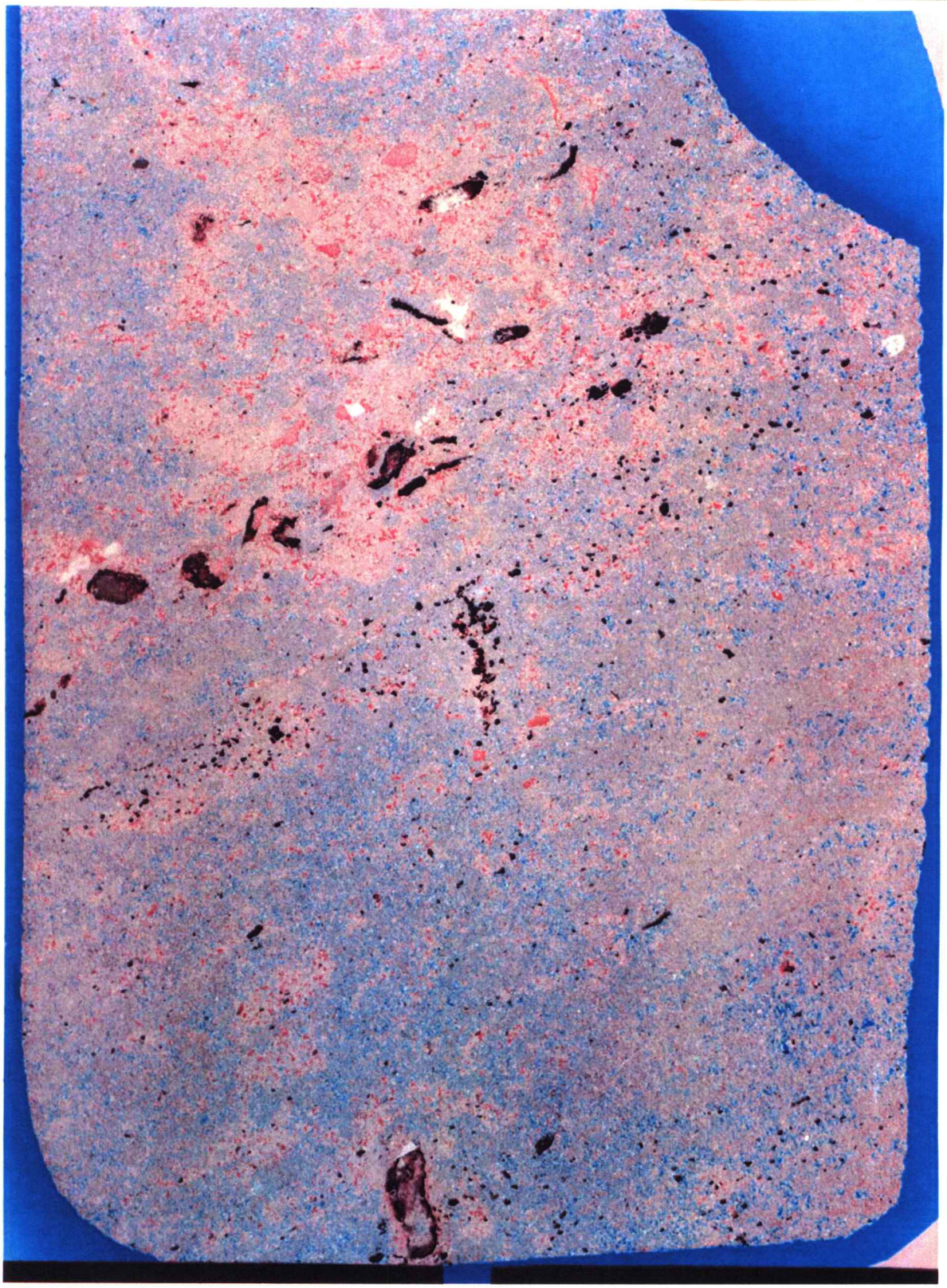
### X-ray Diffraction Data

| | |
|---|---|
| Quartz | 9% |
| Potassium Feldspar | 2% |
| Plagioclase Feldspar | 1% |
| Calcite | 4% |
| Dolomite | 80% |
| Anhydrite | 1% |
| Pyrite | 1% |
| Clay | 2% |

### Petrophysical Data

Cementation Exponent (m): 2.05
Saturation Exponent (n): *Test in Progress*

Figure 26



# FIGURE 27

## WHOLE THIN SECTION PHOTOGRAPH

## ANADARKO PETROLEUM CORPORATION FLOWER A-1 WELL

Depth: 2550.5 feet

Average Grain Size: Coarse Silt (0.055 mm)
Sorting: Very Well Sorted

Porosity: 24.3%
Permeability: 132 md

Stratigraphic Unit: Winfield Sand
Dep. Facies: Tidal Flat

Although patches of calcite (stained pink) and anhydrite (white) cements are scattered throughout this siltstone, most of the sample has a rather well preserved network of primary intergranular pores (see also Figure 11). These intergranular pores are well interconnected, combining to form a rock with high permeability and very good reservoir potential. The space between the bars equals 1 mm.

### X-ray Diffraction Data

| | |
|---|---|
| Quartz | 58% |
| Potassium Feldspar | 7% |
| Plagioclase Feldspar | 16% |
| Calcite | 2% |
| Dolomite | 1% |
| Anhydrite | 13% |
| Clay | 3% |

### Petrophysical Data

Cementation Exponent (m): 1.88
Saturation Exponent (n): *Test in Progress*

Figure 27

# FIGURE 28

## WHOLE THIN SECTION PHOTOGRAPH

## ANADARKO PETROLEUM CORPORATION FLOWER A-1 WELL

Depth: 2949.8 feet

Rock Type: Limestone
Depositional Texture: Packstone
Porosity: 14.4%
Permeability: 177 md
Stratigraphic Unit: Council Grove B5
Dep. Facies: Algal Bank

This limestone has undergone a complex diagenetic history that included processes which dramatically improved the reservoir potential of the rock. This limestone was deposited with a heterogeneous texture; portions of the sample lack detrital micrite and have a fine-grained grainstone texture (see Figure 24,B), while other parts consist of densely packed peloids in a micrite matrix (i.e., wackestone to packestone texture). Some of these heterogeneities are attributable to phylloid algae which acted to create sheltered areas that were protected from micrite infiltration and early compaction. Subsequent dissolution of the phylloid algae created an abundance of moldic pore space. The resultant porous rock was unstable, and brecciation occurred. This collapse created numerous fractures. The presence of calcite cement in some of these fractures indicates that they are clearly natural fractures that will be open in the subsurface. Furthermore, it demonstrates that at least a portion of the calcite cement precipitated after brittle deformation (i.e., relatively late in the diagenetic history of this rock). The fractures combine with moldic pores, solution-enhanced pores and relict intergranular pores to provide for a rock with rather high permeability. The space between the black bars equals 1 mm.

### X-ray Diffraction Data

| | |
|---|---|
| Calcite | 100% |

### Petrophysical Data

Cementation Exponent (m): 2.06
Saturation Exponent (n): *Test in Progress*

Figure 28