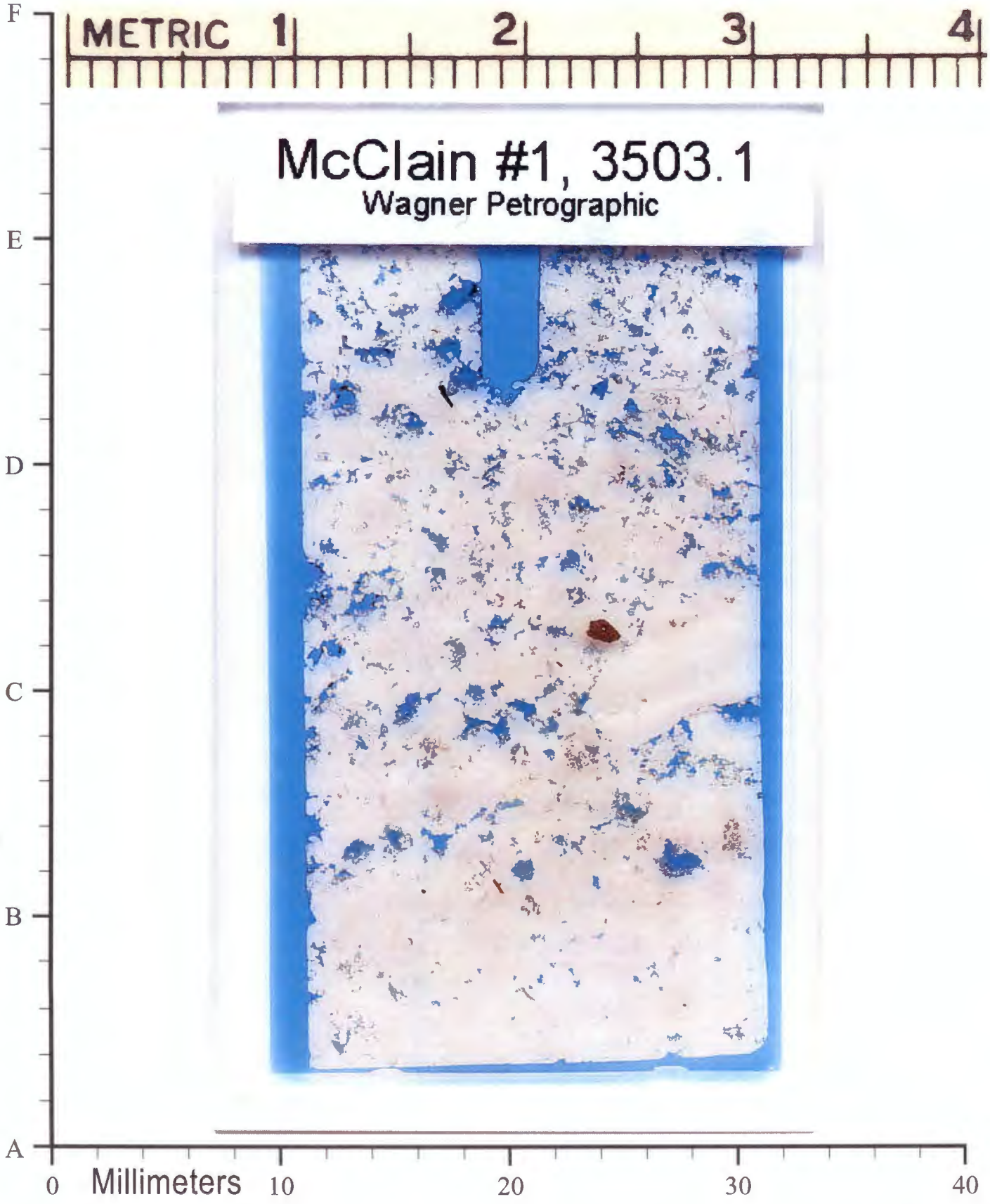
McClain #1, 3501.8 ft
Interval: Viola Dolomite Reservoir
Oil-Stained Porous Medium- to Coarse-Crystalline Vuggy Dolomite

PLATE 1

McClain #1, 3503.1 ft
Interval: Viola Dolomite Reservoir
Minor Bitumen Residue in Vugs in Medium-Crystalline Dolomite

PLATE 2



McClain #1, 3506.0 ft

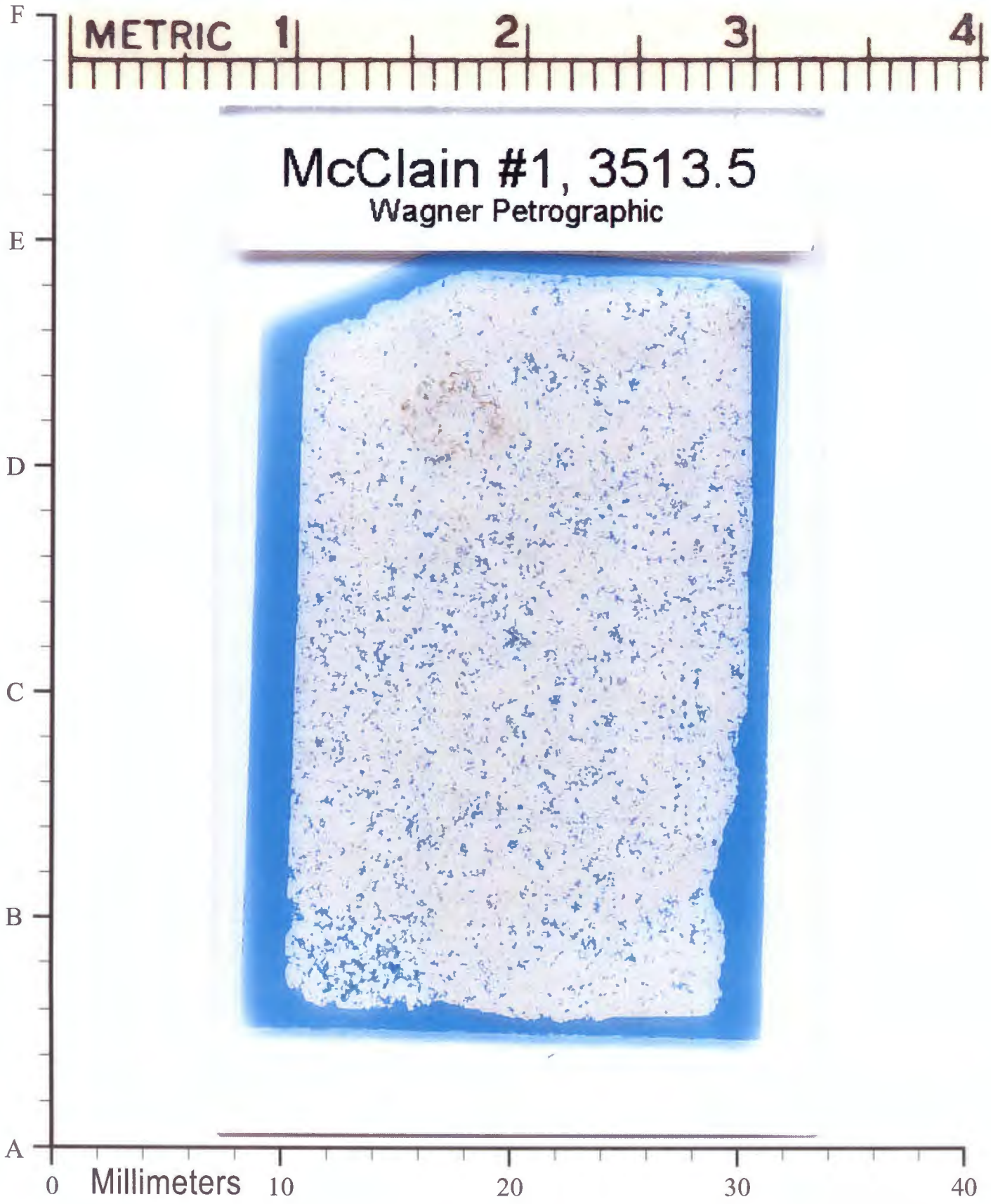
PLATE 3

Interval: Viola Formation Dolomite

Vugs, Molds, and Intercrystalline Pores in Medium-Crystalline Dolomite

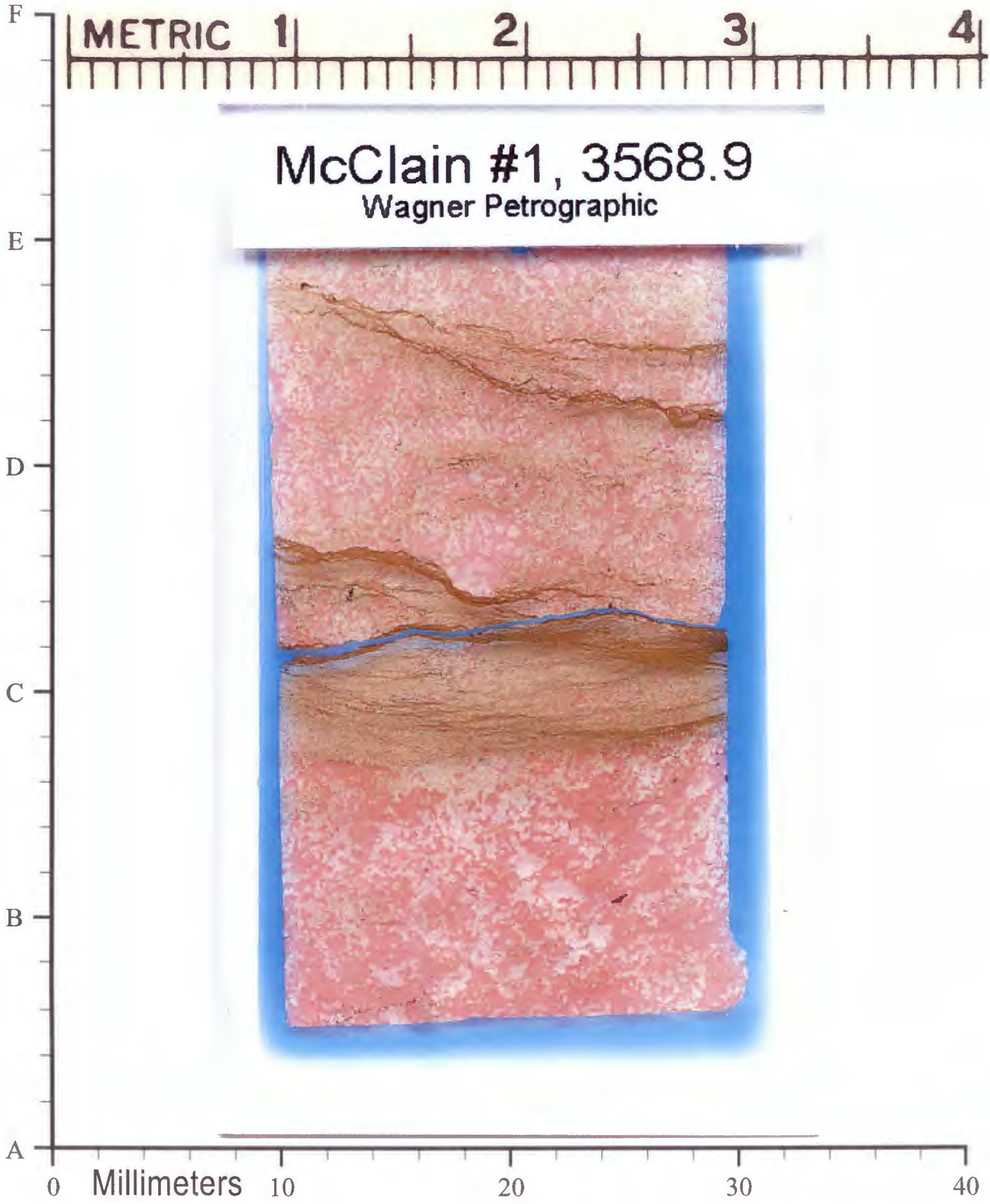
McClain #1, 3513.5 ft
Interval: Viola Formation Dolomite
Small Intercrystalline Pores and Vugs in Medium-Crystalline Dolomite

PLATE 4



McClain #1, 3568.9 ft
Interval: Viola Limestone
Shaly Beds and Wispy Laminae in Dolomitic Limestone

PLATE 5



McClain #1, 3573.5 ft
Interval: Viola Limestone
Shaly Beds and Tabulate Coral in Dolomitic Limestone

PLATE 6

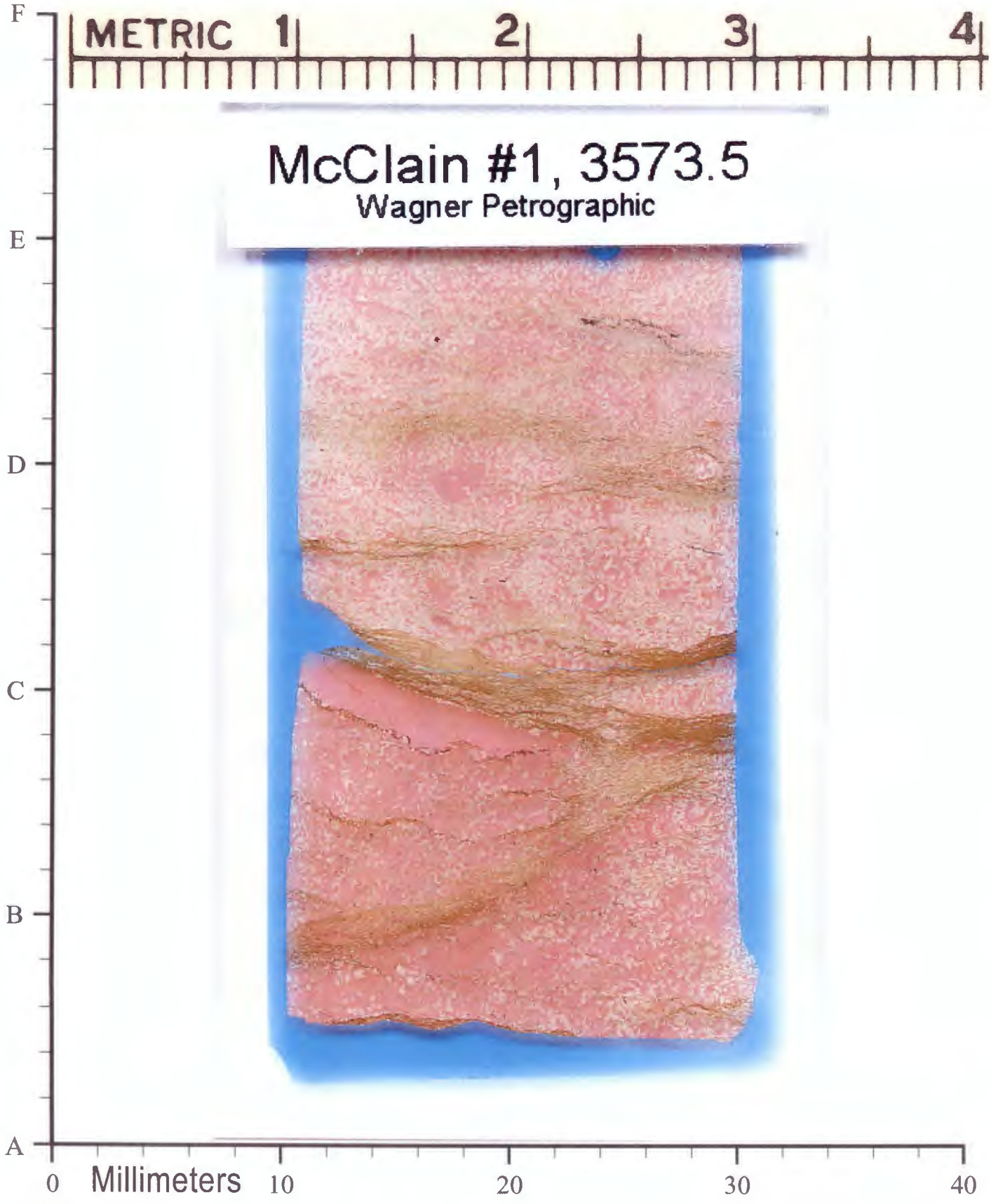
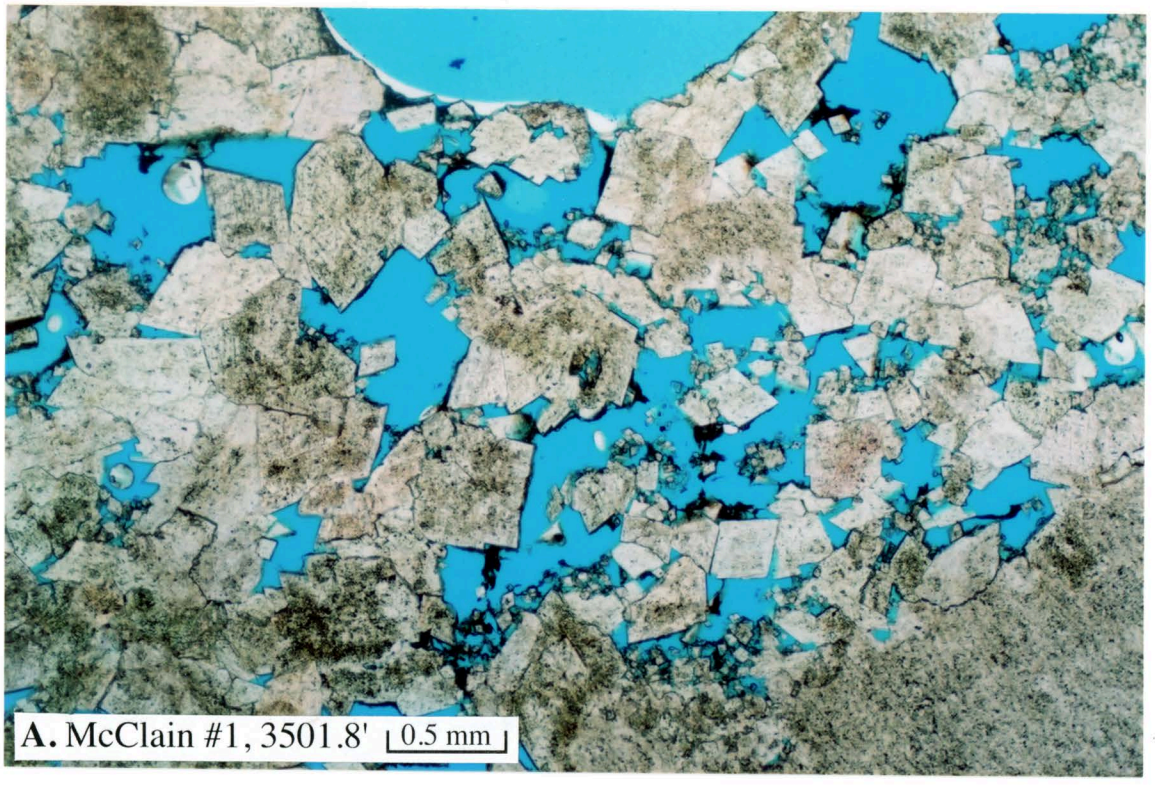
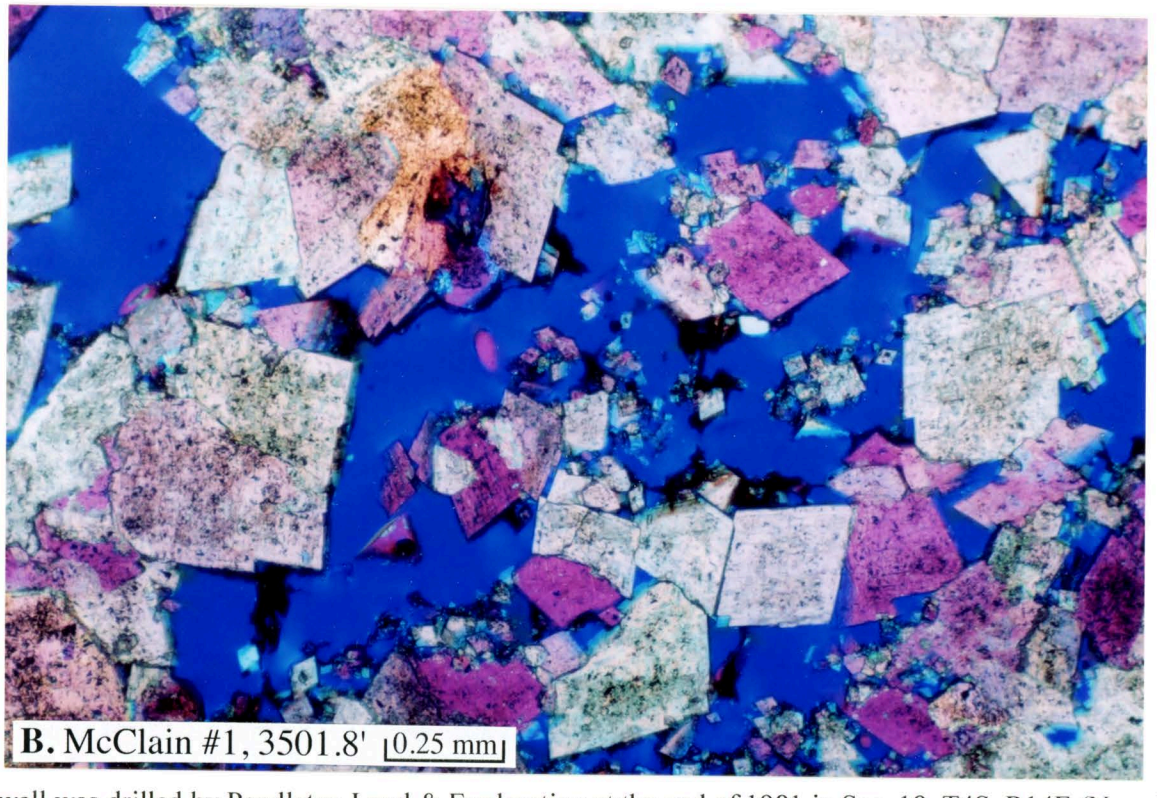


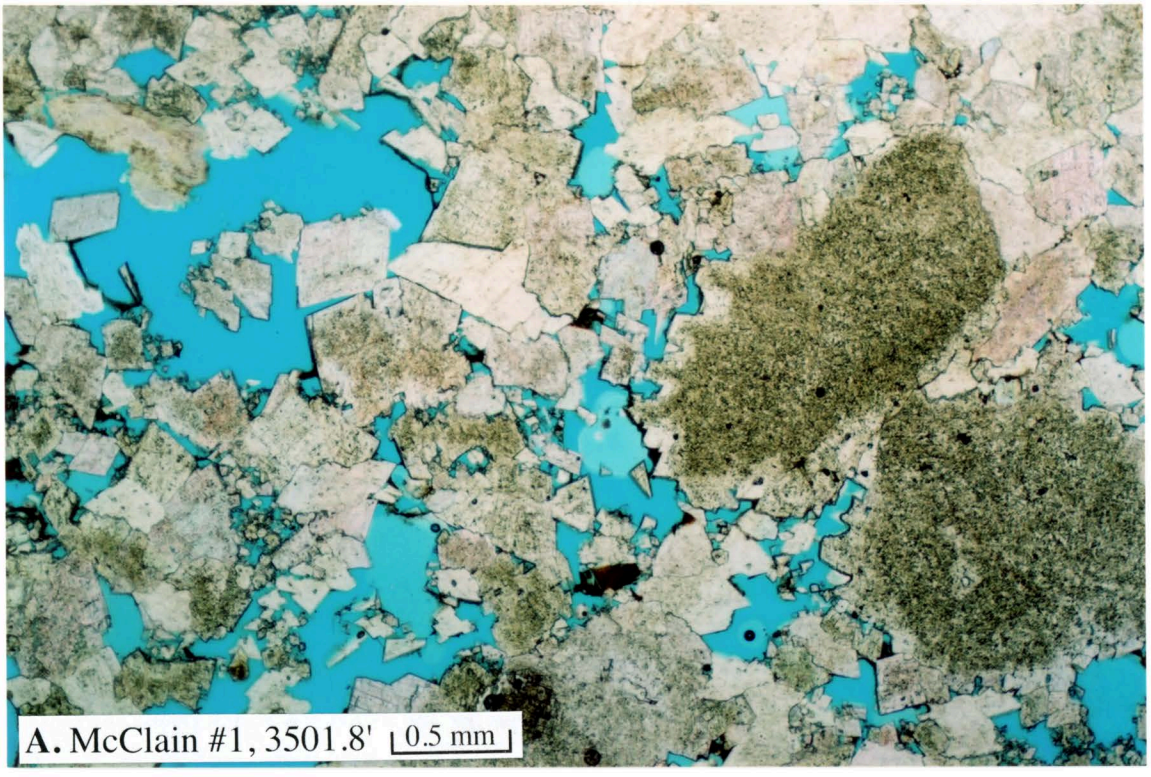
Plate 1. McClain #1, 3501.8 ft: Viola Formation Dolomite
"Up" Notch in Porous Medium- to Coarse-Crystalline Vuggy Dolomite

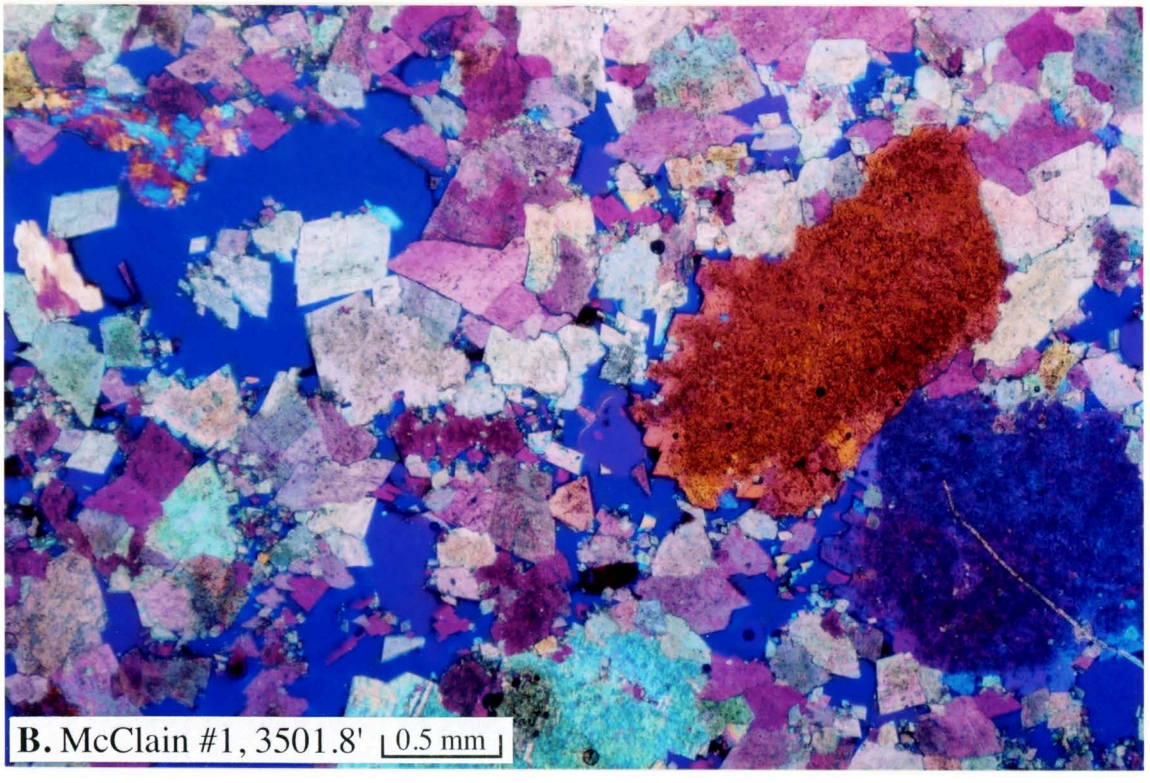




This well was drilled by Pendleton Land & Exploration at the end of 1981 in Sec. 18, T4S, R14E (Nemaha County, KS) to 3800 ft in the Simpson and completed as an oil well pumping 80 BOPD with no water from the Viola dolomite at 3489 to 3493 ft. The well has produced 121.9 MBO before being P & A in 2013. A core was cut at top of the Viola Dolomite through the reservoir zone. As shown in these photomicrographs, the reservoir consists of medium- to coarse crystalline dolomite with up to 20% vuggy and intercrystalline porosity. The dolomite crystals are mostly euhedral with no undulose extinction. The core is about 13 ft low to the logs.

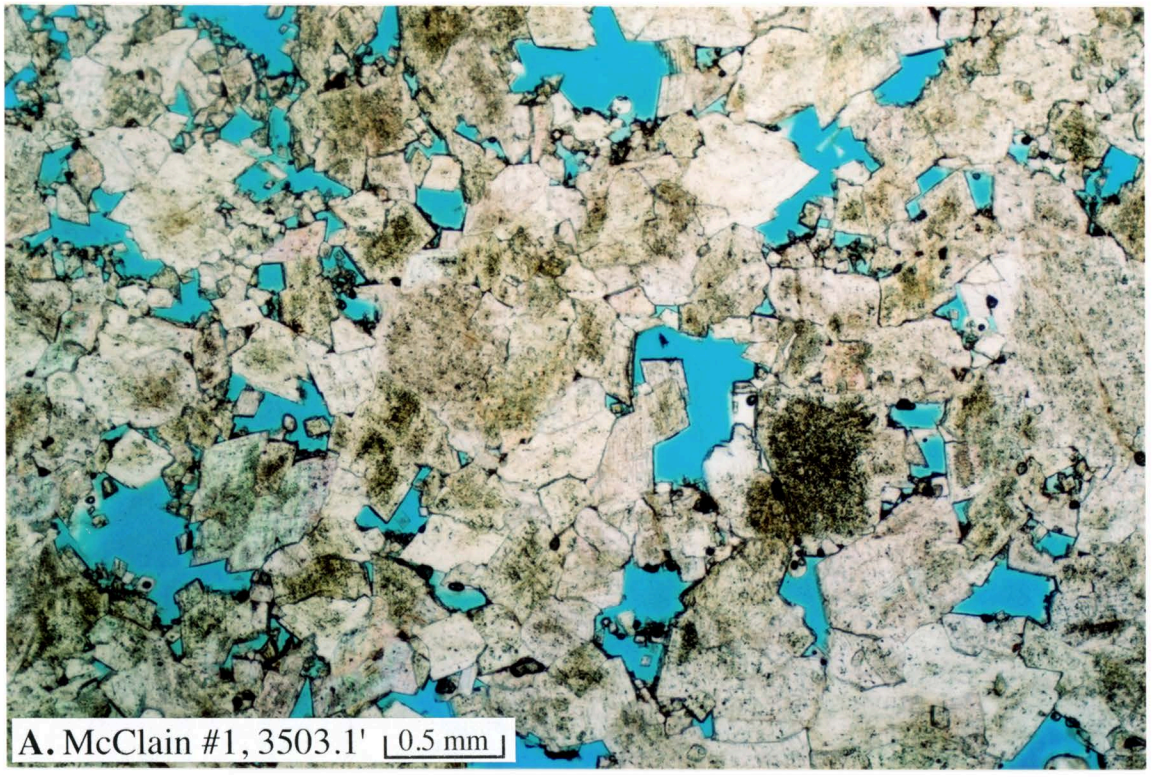
Plate 2. McClain #1, 3501.8 ft: Viola Formation Dolomite
Dolomitized Echinoderm Fragments & Euhedral Dolomite Growing into Vugs

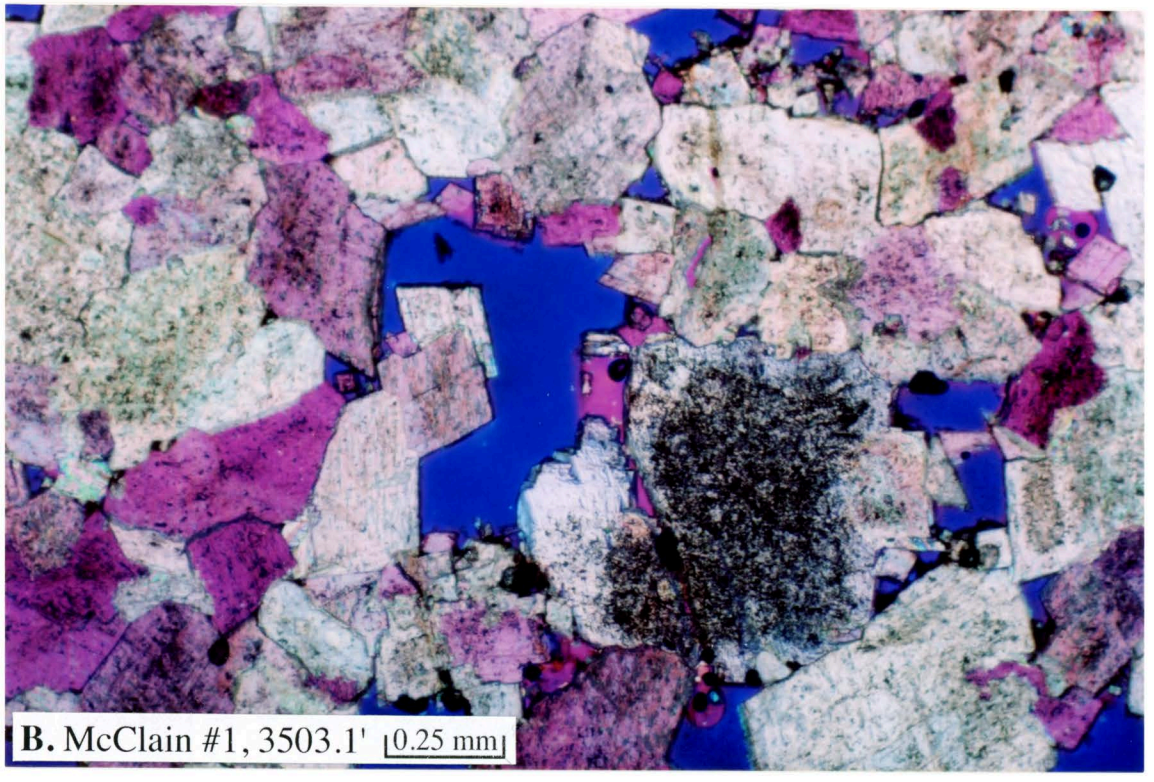




These photomicrographs show more of the same sample seen in Plate 1. This is more of the medium- to coarse-crystalline dolomite with large vugs containing some beautiful euhedral crystals mostly ~0.5 mm in size. The largest dolomite crystals have echinoderm fragments as nuclei (e.g., the cloudy part of the large crystals at right in both photos). The crystal faces of the dolomites are straight with no hint of undulose extinction. This part of the core had a heavy brown oil stain, but only traces of oil are visible in this photomicrographs. Total porosity in this sample is estimated at 18%.

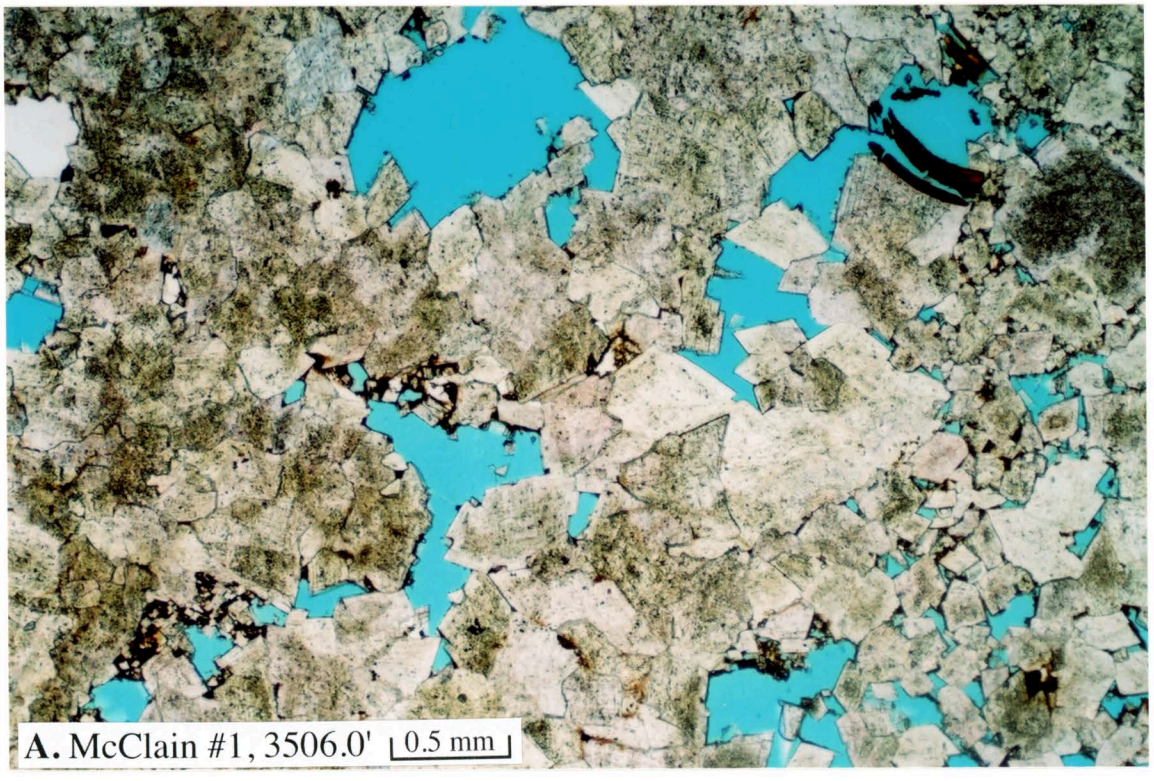
Plate 3. McClain #1, 3503.1 ft: Viola Formation Dolomite
Minor Bitumen Residue in Vugs in Medium-Crystalline Dolomite

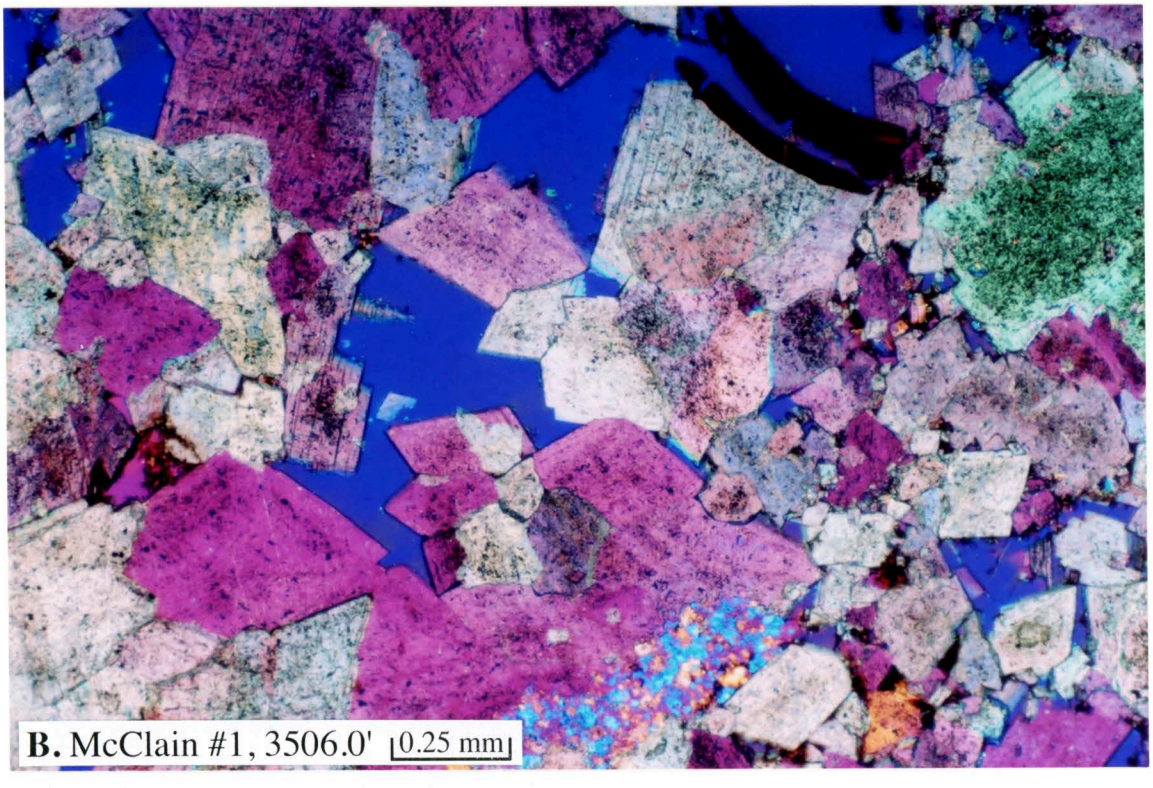




This sample from less than 2 ft below that shown in Plates 1 and 2 reveals more of the medium- to coarse-crystalline dolomite that forms the Viola reservoir in this well. The pore system is dominantly intercrystalline and vuggy with total porosity estimated at 15%. Minor residual brown bitumen residue is visible locally. The shape and cloudy centers of the larger dolomite crystals suggest the presence of dolomitized echinoderm fragments. Photo B was taken with crossed polarized light and a gypsum filter.

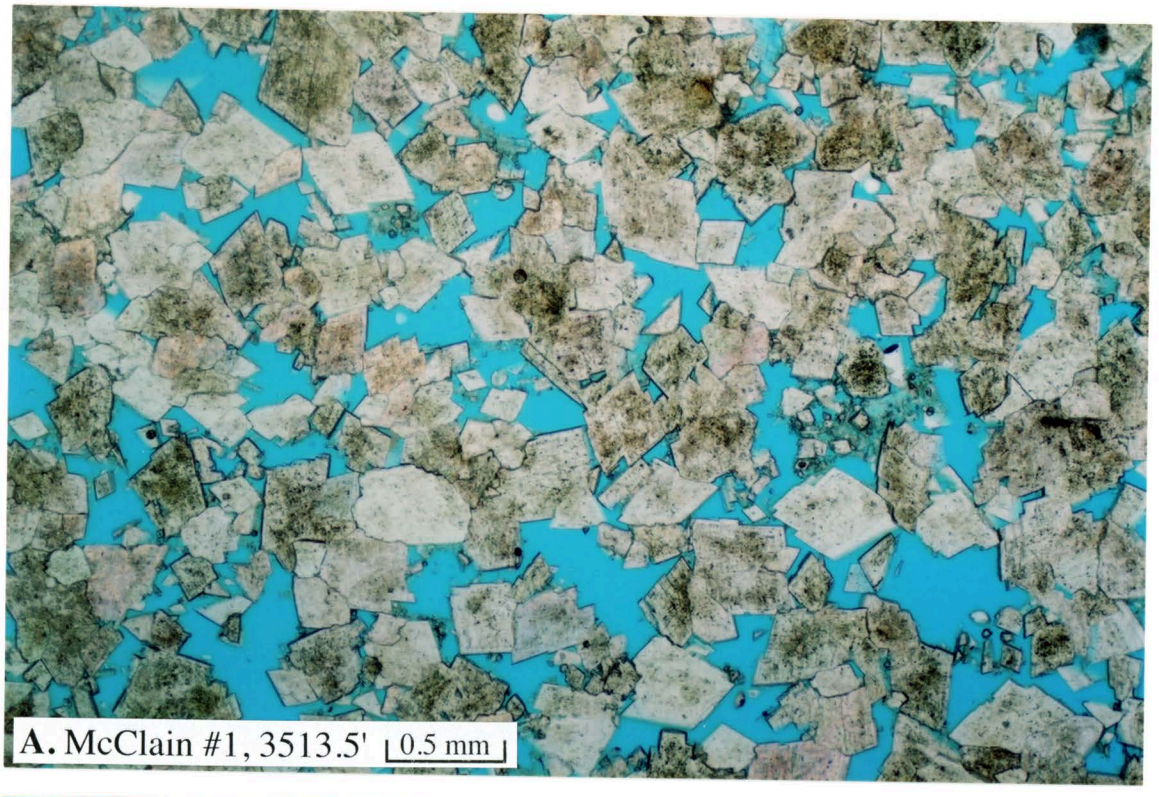
Plate 4. McClain #1, 3506.0 ft: Viola Formation Dolomite
Vugs, Molds, and Intercrystalline Pores in Medium-Crystalline Dolomite

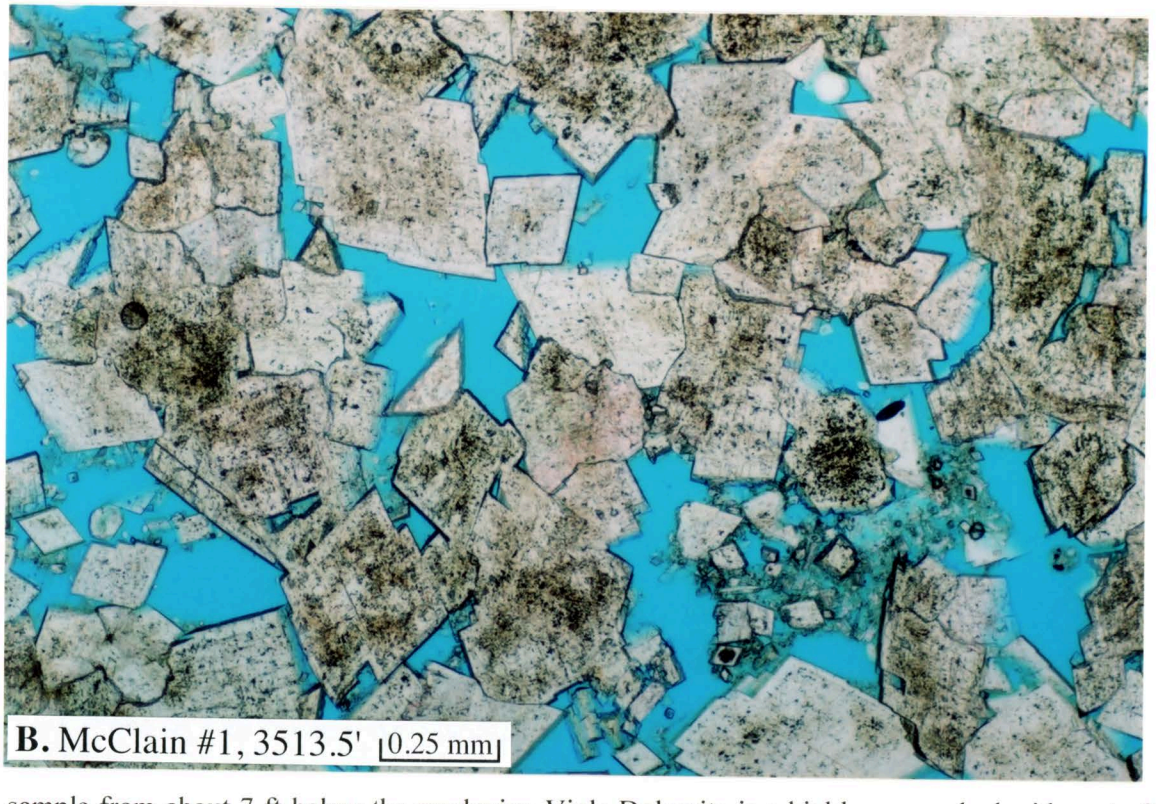




These photomicrographs show another vuggy medium-crystalline dolomite that lies near the oil/water contact in the Viola reservoir in this well. Brown bitumen residue lines parts of the poor system, particularly where there are smaller dolomite crystals (best seen in Photo A). A phosphatic fossil fragment is visible at upper right in both photos. Round moldic pores (e.g., top center, Photo A) and coarse dolomite crystals with cloudy centers (e.g., far upper right, Photo B) suggest the presence of former echinoderm fragments that have unit extinction (visible in Photo B taken with crossed polarized light and a gypsum filter).

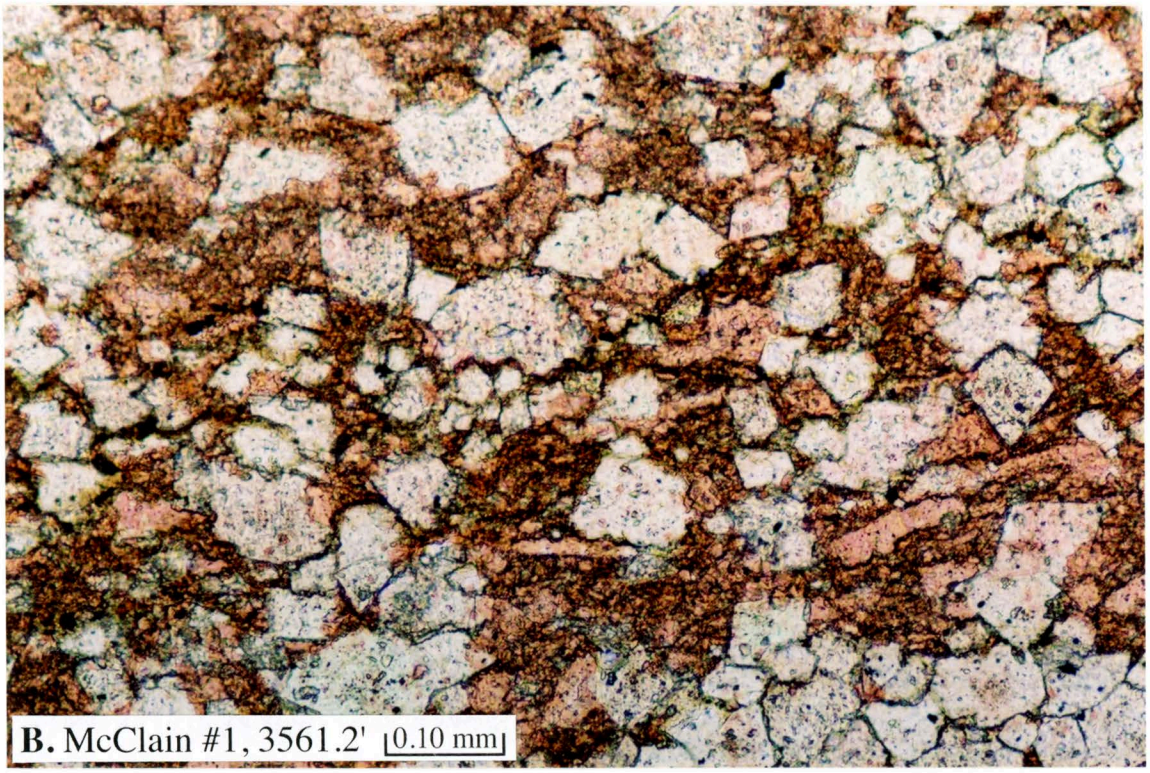
Plate 5. McClain #1, 3513.5 ft: Viola Formation Dolomite
Intercrystalline Pores and Vugs in Highly Porous Medium-Crystalline Dolomite





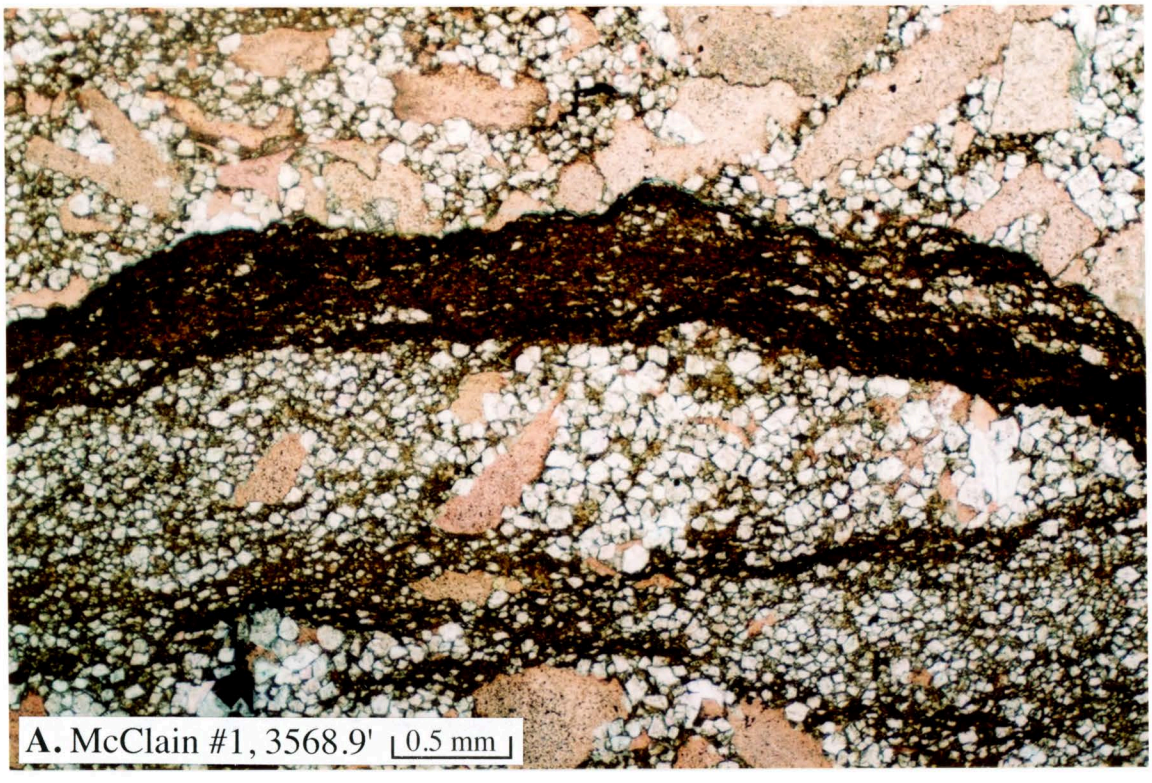
This sample from about 7 ft below the producing Viola Dolomite is a highly porous bed with up to 25% intercrystalline and vuggy porosity. Here the core lacks the brown oil stain because it comes from below the oil/water contact. The euhedral dolomite crystals seen throughout these photomicrographs have straight crystal faces and no undulose extinction so they are not hydrothermal saddle dolomite. Instead, they probably formed in a mixing-zone environment related to the unconformity at the top of the Viola. The degree of dolomitization decreases rapidly in the core below this sample.

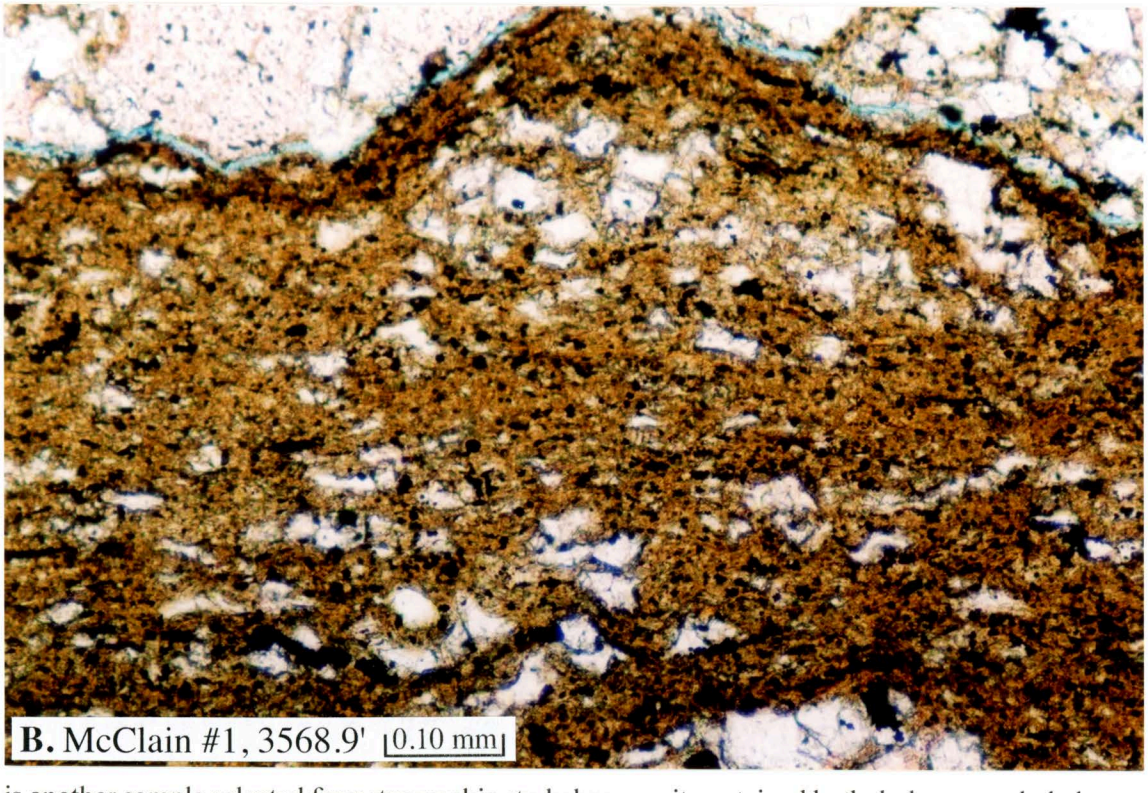
Plate 6. McClain #1, 3561.2 ft: Viola Formation Dolomitic Limestone
Common Dolomite Crystals in Skeletal Wackestone



This sample was selected for petrographic study because it contained both thin wispy shaly layers that we thought might have some hydrocarbon source potential, but the measured TOC content of this sample was just 0.22% with 0.45% S2 remaining generative potential. Clearly these wispy shaly beds offer little or no hydrocarbon source potential. The host rock is a micritic skeletal wackestone with common to abundant replacive dolomite crystals. An "up" notch is visible at the top center of Photo A. This sample contains no visible porosity.

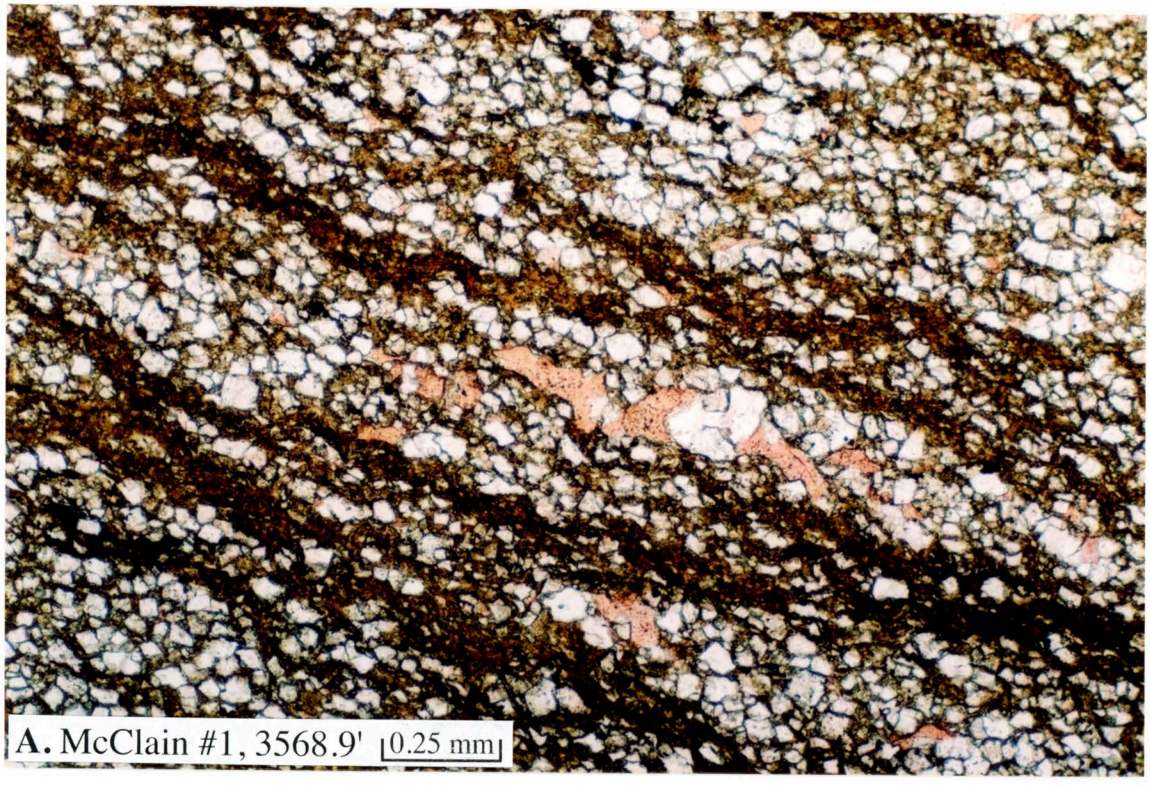
Plate 7. McClain #1, 3568.9 ft: Viola Limestone
Shaly Beds and Laminae in Crinoidal and Dolomitic Limestone

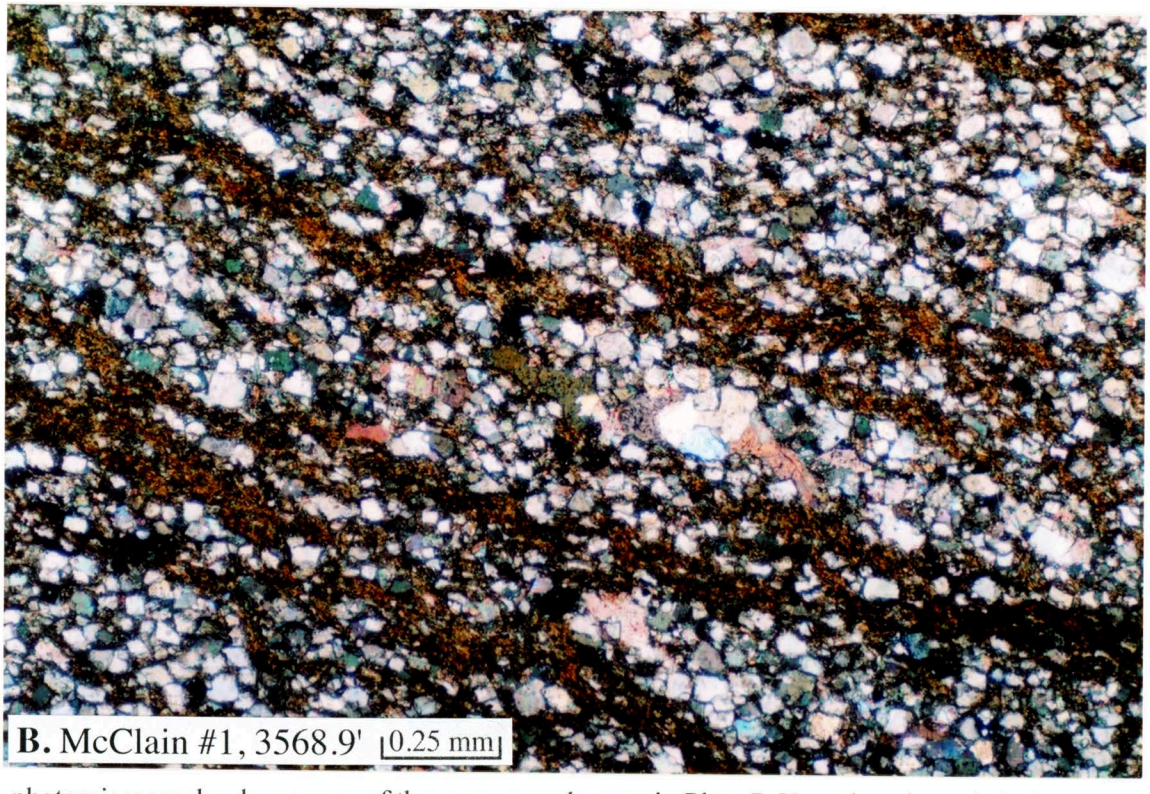




This is another sample selected for petrographic study because it contained both darker gray shaly layers that were thought to possibly have hydrocarbon source potential. However, the measured TOC content of this sample was just 0.23% with 0.52% S2 remaining generative potential. Thus, these wispy shaly beds are not kerogenites and offer little or no hydrocarbon source potential. The clay minerals are dominantly illite with significant birefringence as shown in Plate 8.

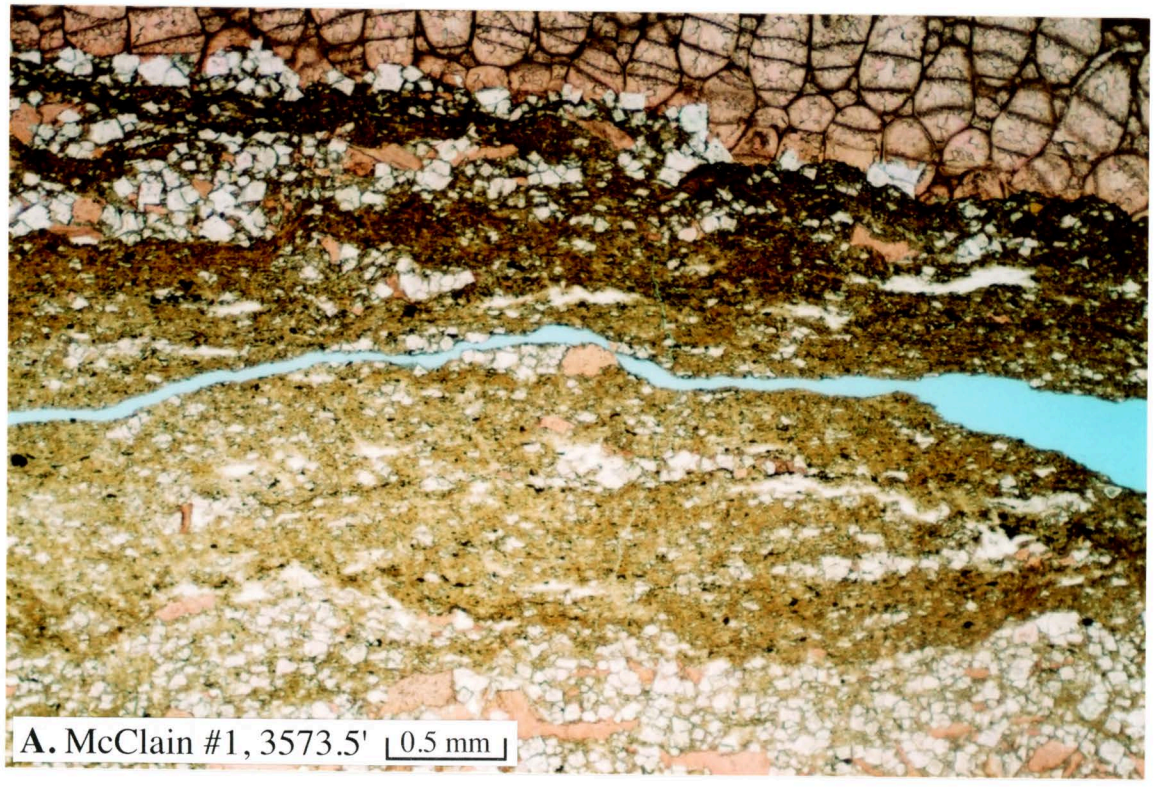
Plate 8. McClain #1, 3568.9 ft: Viola Limestone
Illitic Shaly Laminae in Dolomitic Limestone

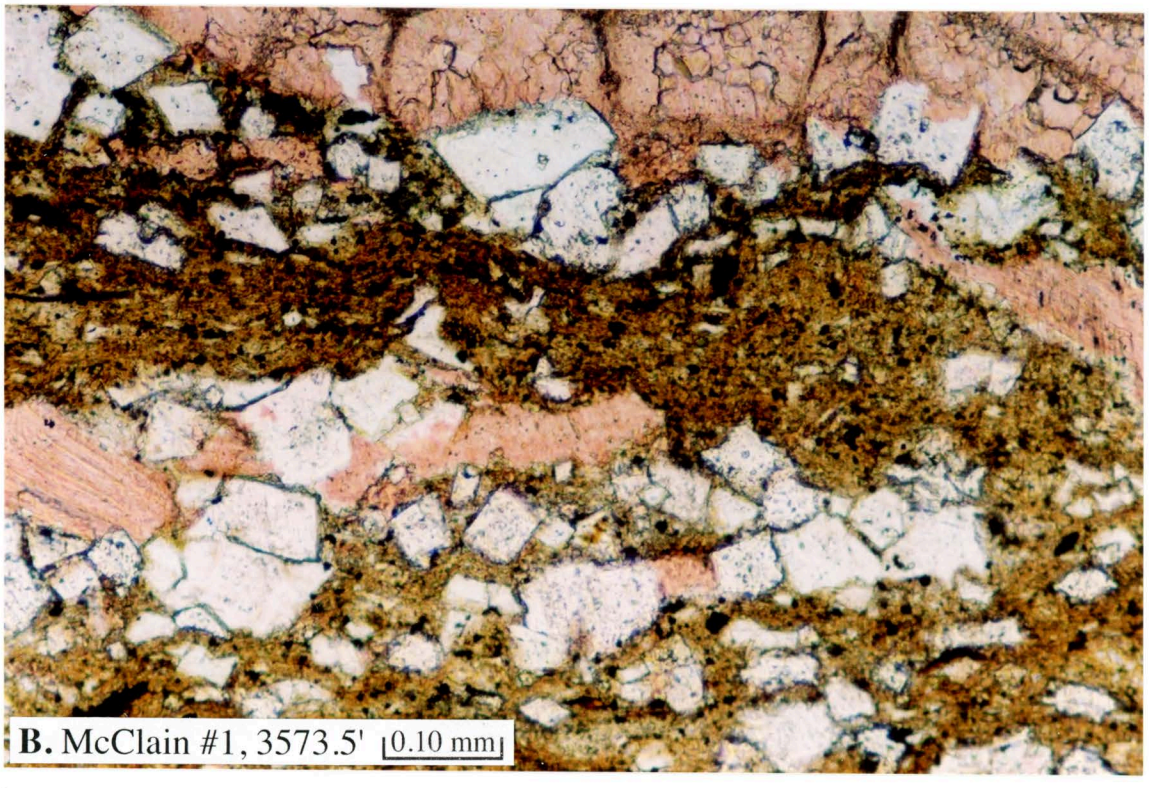




These photomicrographs show more of the same sample seen in Plate 7. Here the wispy shaly laminae have been tilted about 30 degrees to the polarizer to show second order birefringence typical of illite but not present in organic matter. The presence of common clay to form the darker colored shaly laminae is consistent with the very low measured TOC in this sample (0.23%). This interval offers little or no hydrocarbon source potential.

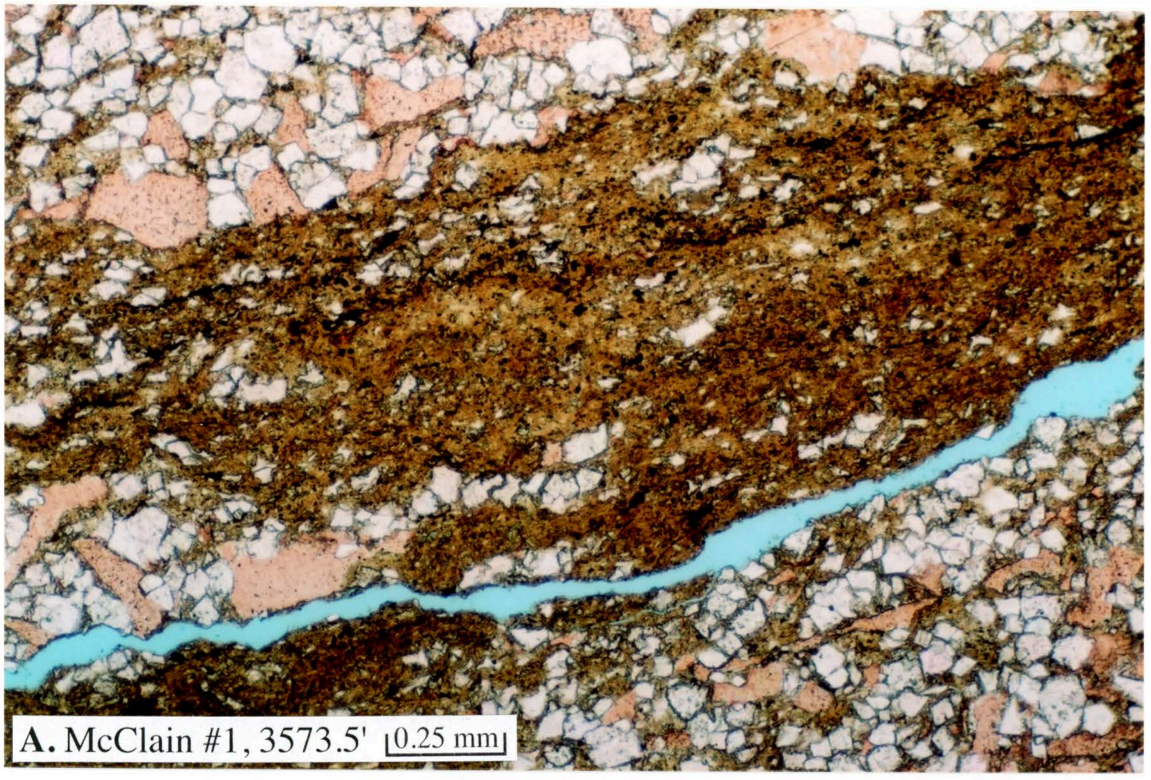
Plate 9. McClain #1, 3573.5 ft: Viola Limestone
Shaly Beds and Tabulate Coral in Dolomitic Limestone

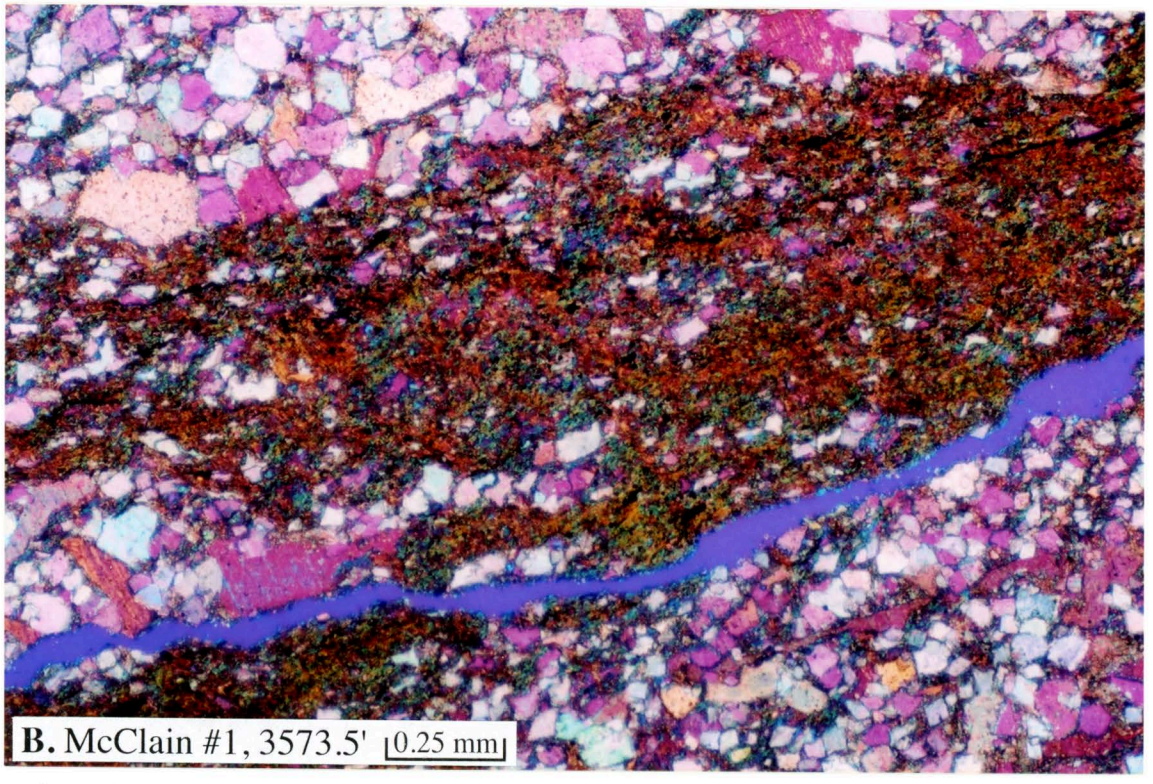




This is another sample selected for petrographic study because it contained both darker gray shaly layers that were thought to possibly have hydrocarbon source potential. However, the measured TOC content of this sample was just 0.42% with 1.5% S2 remaining generative potential. In thin section, these shaly beds are clearly not kerogenites, but instead are illitic shales with common dolomite crystals (e.g., Photo B). Capping one of the shaly beds is a tabulate coral as seen at the top of Photo A. Obviously, these shale beds offer little or no hydrocarbon source potential.

Plate 10. McClain #1, 3573.5 ft: Viola Limestone
More Photos of the Shaly Beds in a Crinoidal and Dolomitic Limestone





These photomicrographs show more of the same sample seen in Plate 9. Here the shaly bed has been tilted for the photos to show the second-order birefringence of the illite clays (best seen in Photo B taken with crossed polarized light and a gypsum filter). The host rock is a dolomitic crinoidal wackestone (visible at top of both photos). The shale beds have a medium-gray color in the core, but appear brownish with only traces of possible orgnic matter in the thin sections. The measured TOC content of this sample was just 0.42%.