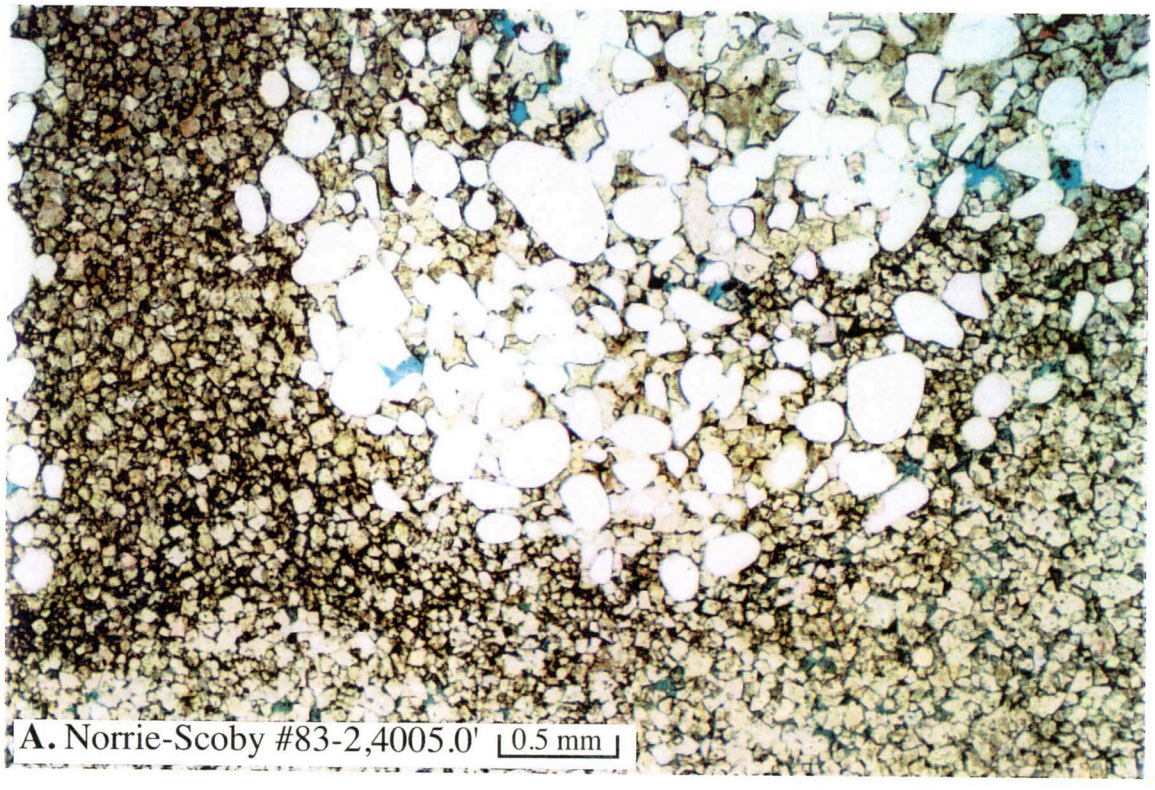
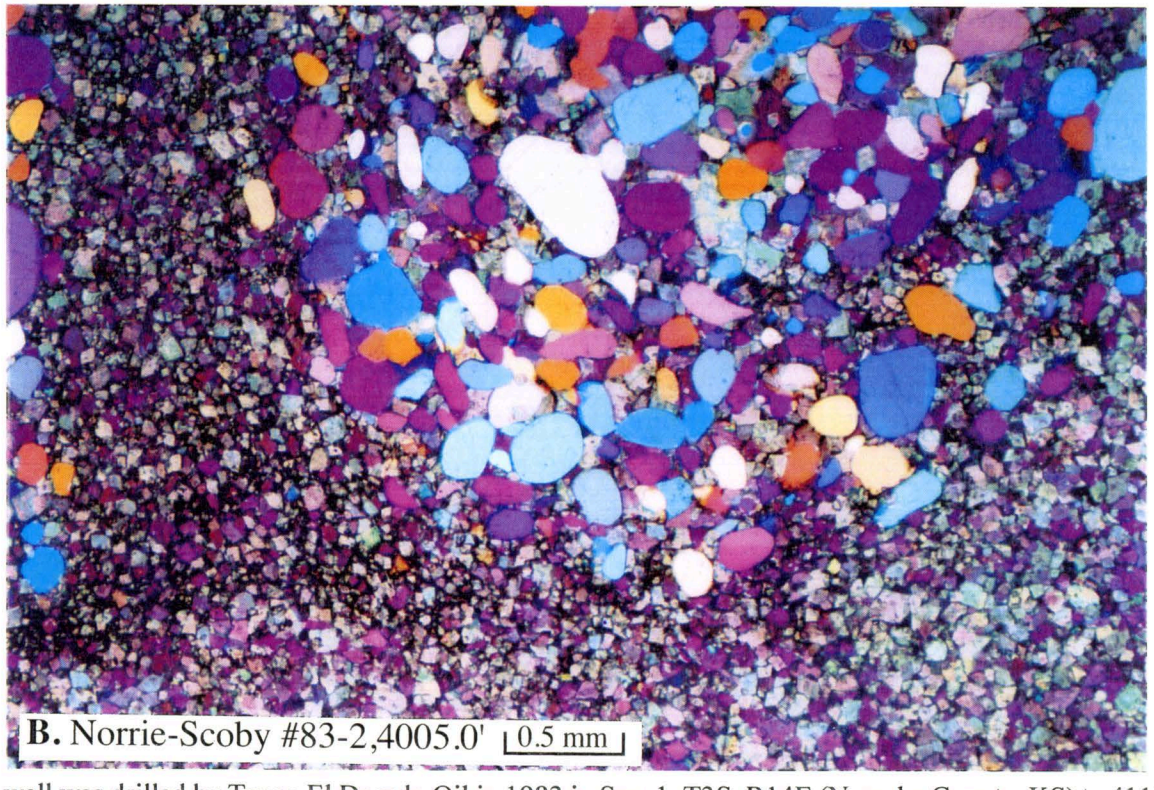
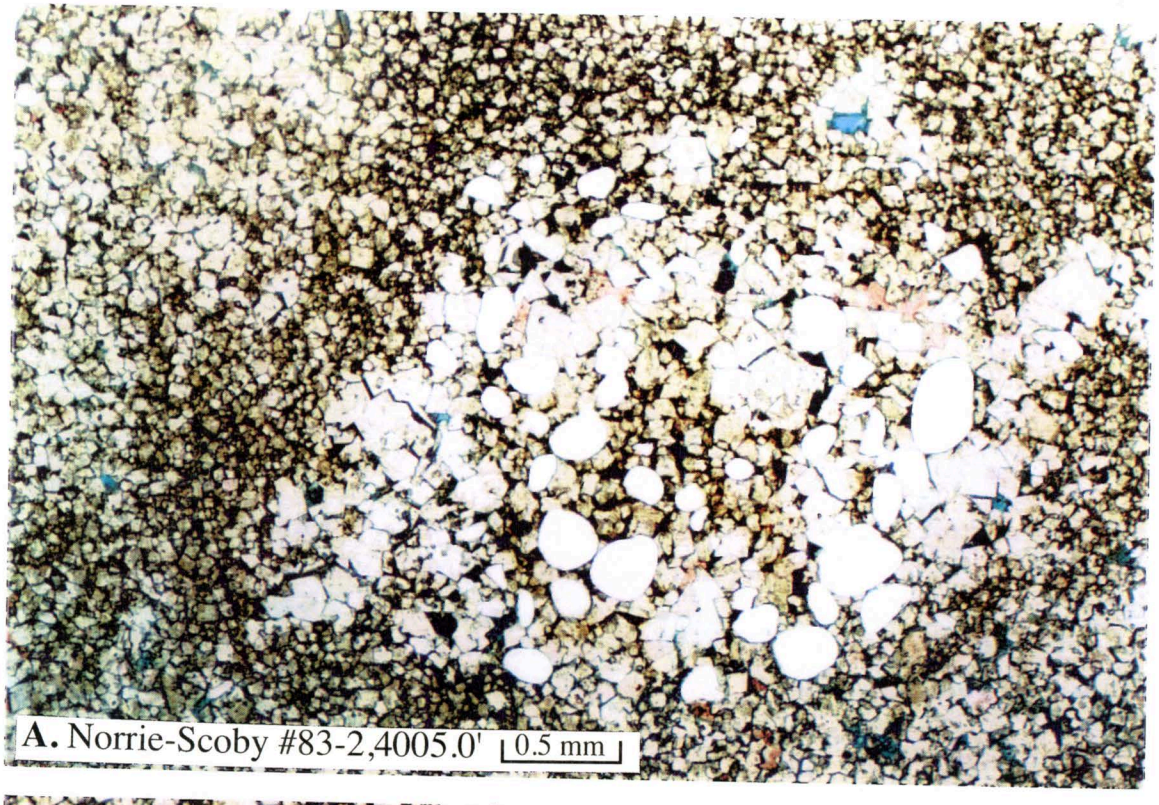
Plate 1. Norrie-Scoby #83-2, 4005.0 ft: Simpson Group Dolomite Quartz Sand in Burrow in Finely Crystalline Dolomite Mudstone

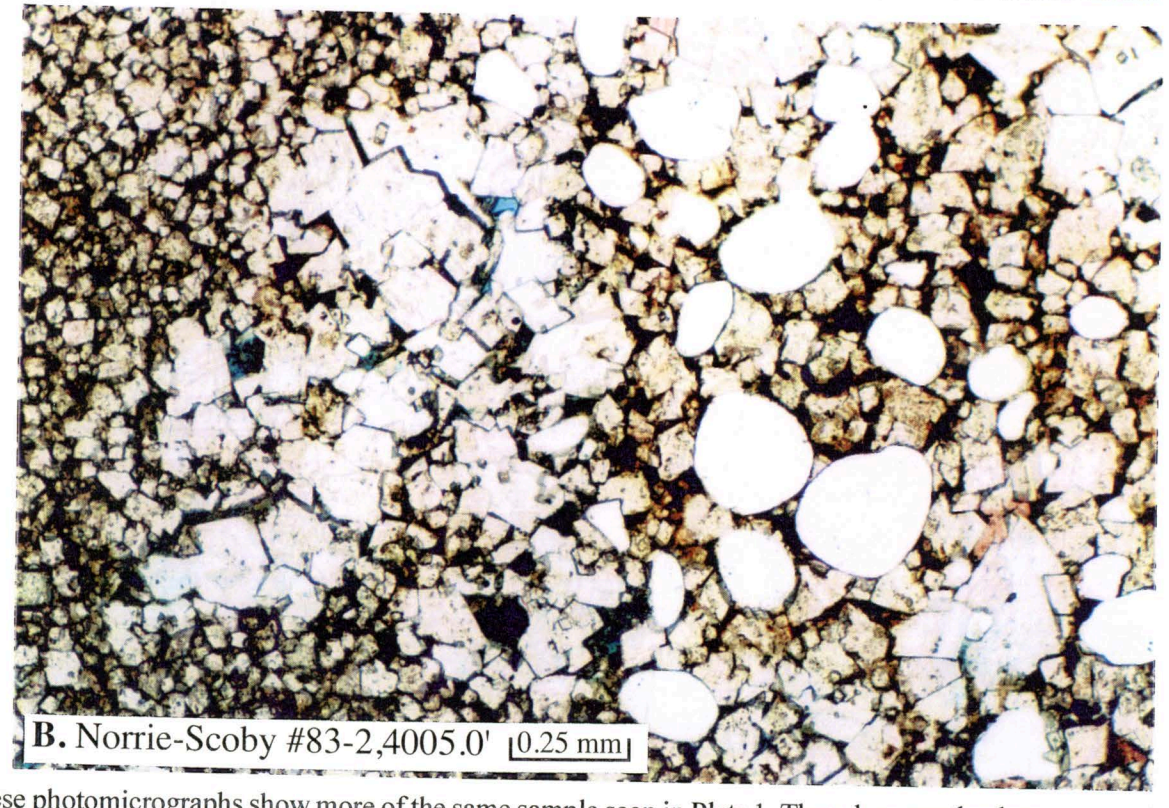




This well was drilled by Texas-El Dorado Oil in 1983 in Sec. 1, T3S, R14E (Nemaha County, KS) to 4110 ft in the Arbuckle Dolomite and P & A with no testing. A core was cut in the Simpson from 4005 to 4045 ft and consists of several lithologies including the burrowed dolomite mudstone shown here. These photomicrographs show a burrow containing superbly rounded quartz sand grains in a matrix of finely crystalline dolomite with traces of pinpoint porosity (e.g.,in the burrow fill in Photo A). The burrows have a typical "reburrowed burrow" fabric identical to what is seen locally in the Ordovician Red River Formation of Montana.

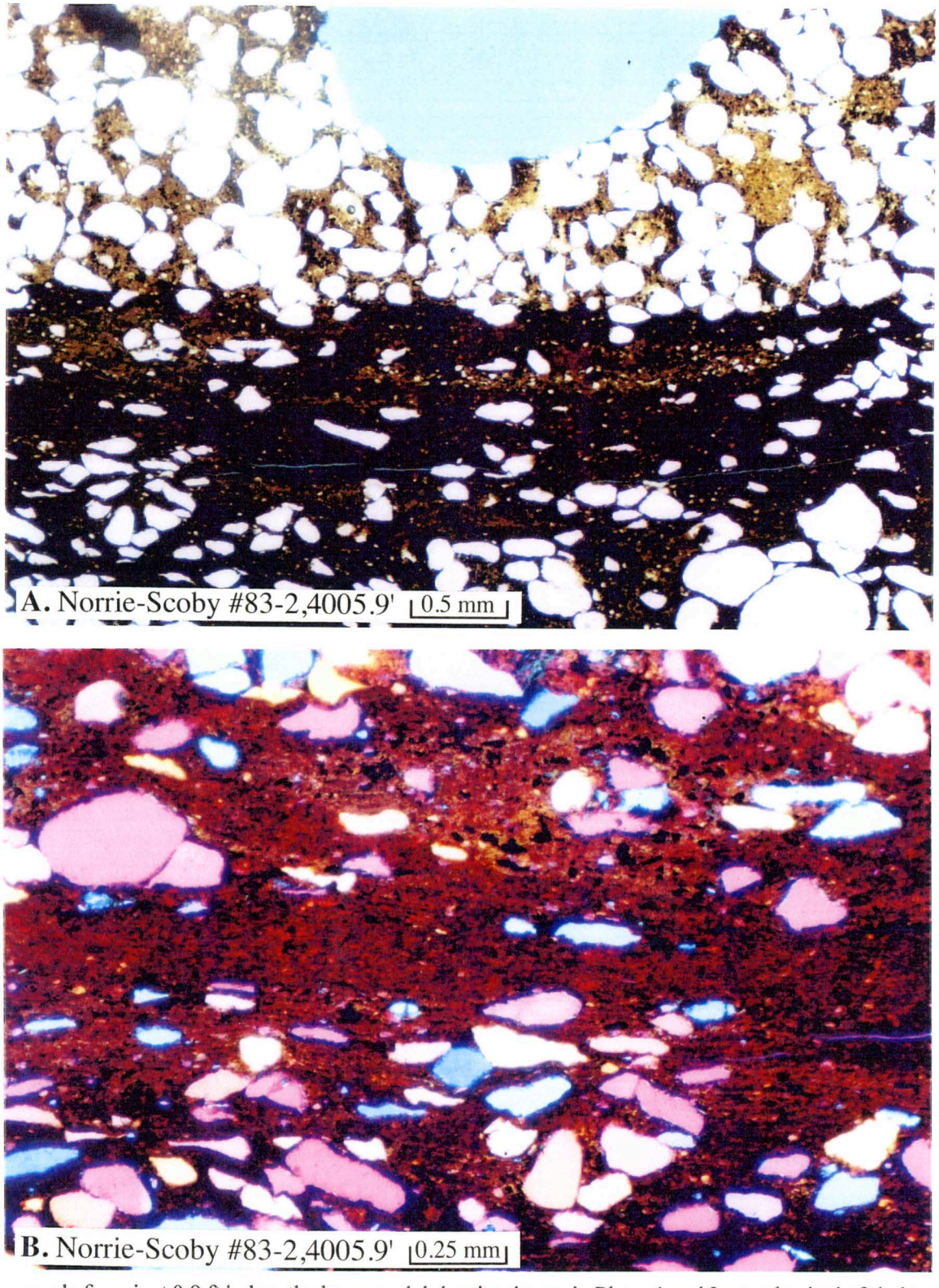
Plate 2. Norrie-Scoby #83-2, 4005.0 ft: Simpson Group Dolomite
Quartz Sand Grains in Burrow Fill in Finely Crystalline Dolomite w/Bitumen Stain





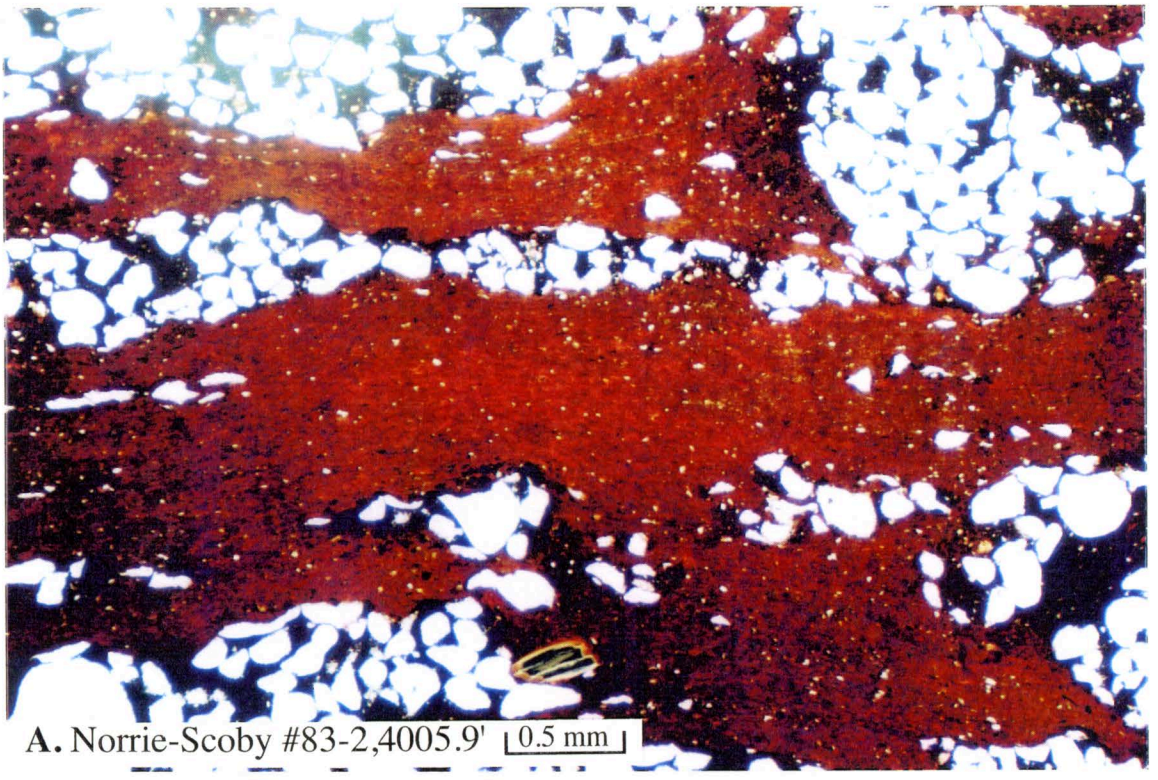
These photomicrographs show more of the same sample seen in Plate 1. They show another burrow containing sscattered superbly rounded quartz sand grains and minor calcite cement (stained pink) in a matrix of finely crystalline dolomite with some bitumen residue (dark brown) between the dolomite crystals. Also present are traces of pinpoint vuggy porosity (e.g., upper right, Photo A). Total visible porosity is less than 5% and reservoir potential appears poor.

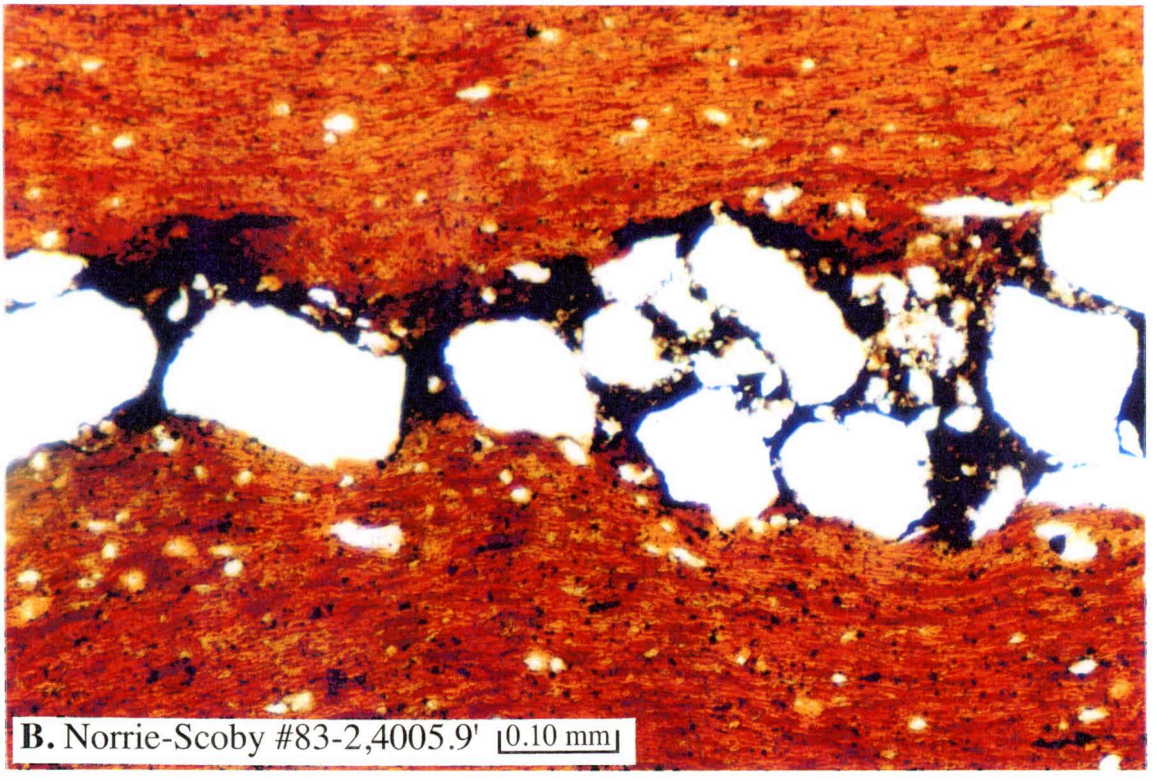
Plate 3. Norrie-Scoby #83-2, 4005.9 ft: Simpson Group Kerogenite
"Up" Notch in Shaly Sandstone on Sandy Organic-Rich Kerogenite Bed



This sample from just 0.9 ft below the burrowed dolomite shown in Plates 1 and 2 reveals a bed of shaly quartz sandstone (top Photo A, with the base of a notch cut in the thin-section stub to indicate "up") resting in sharp contact on a bed of kerogenite (originally kukersite) with scattered partly dissolved, flattened quartz sand grains. This sample had 9.8% TOC by weight and a Tmax of 447°C, but its S1 was just 1.96% with an S2 of 61.2% and an HI of 625. The S1, S2, and HI numbers indicate this kerogenite has just barely entered the oil generation window. It was probably the source of the minor bitumen seen in the sample from 4005.0 ft.

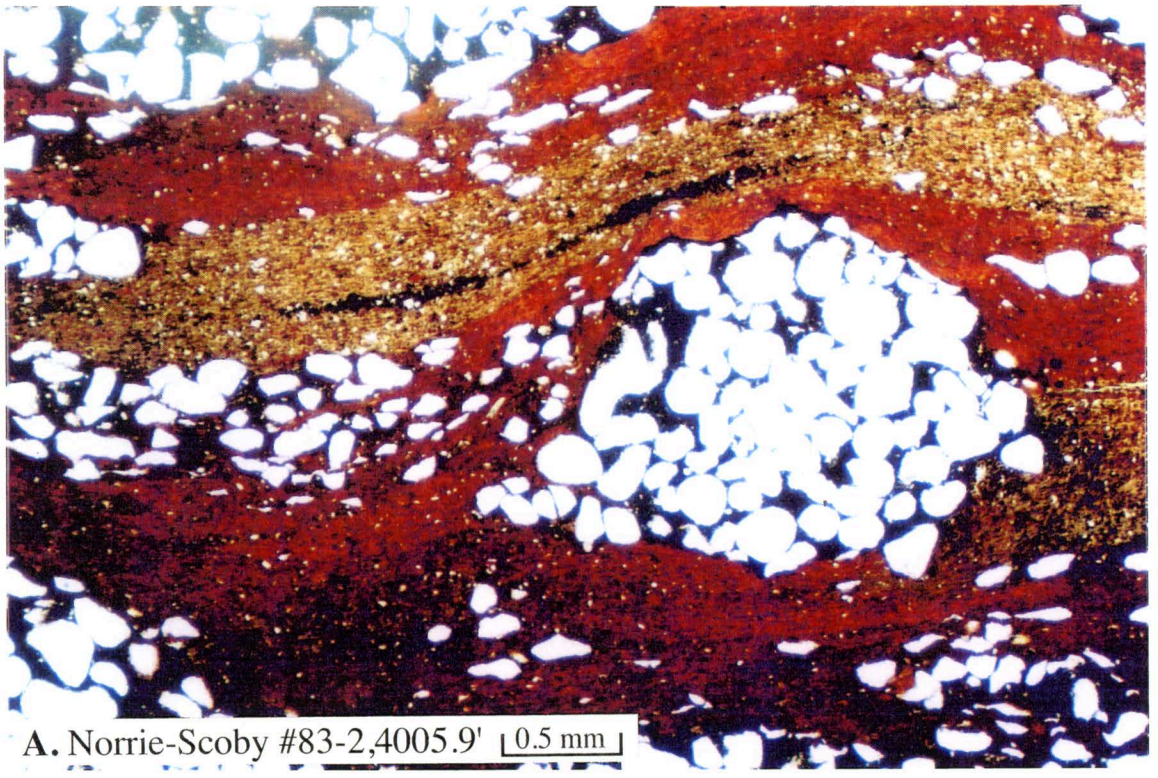
Plate 4. Norrie-Scoby #83-2, 4005.9 ft: Simpson Group Kerogenite Laminae of Quartz Sandstone between Dark "Honey-Brown" Kerogenite Beds

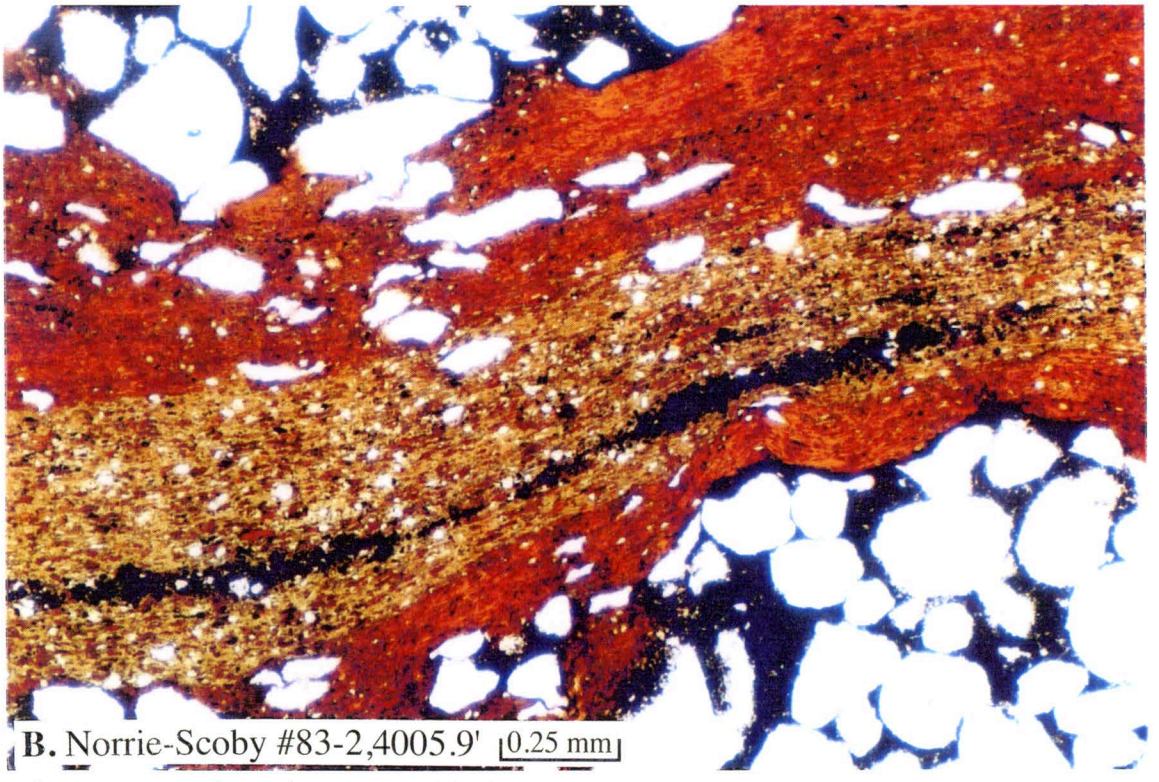




These photomicrographs show more of the kerogenite beds just 0.9 ft below the burrowed dolomite shown in Plates 1 and 2. Laminae of quartz sand grains separate distinct beds of kerogenite (originally kukersite) in which the flattened remains of *Gloeocapsamorpha prisca* cells are barely visible in Photo B. An abraded phosphatic fossil fragment is visible at the bottom center of Photo A. The brown color of the kerogenite beds and the flattened remains of *G. prisca* cells suggest that this sample is at best just entering the oil generation window. After true thermal maturation, all visible evidence of *G. prisca* would disappear into blackness.

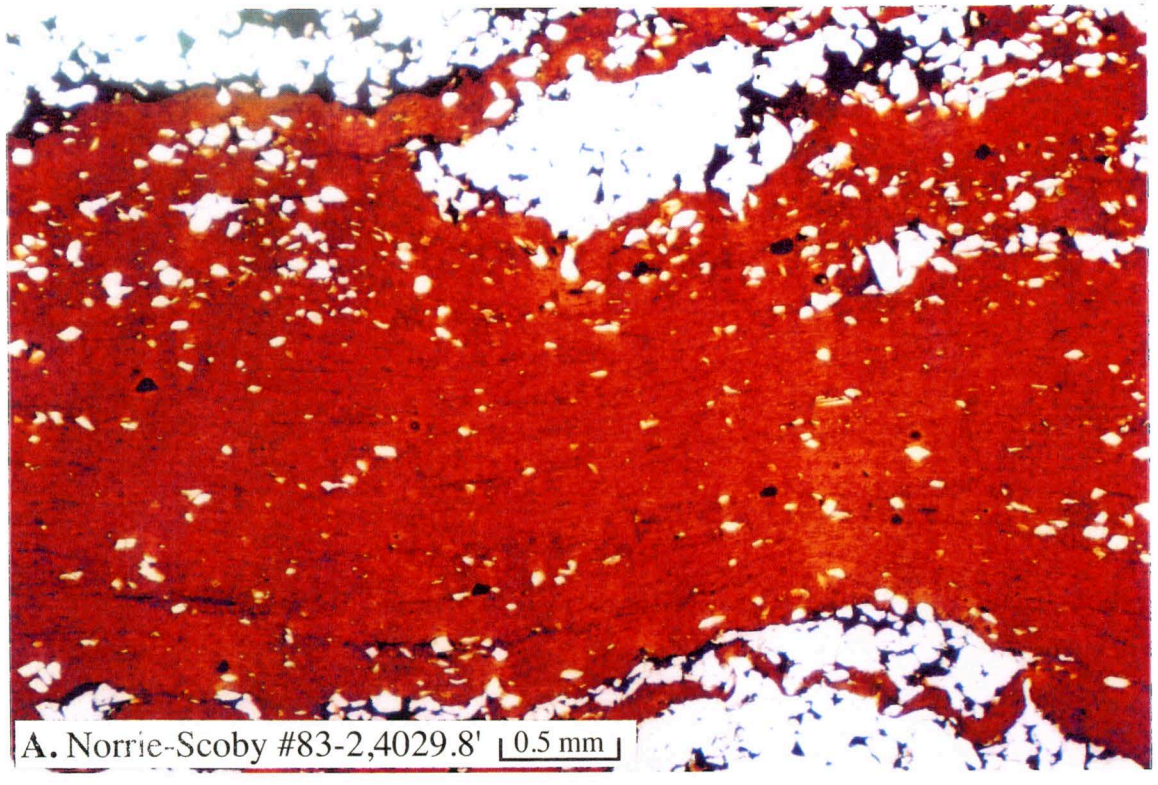
Plate 5. Norrie-Scoby #83-2, 4005.9 ft: Simpson Group Kerogenite Shale Laminae and Quartz Sand in Burrow between Brown Kerogenite Beds

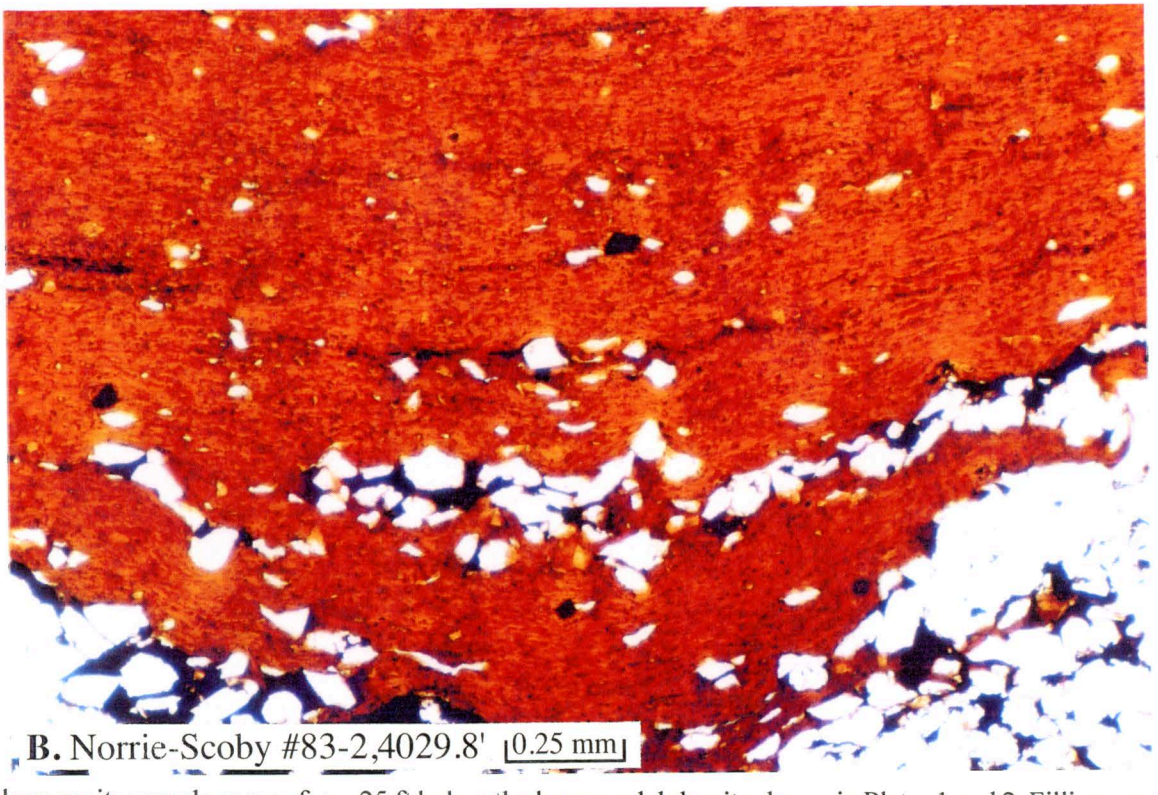




Shown here are more photomicrographs of the kerogenite beds just 0.9 ft below the burrowed dolomite shown in Plates 1 and 2. At right center is a burrow filled with quartz sand within a bed of kerogenite that is overlain by a layer of shale (dark tan) with a very thin pyrite stringer (black) beneath another kerogenite bed with flattened (partly dissolved) quartz grains. Remains of *Gloeocapsamorpha prisca* cells are visible in Photo B, which shows the shaly bed running through the center of the photo. The dark reddish-brown color of the kerogenite beds and the flattened *G. prisca* cells indicate these beds had just entered the oil window.

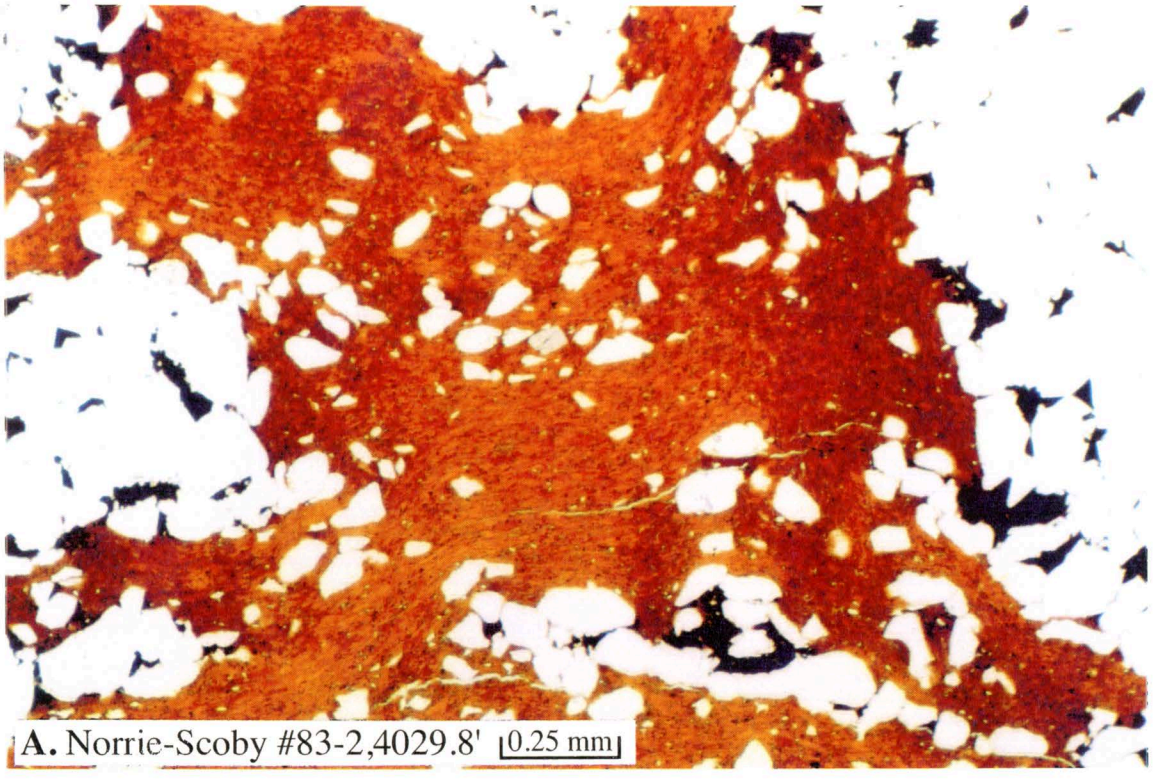
Plate 6. Norrie-Scoby #83-2, 4029.8 ft: Simpson Group Kerogenite Quartz Sand in Burrows near a Thick Reddish-Brown Kerogenite Bed

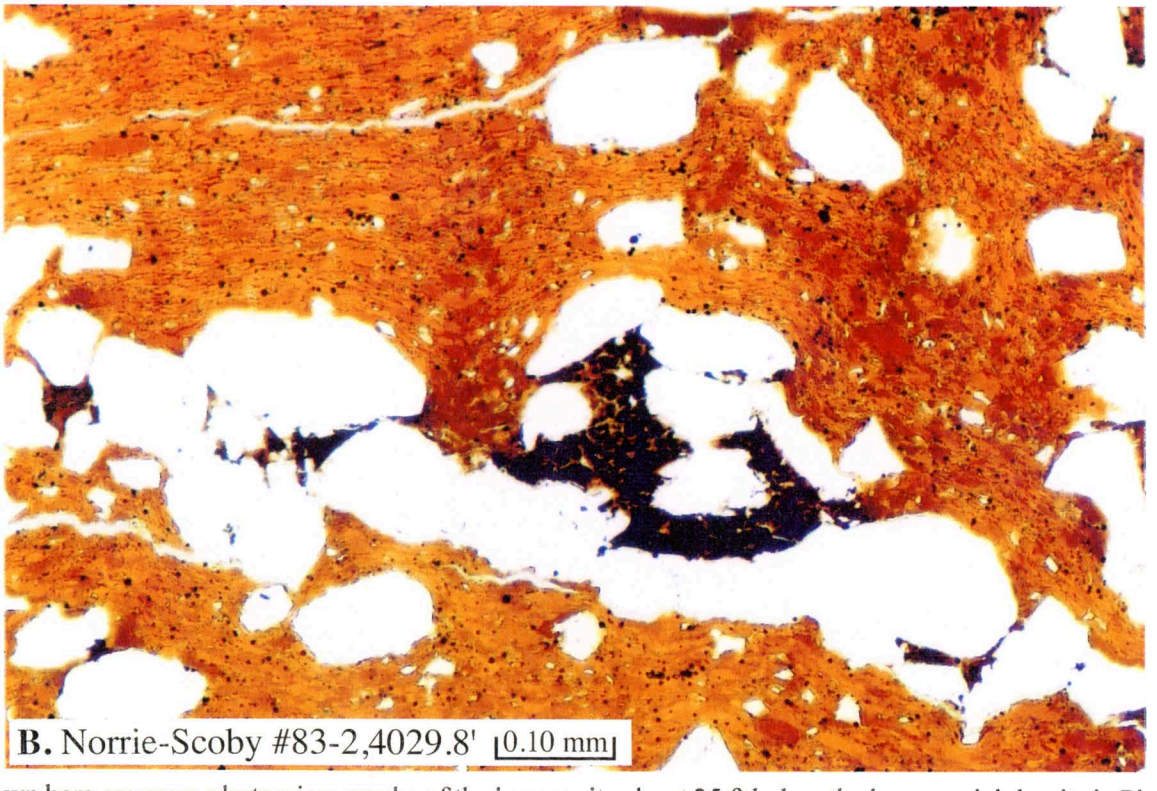




This kerogenite sample comes from 25 ft below the burrowed dolomite shown in Plates 1 and 2. Filling most of Photo A is a relatively thick bed of kerogenite (originally kukersite) with scattered partly dissolved quartz silt grains. Near the base and top of Photo A, small burrows filled with quartz sand grains are visible. This sample had 5.5% TOC by weight and a Tmax of 447°C, but its S1 was just 1.3% with an S2 of 39.3% and an HI of 722. The reddish-brown color combined with the S1, S2, and HI numbers indicate that this kerogenite has just barely entered the oil generation window.

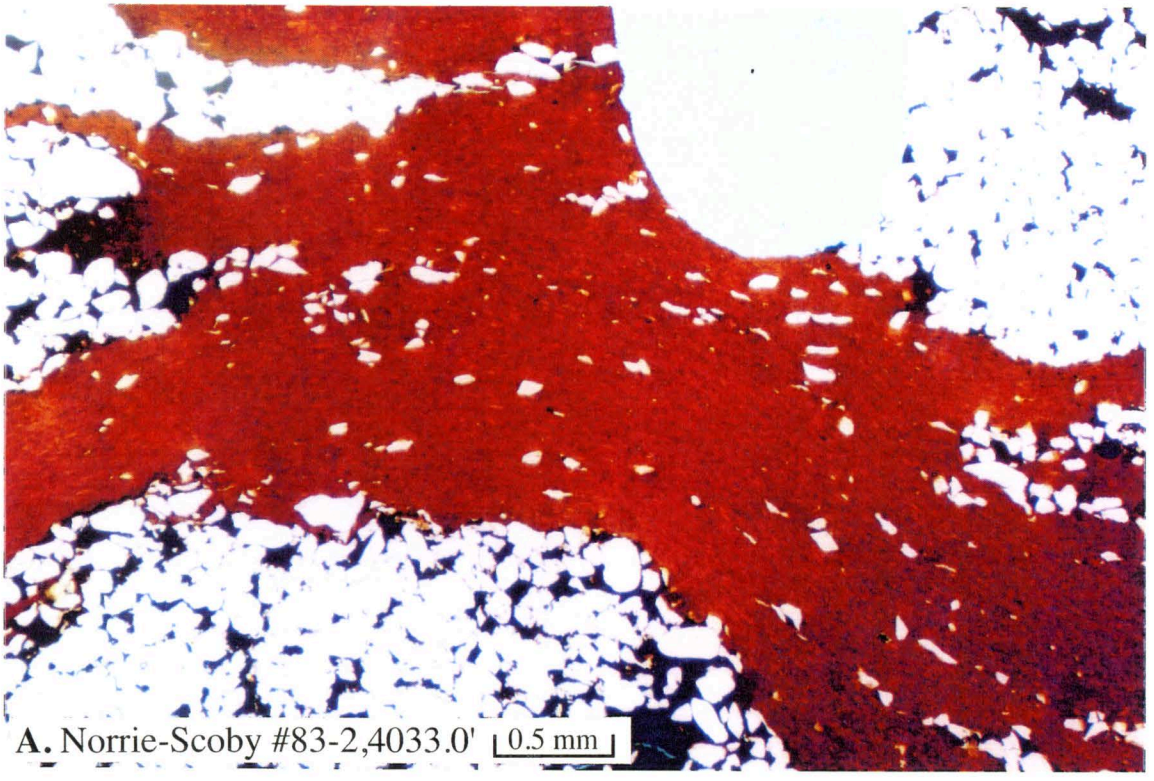
Plate 7. Norrie-Scoby #83-2, 4029.8 ft: Simpson Group Kerogenite Quartz Sand Grains and Sand in Burrows in Reddish-Brown Kerogenite Bed

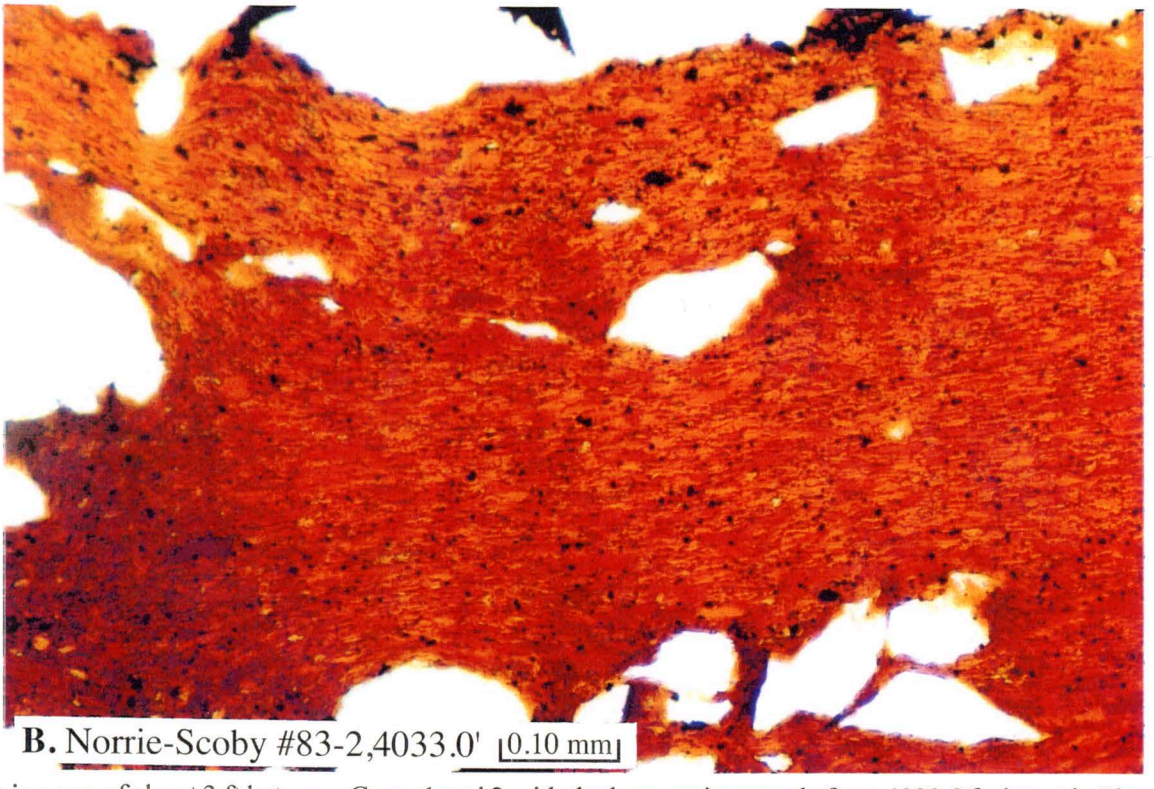




Shown here are more photomicrographs of the kerogenite about 25 ft below the burrowed dolomite in Plates 1 and 2. At far left and right in Photo A are burrows filled with quartz sand within a bed of reddish-brown kerogenite. Ghosts of what were originally round *Gloeocapsamorpha prisca* cells are visible in both photos although they are very much compressed. The quartz grains in the kerogenite also show evidence of dissolution, presumably in organic acids generated in the kerogenite. The nearly black material visible in both photos is interpreted as bitumen residue.

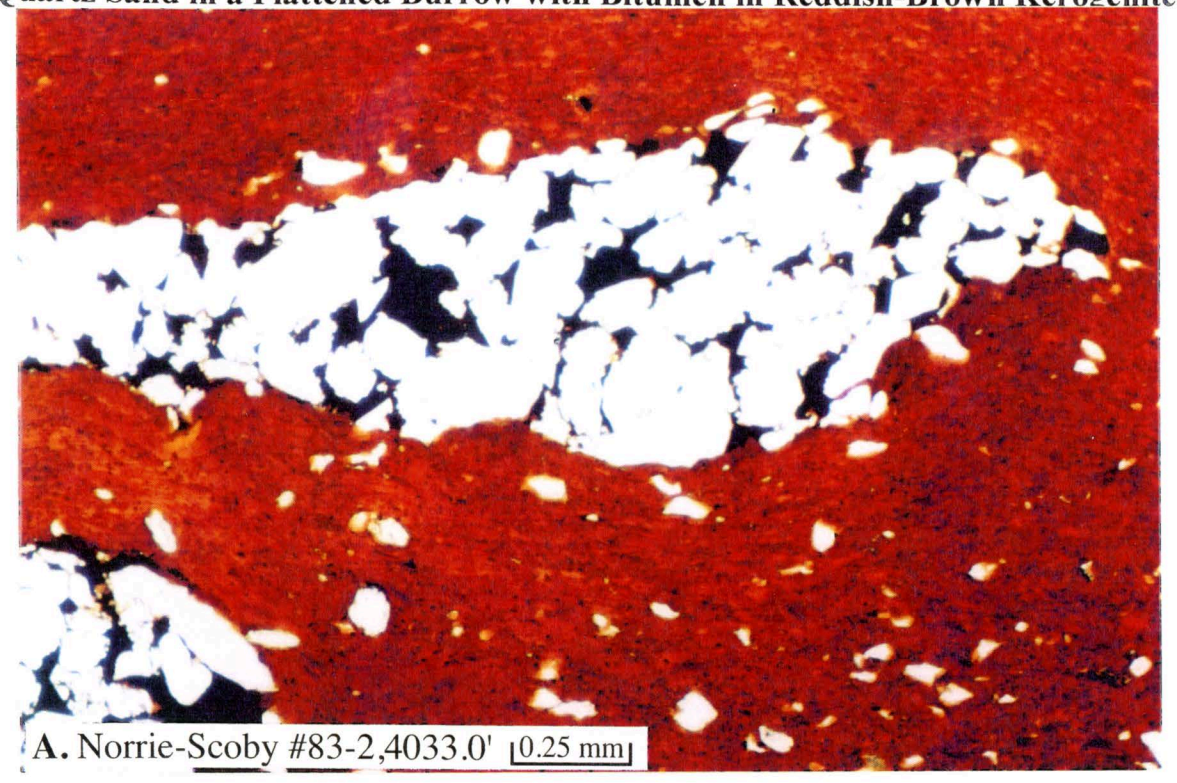
Plate 8. Norrie-Scoby #83-2, 4033.0 ft: Simpson Group Kerogenite
Quartz Sand in Burrows and "Up" Notch in Reddish-Brown Kerogenite

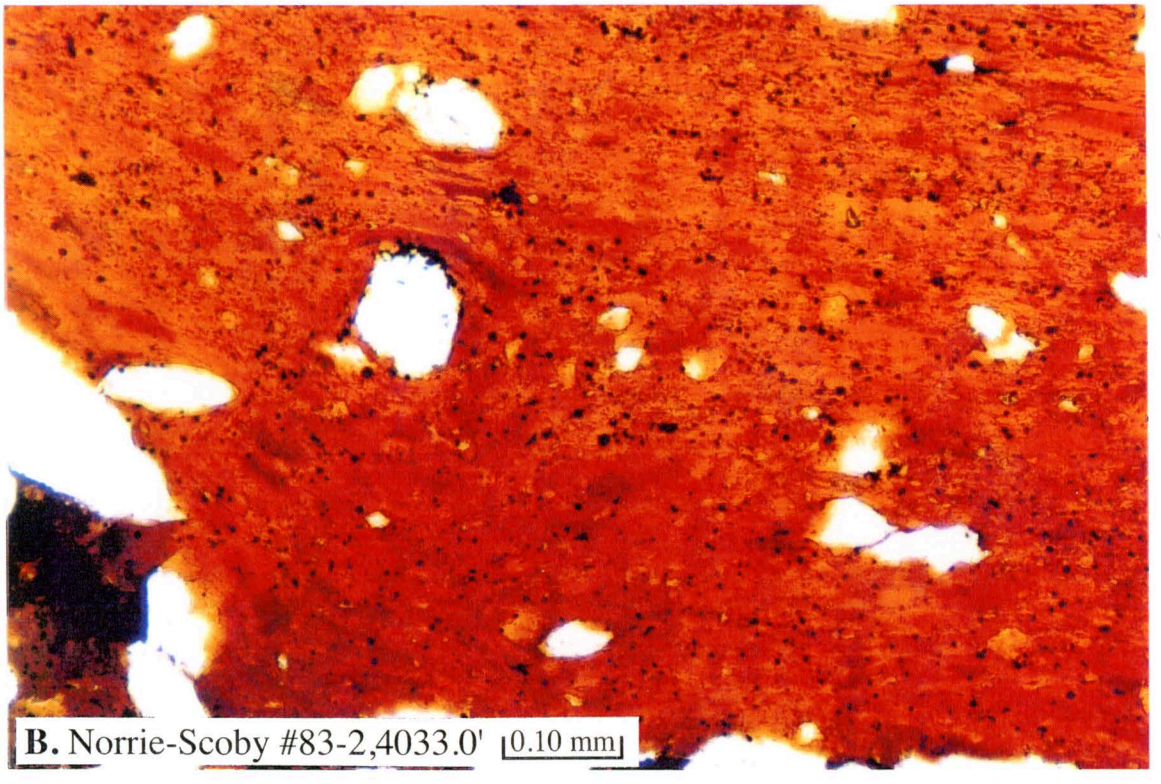




There is a gap of about 3 ft between Cores 1 and 2 with the kerogenite sample from 4029.8 ft shown in Plates 6 and 7 representing the base of Core #1 and this sample from 4033 ft representing the top of Core #2. It is not clear if the whole interval between these two cores consists of kerogenites, but it seems likely. Shown in Photo A are burrows filled with quartz sand in a relatively thick bed of kerogenite (originally kukersite) with scattered partly dissolved quartz silt grains. Hints of the original G. prisca cells, now strongly flattened, are visible in Photo B. This sample had 6.5% TOC by weight with an S1 of 1.4%, an S2 of 47.4% and an HI of 729.

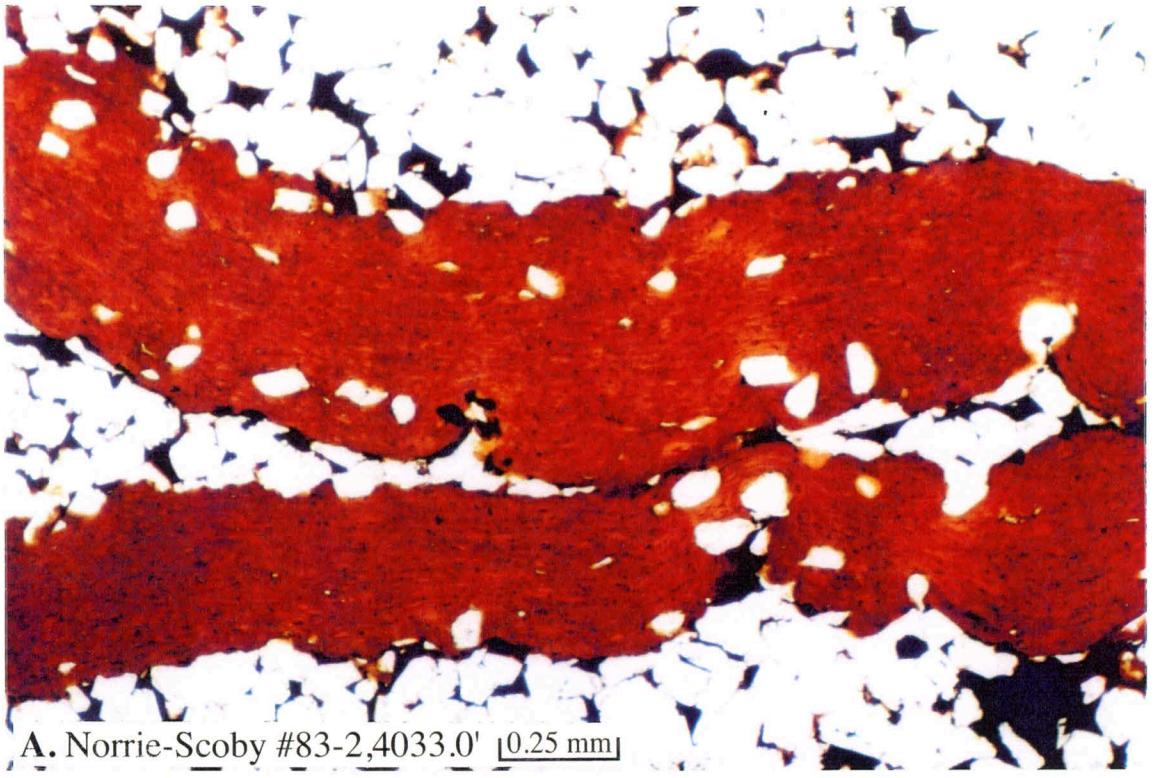
Plate 9. Norrie-Scoby #83-2, 4033.0 ft: Simpson Group Kerogenite
Quartz Sand in a Flattened Burrow with Bitumen in Reddish-Brown Kerogenite

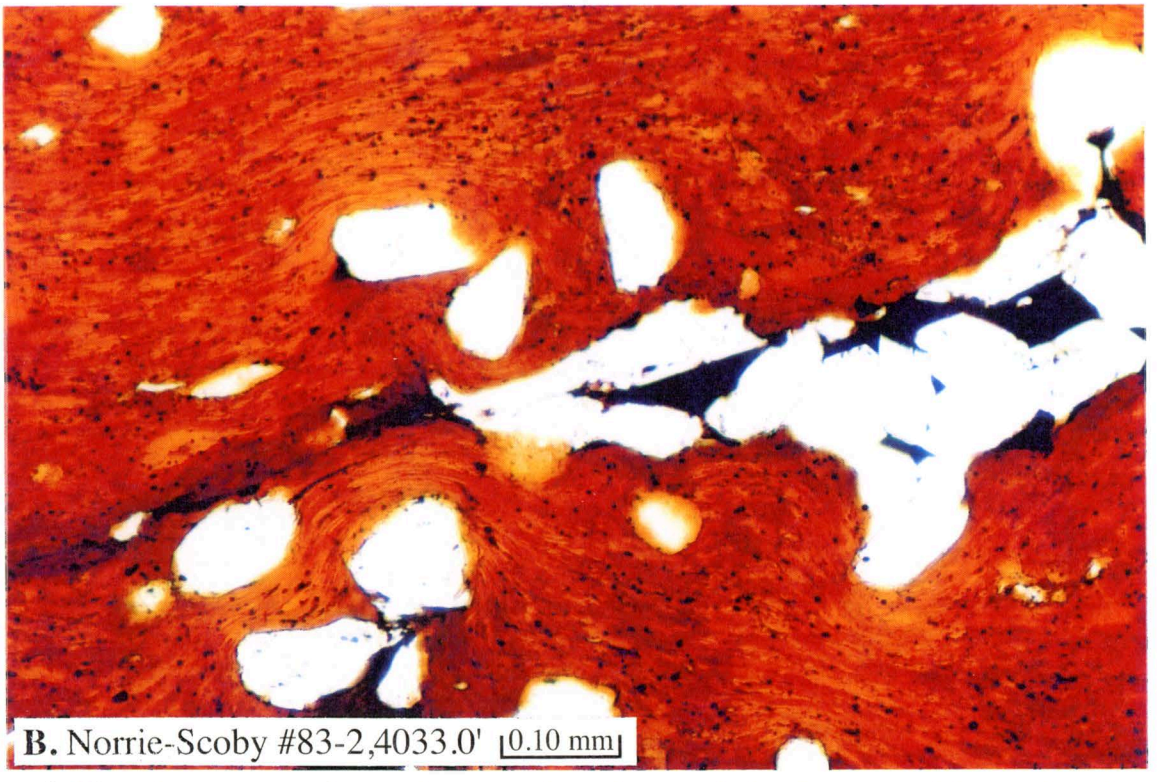




Shown here are more photomicrographs of the same kerogenite seen in Plate 8. A flattened burrow filled with quartz sand is visible in Photo A and scattered partly dissolved sand grains are visible in the reddish-brown kerogenite in Photo B. Ghosts of now flattened (but originally round) *Gloeocapsamorpha prisca* cells are visible in both photos. The nearly black material between the quartz sand grains in the burrow in Photo A is interpreted to be bitumen residue.

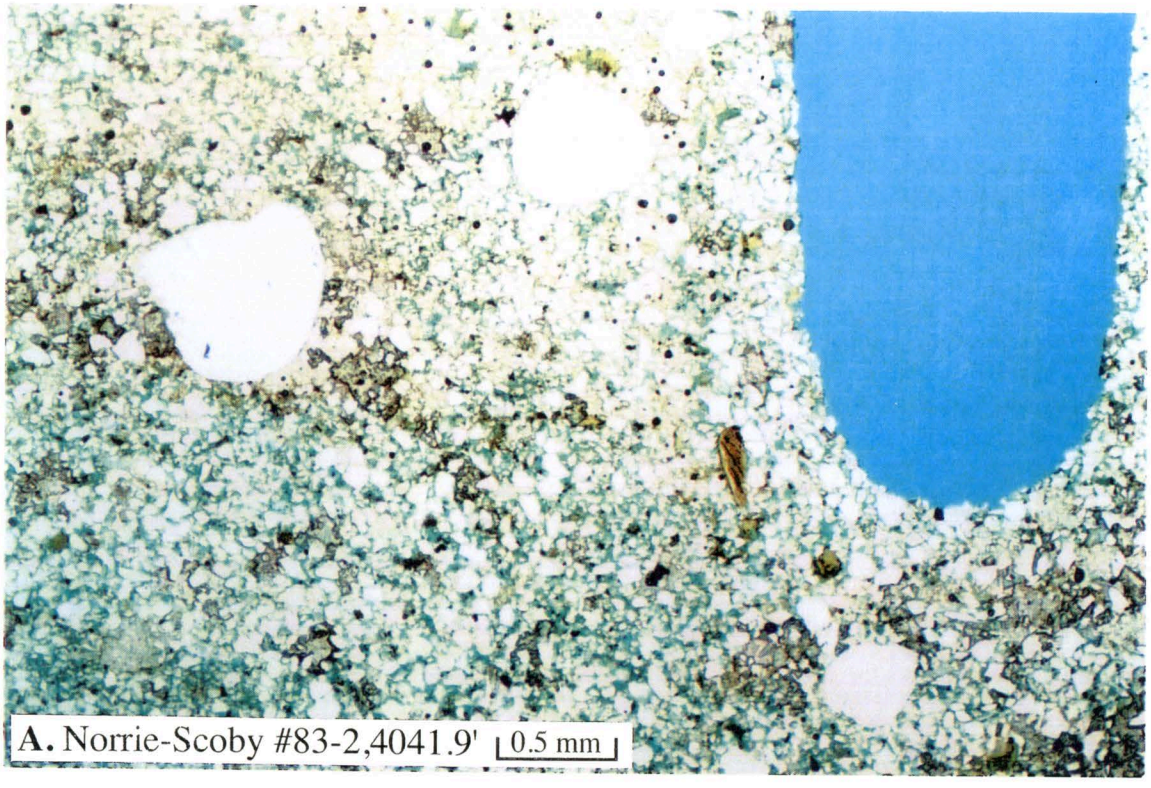
Plate 10. Norrie-Scoby #83-2, 4033.0 ft: Simpson Group Kerogenite
Two Thin Beds of Reddish-Brown Kerogenite Separated by Quartz Sand Laminae

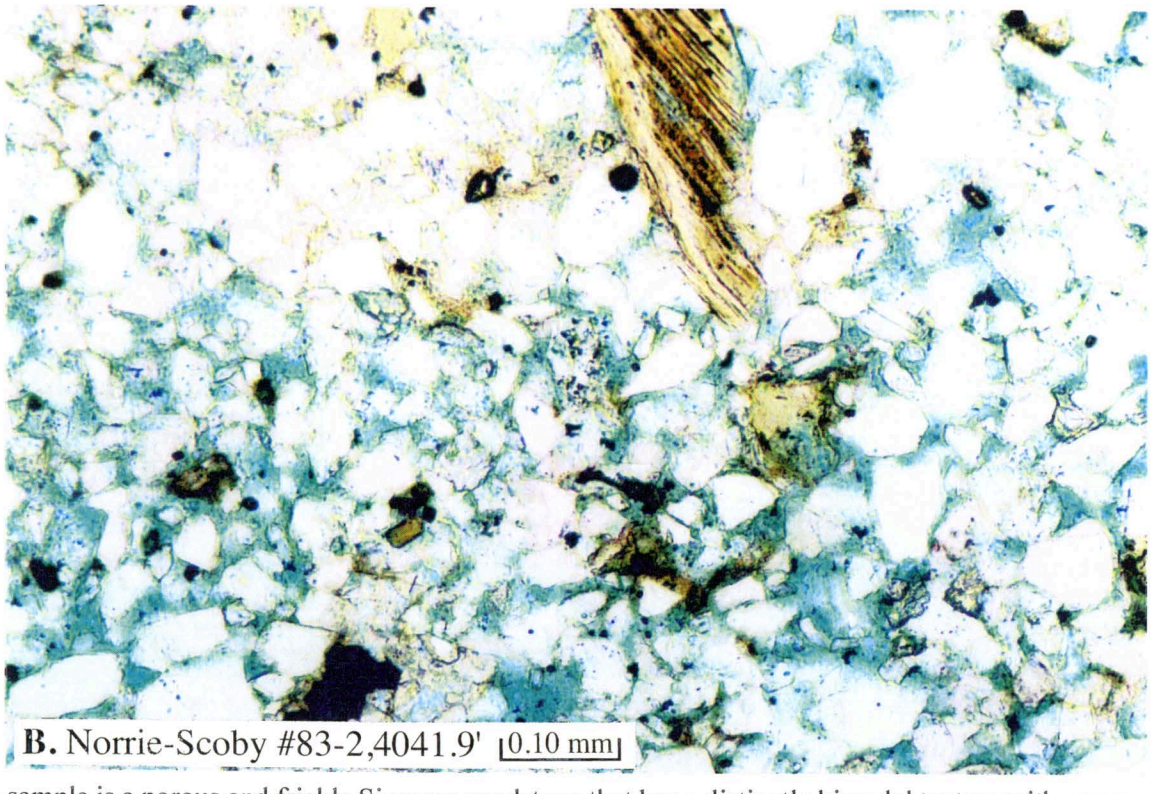




Shown in Photo A are two thin beds of kerogenite lying between beds of quartz sand. Nearly black bitumen residue occurs locally between the quartz sand grains. Compaction of what were originally round cells of *G. prisca* around quartz sand grains is visible in Photo B. The reddish-brown color of the kerogenites indicates that they have just barely entered the oil generation window to form the black bitumen residue visible in both photos. Apparently the amount of oil generated by these kerogenite beds was insufficient to make this well a producer and it was plugged and abandoned as a dry hole shortly after it was drilled in 1983.

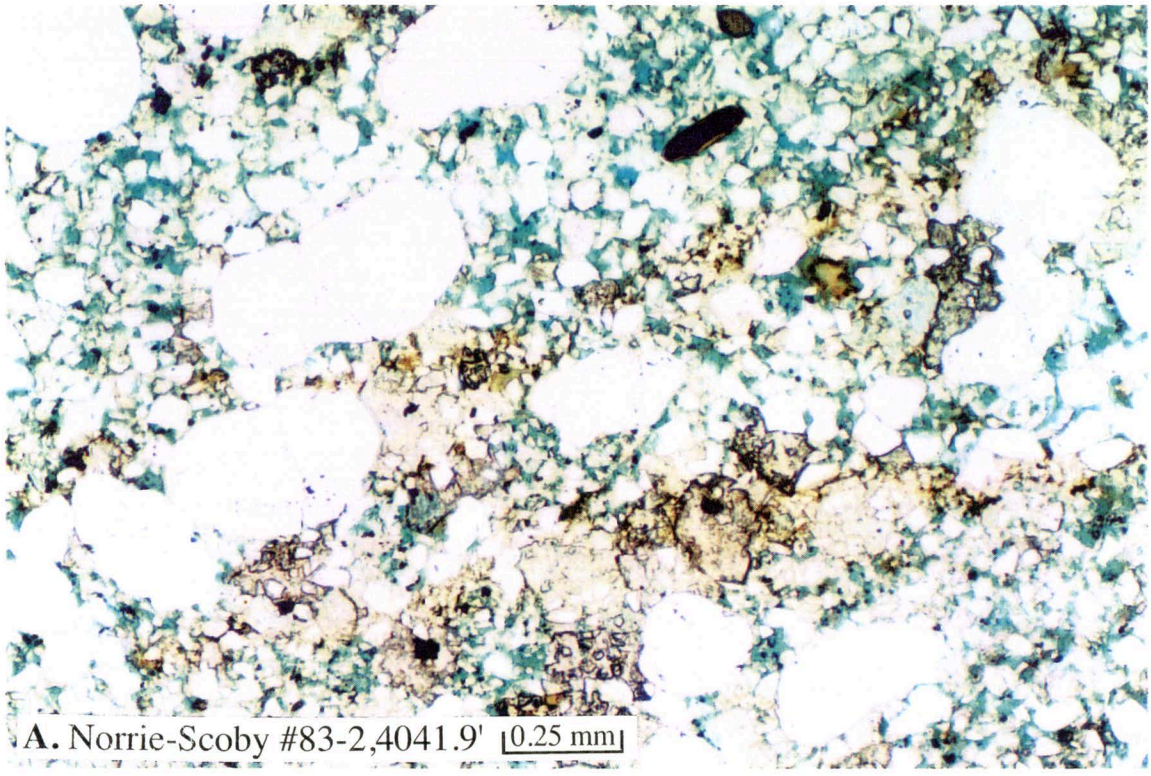
Plate 11. Norrie-Scoby #83-2, 4041.9 ft: Simpson Group Sandstone
Porous Bimodal Quartz Sandstone with "Up" Notch and Phosphatic Fossil Debris

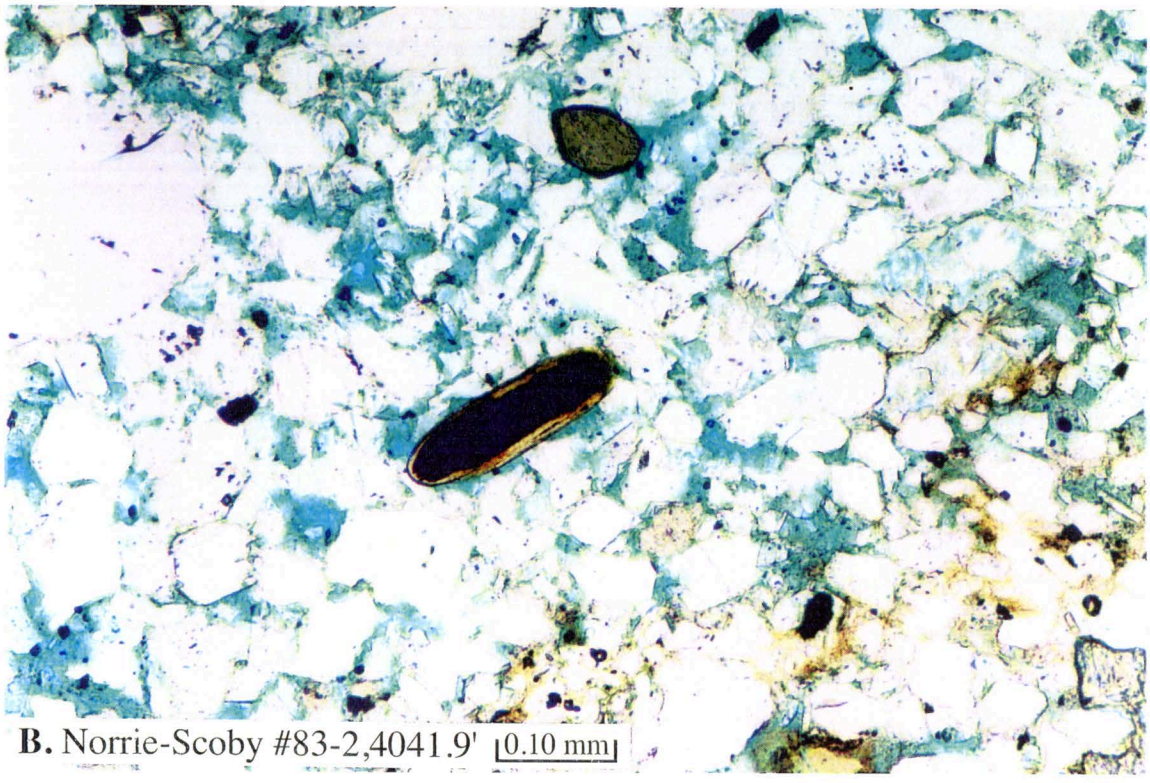




This sample is a porous and friable Simpson sandstone that has a distinctly bimodal texture with coarse sand grains more than half a millimeter is size in a matrix of quartz silt less than 0.05 mm in diameter. A notch cut in the sample to indicate "up" is visible in Photo A, and a phosphatic fossil fragment (tan) is visible in both photos. The pale blue epoxy between the silt grains in Photo A appears to contain common chlorite cement that is nearly isotropic. This sandstone was nearly white with no evidence of any oil stain despite >15% porosity.

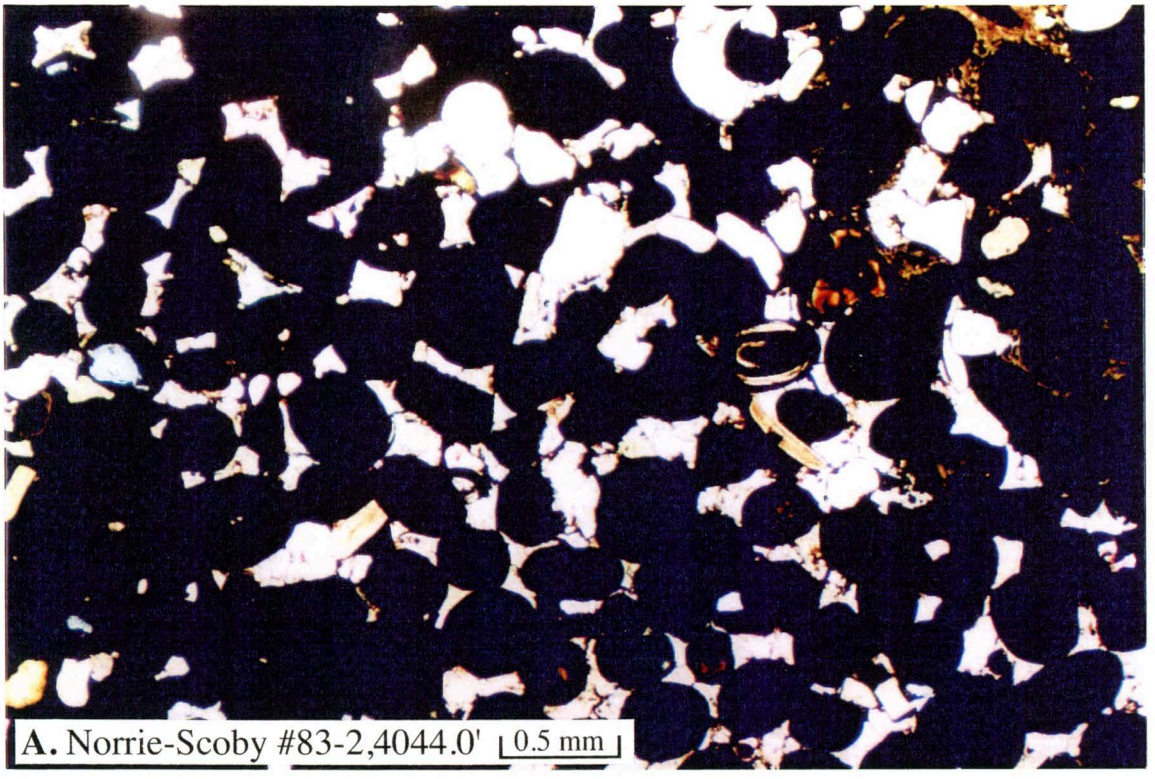
Plate 12. Norrie-Scoby #83-2, 4041.9 ft: Simpson Group Sandstone
Porous Bimodal Quartz Sandstone w/Phosphatic Fossil Debris & Chlorite Cement

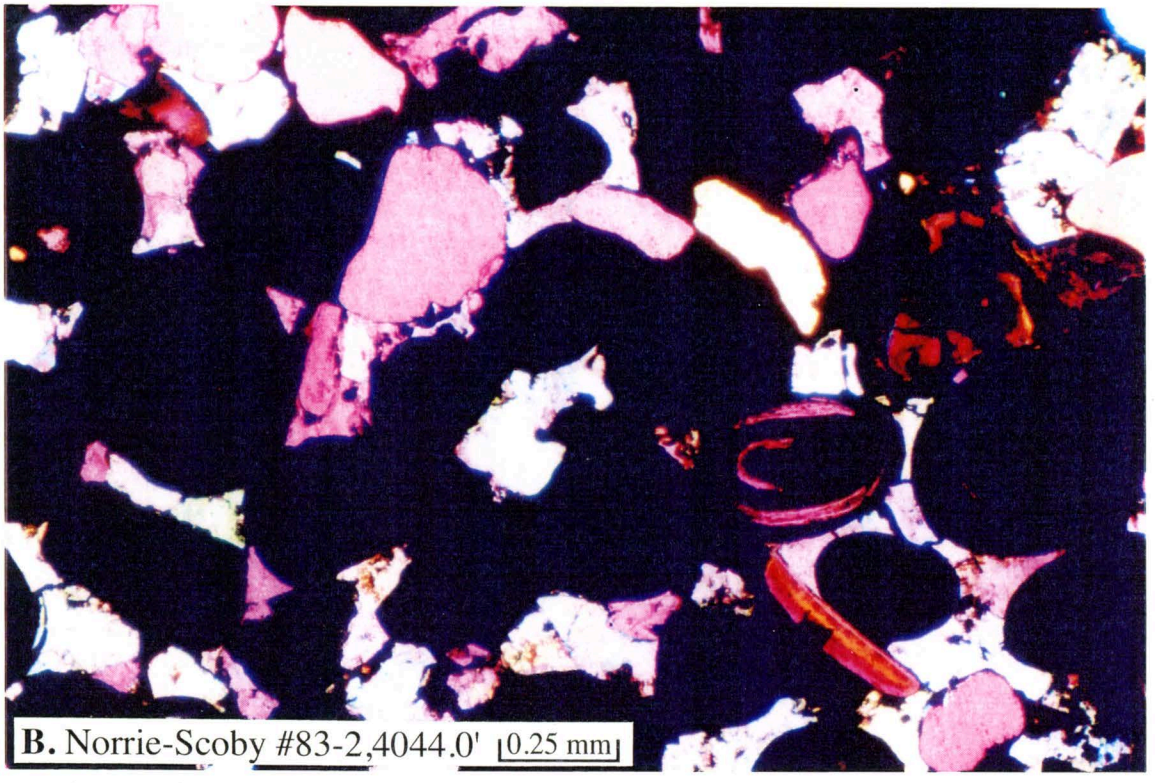




These photomicrographs show more of the same porous and friable Simpson sandstone seen in Plate 11. The distinctly bimodal texture is clearly seen in Photo A whereas the common intergranular porosity is best seen in Photo B. A brown phosphatic fossil fragment is visible near the center of Photo B along with a grain of green tourmaline at top center of Photo B. The blue epoxy between the silt and very fine sand grains in Photo B appears to contain common chlorite cement that is nearly isotropic. This sandstone had no evidence of oil stain.

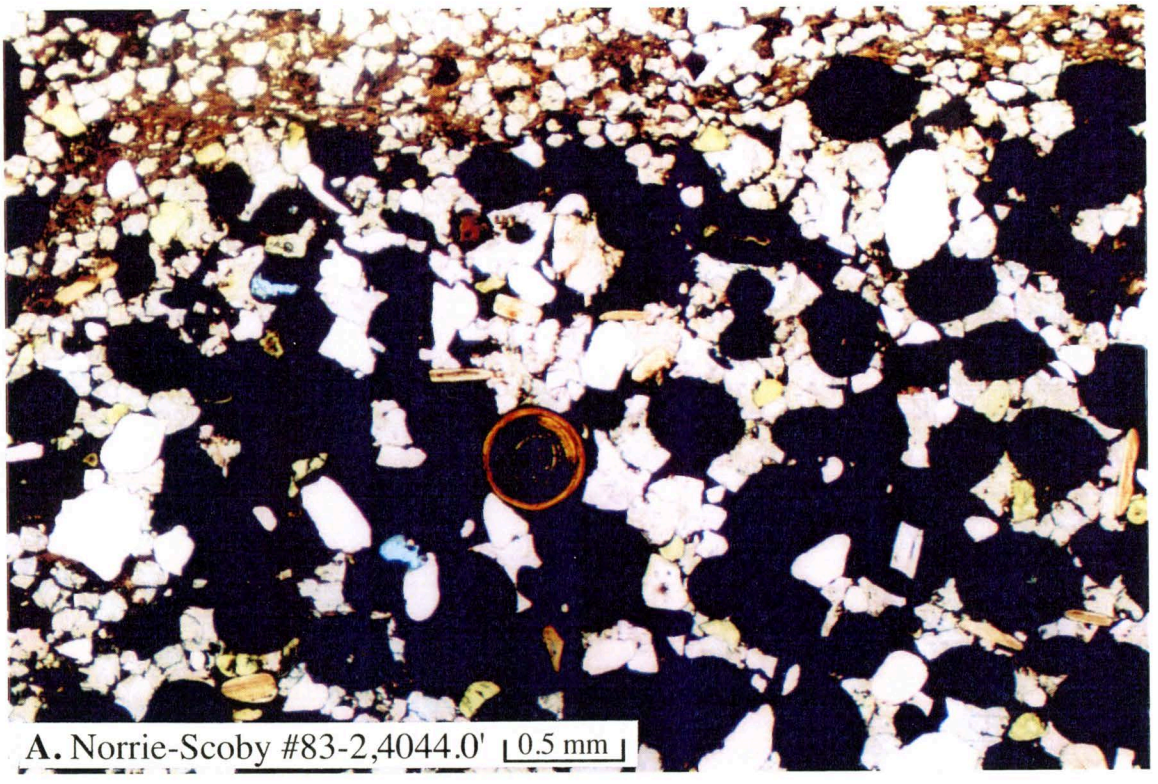
Plate 13. Norrie-Scoby #83-2, 4044.0 ft: Simpson Group "Ironstone"
Iron-Rich Hematitic Ooids with Phosphatic Debris and Dolomite Cement



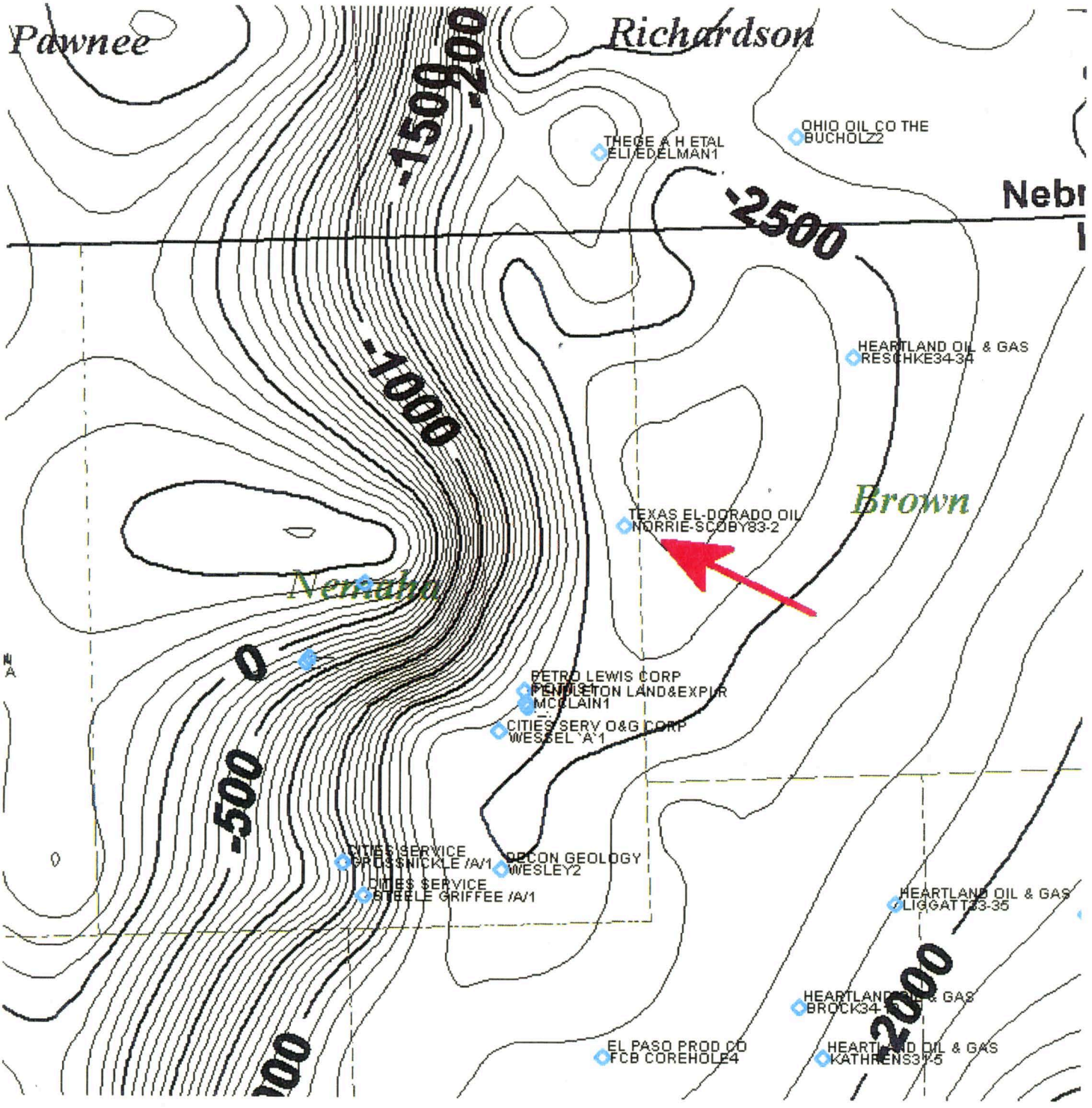


This sample was selected for petrographic study because it comes from a very heavy (dense) reddish-brown bed of ironstone a few feet thick with a distinctive log signature. The thinsection reveals that the rock is an oolitic ironstone with dolomite cement between the grains. Scattered grains of quartz sand and phosphatic fossil fragments are also present. The ooids are well sorted and appear to have formed as hematite.

Plate 14. Norrie-Scoby #83-2, 4044.0 ft: Simpson Group "Ironstone"
Iron-Rich Hematitic Ooids with Phosphatic Debris, Glauconite, & Dolomite Cement



These photomicrographs show more of the same sample seen in Plate 13. An ooid with brown phosphatic bands is visible at lower left in Photo B (and near the center of Photo A), and the sample also contains scattered grains of yellowish glauconite (visible near the center of Photo B). A slightly shaly bed of siltstone is visible at the top of Photo A. Neither photo shows any significant visible porosity.



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QEP RESOURCES

STRATOCHEM SERVICES

TOTAL ORGANIC CARBON and ROCK-EVAL PYROLYSIS

Company: QEP **Project #: 14EG0285**

Well Name	Lab ID	Sample Type	Depth	Prep	TOC Wt. %	S1 mg/g	S2 mg/g	S3 mg/g	Tmax	HI	OI	S1/ TOC	PI	Formation	Description
WESSEL "A"#1	QEEG000121	CORE	3480.5 FT	NOPR	0.56	0.09	1.27	0.32	437	226	57	16	0.07	Maquoketa Sh.	Maquoketa Sh.
WESSEL "A"#1	QEEG000122	CORE	3484.1 FT	NOPR	0.50	0.14	1.13	0.31	438	226	62	28	0.11	Maquoketa Sh.	Maquoketa Sh.
WESSEL "A"#1	QEEG000118	CORE	3685.5 FT	NOPR	1.05	0.16	3.96	0.41	442	377	39	15	0.04	Black Simpson Shale	Black Simpson Sh.
WESSEL "A"#1	QEEG000119	CORE	3690.0 FT	NOPR	0.41	0.05	0.88	0.30	436	214	73	12	0.05	Fissile Gray Simpson Sh.	Simpson Gray Shale
WESSEL "A"#1	QEEG000120	CORE	3713.6 FT	NOPR	0.26	0.10	0.39	0.29	437	152	113	39	0.20	Gray Simpson Sh in LS	Simpson Gray Shale
MCCLAIN#1	QEEG000123	CORE	3561.2 FT	NOPR	0.22	0.08	0.45	0.35	437	209	163	37	0.15	VIOLA GY SHALE	VIOLA GY SHALE
MCCLAIN#1	QEEG000124	CORE	3568.9 FT	NOPR	0.23	0.09	0.52	0.33	436	228	145	39	0.15	VIOLA GY SHALE	VIOLA GY SHALE
MCCLAIN#1	QEEG000125	CORE	3573.5 FT	NOPR	0.42	0.18	1.51	0.20	436	361	48	43	0.11	VIOLA GY SHALE	VIOLA GY SHALE
SCOBY 83-2	QEEG000126	CORE	4005.9 FT	NOPR	9.80	1.96	61.22	0.29	447	625	3	20	0.03	SIMPSON KEROG.	SIMPSON KEROG.
SCOBY 83-2	QEEG000127	CORE	4027.1 FT	NOPR	7.55	2.92	55.12	0.19	446	730	3	39	0.05	SIMPSON KEROG.	SIMPSON KEROG.
SCOBY 83-2	QEEG000128	CORE	4029.8 FT	NOPR	5.45	1.30	39.34	0.15	447	722	3	24	0.03	SIMPSON KEROG.	SIMPSON KEROG.
SCOBY 83-2	QEEG000129	CORE	4033.0 FT	NOPR	6.50	1.37	47.36	0.22	448	729	3	21	0.03	SIMPSON KEROG.	SIMPSON KEROG.
SCOBY 83-2	QEEG000130	CORE	4044.9 FT	NOPR	0.87	0.10	0.38	0.36	439	44	42	12	0.21	Simpson Shale	BELOW IRONSTONE

STRATOCHEM SERVICES

TOTAL ORGANIC CARBON, TOTAL CARBON

Company: QEP **Project #:** 14EG0285

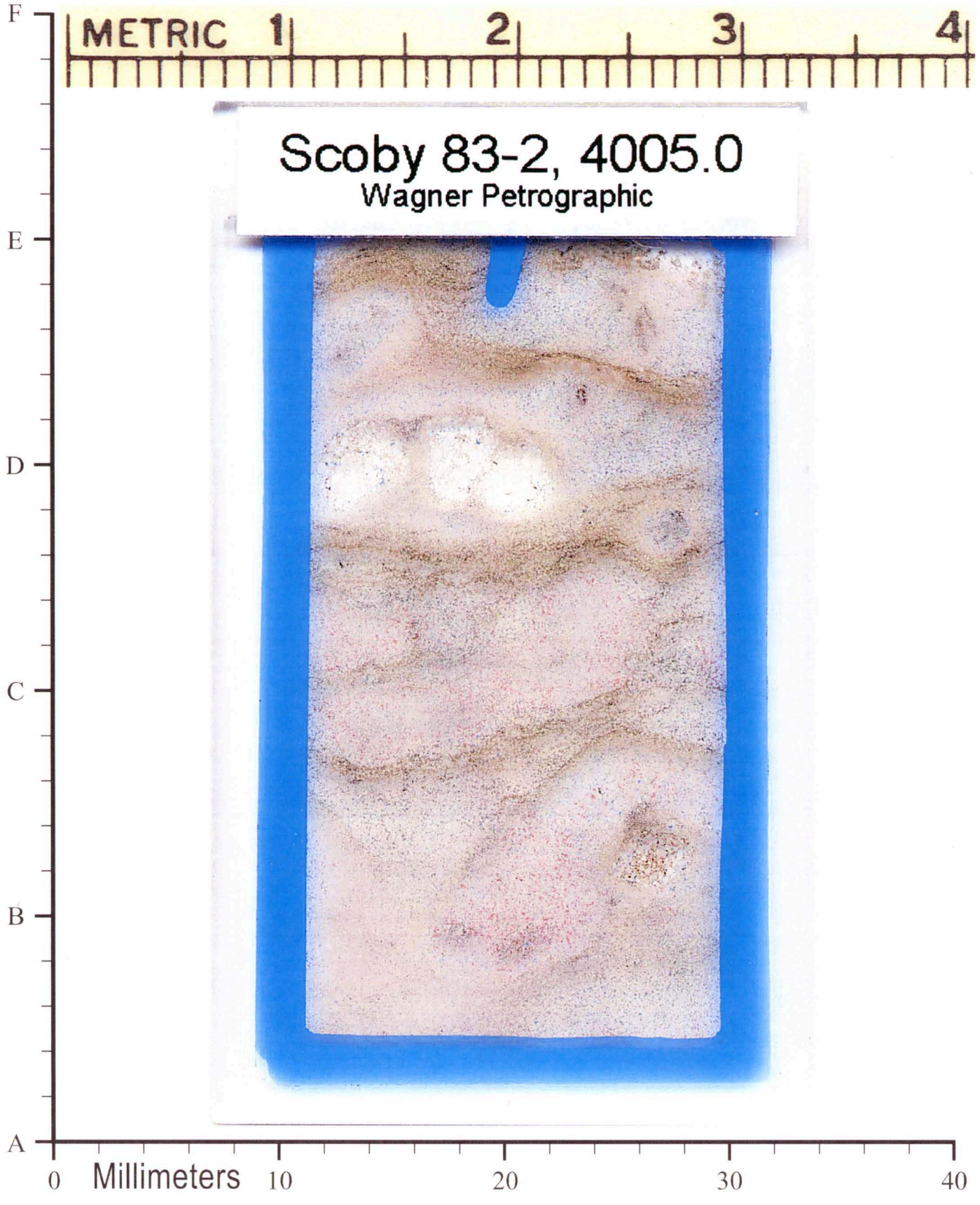
Well Name	Lab ID	Sample Type	Depth	Prep	TOC Wt. %	Carbon Wt. %	Carbonate%	Formation	Description
WESSEL "A"#1	QEEG000121	CORE	3480.5 FT	NOPR	0.56	3.25	22.40	Maquoketa Gray Sh.	MAQUOKETA SH.
WESSEL "A"#1	QEEG000122	CORE	3484.1 FT	NOPR	0.50	4.25	31.26	Maquoketa Gray Sh.	MAQUOKETA SH.
WESSEL "A"#1	QEEG000118	CORE	3685.5 FT	NOPR	1.05	2.97	16.00	Black Simpson Sh.	SIMPSON SHALE
WESSEL "A"#1	QEEG000119	CORE	3690.0 FT	NOPR	0.41	0.70	2.41	Simpson Gray Sh.	SIMPSON SHALE
WESSEL "A"#1	QEEG000120	CORE	3713.6 FT	NOPR	0.26	10.30	83.70	Simpson Gray Sh.	SIMPSON SHALE
MCCLAIN#1	QEEG000123	CORE	3561.2 FT	NOPR	0.22	12.10	99.04	VIOLA GY SHALE	VIOLA GY SHALE
MCCLAIN#1	QEEG000124	CORE	3568.9 FT	NOPR	0.23	11.00	89.77	VIOLA GY SHALE	VIOLA GY SHALE
MCCLAIN#1	QEEG000125	CORE	3573.5 FT	NOPR	0.42	9.87	78.77	VIOLA GY SHALE	VIOLA GY SHALE
SCOBY 83-2	QEEG000126	CORE	4005.9 FT	NOPR	9.80	10.30	4.17	SIMPSON KEROG.	SIMPSON KEROG.
SCOBY 83-2	QEEG000127	CORE	4027.1 FT	NOPR	7.55	7.62	0.58	SIMPSON KEROG.	SIMPSON KEROG.
SCOBY 83-2	QEEG000128	CORE	4029.8 FT	NOPR	5.45	5.62	1.42	SIMPSON KEROG.	SIMPSON KEROG.
SCOBY 83-2	QEEG000129	CORE	4033.0 FT	NOPR	6.50	6.85	2.92	SIMPSON KEROG.	SIMPSON KEROG.
SCOBY 83-2	QEEG000130	CORE	4044.9 FT	NOPR	0.87	1.31	3.71	Simpson Shale	BELOW IRONSTONE

Norrie-Scoby #83-2, 4005.0 ft

PLATE 1

Interval: Simpson Group Dolomite

Quartz Sand in Burrows in Finely Crystalline Dolomite Mudstone

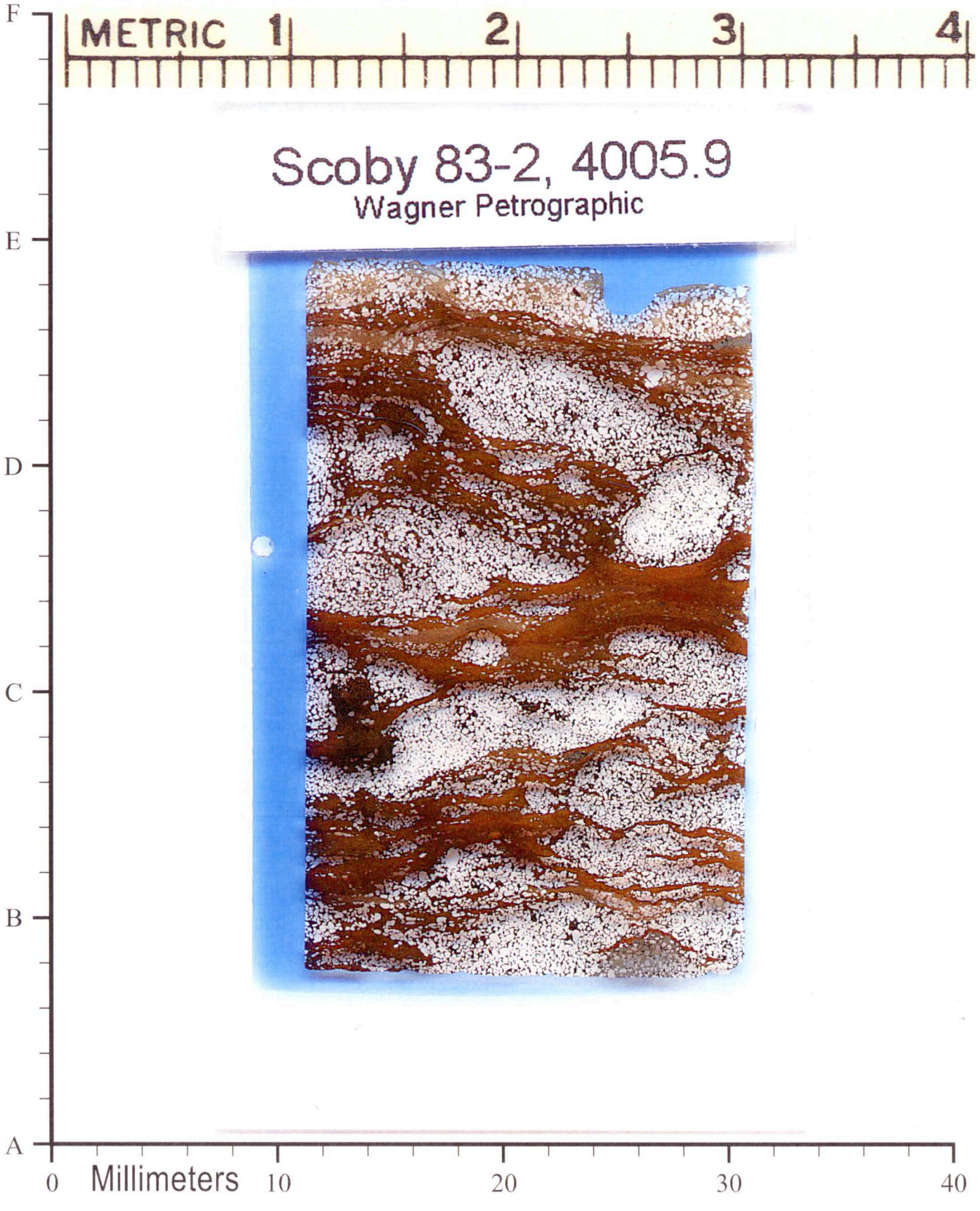


Norrie-Scoby #83-2, 4005.9 ft

Interval: Simpson Group Kerogenite

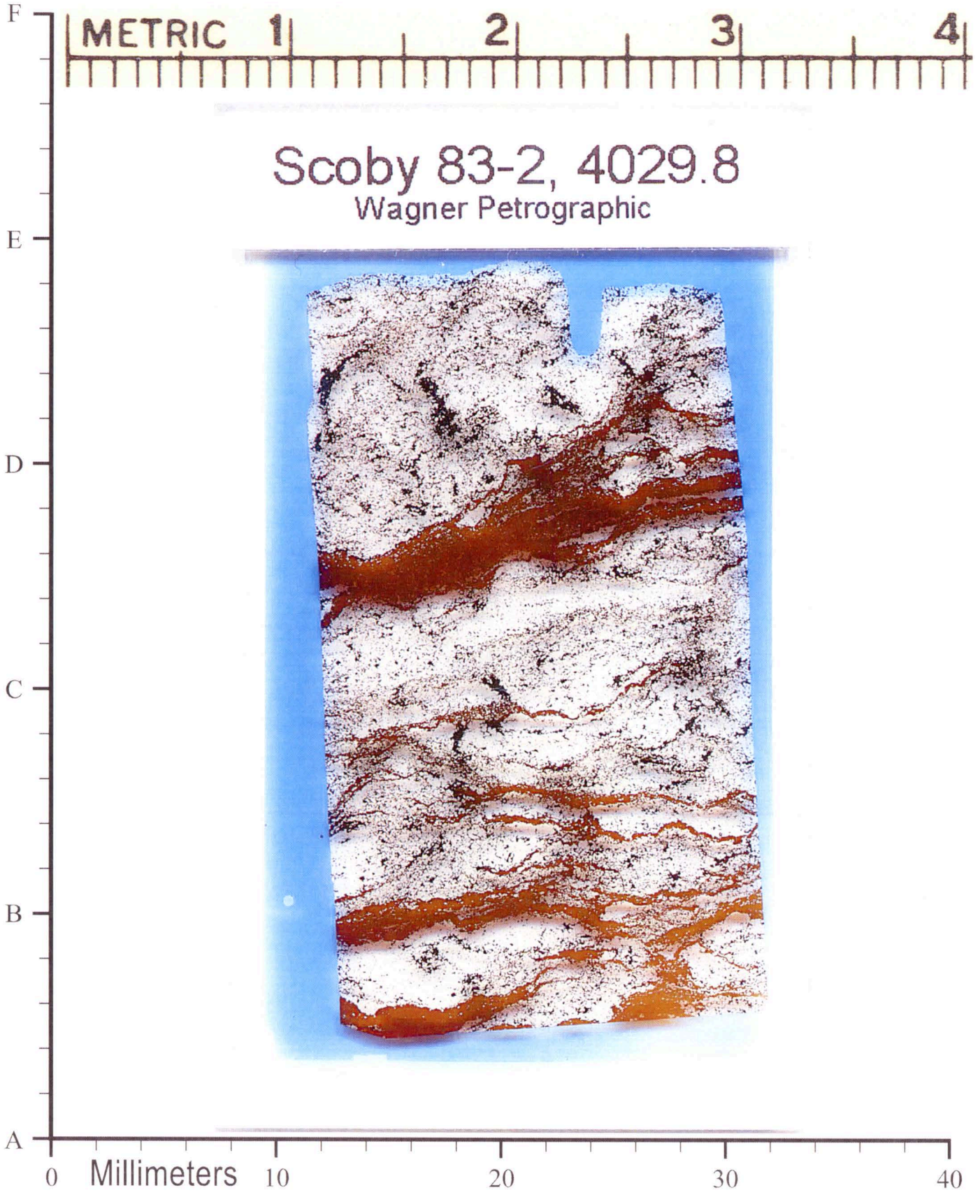
Sand-Filled Burrows and Organic-Rich Kerogenite Beds

PLATE 2



Norrie-Scoby #83-2, 4029.8 ft
Interval: Simpson Group Kerogenite
Quartz Sand in Burrows in Reddish-Brown Kerogenite Bed

PLATE 3

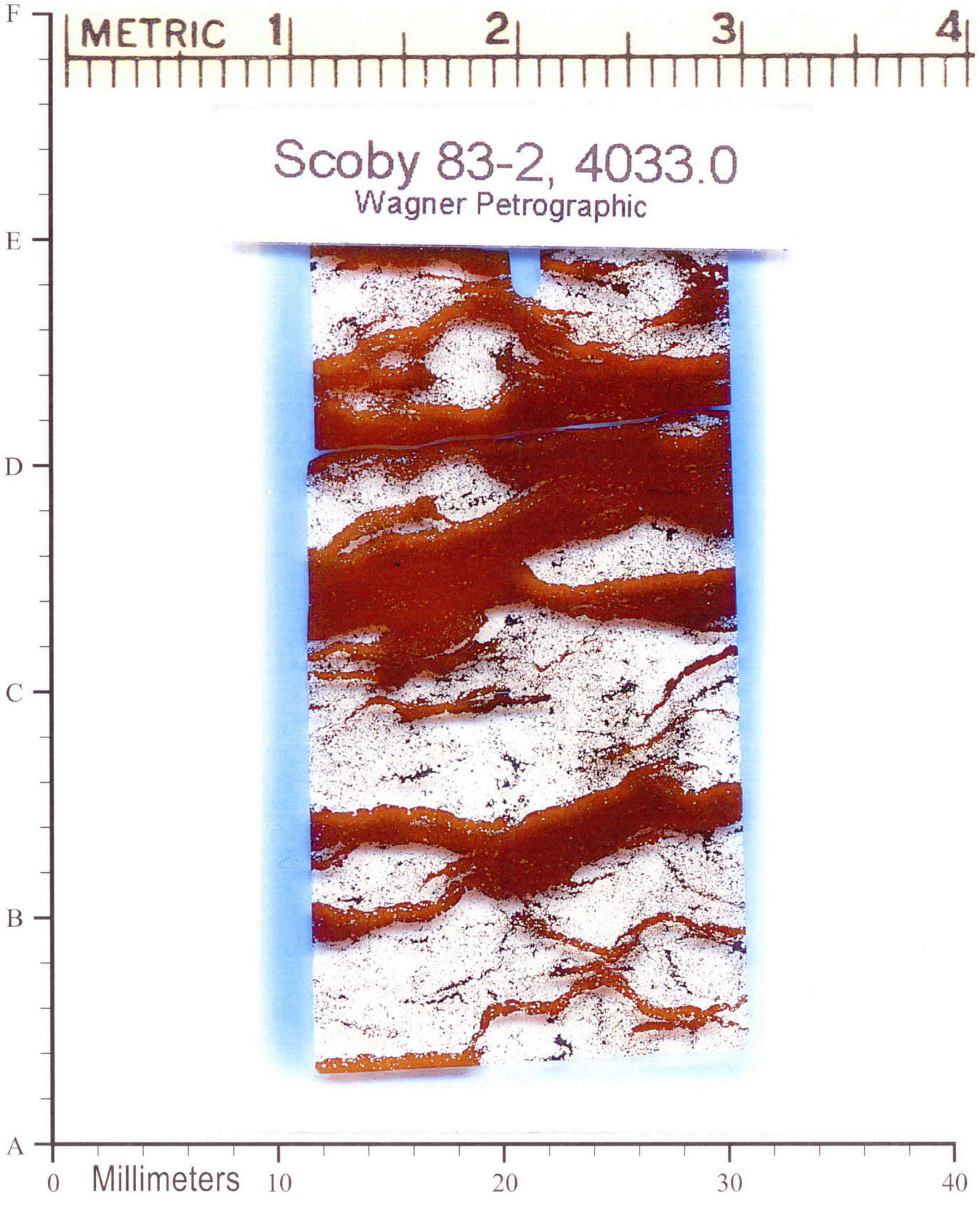


Norrie-Scoby #83-2, 4033.0 ft

PLATE 4

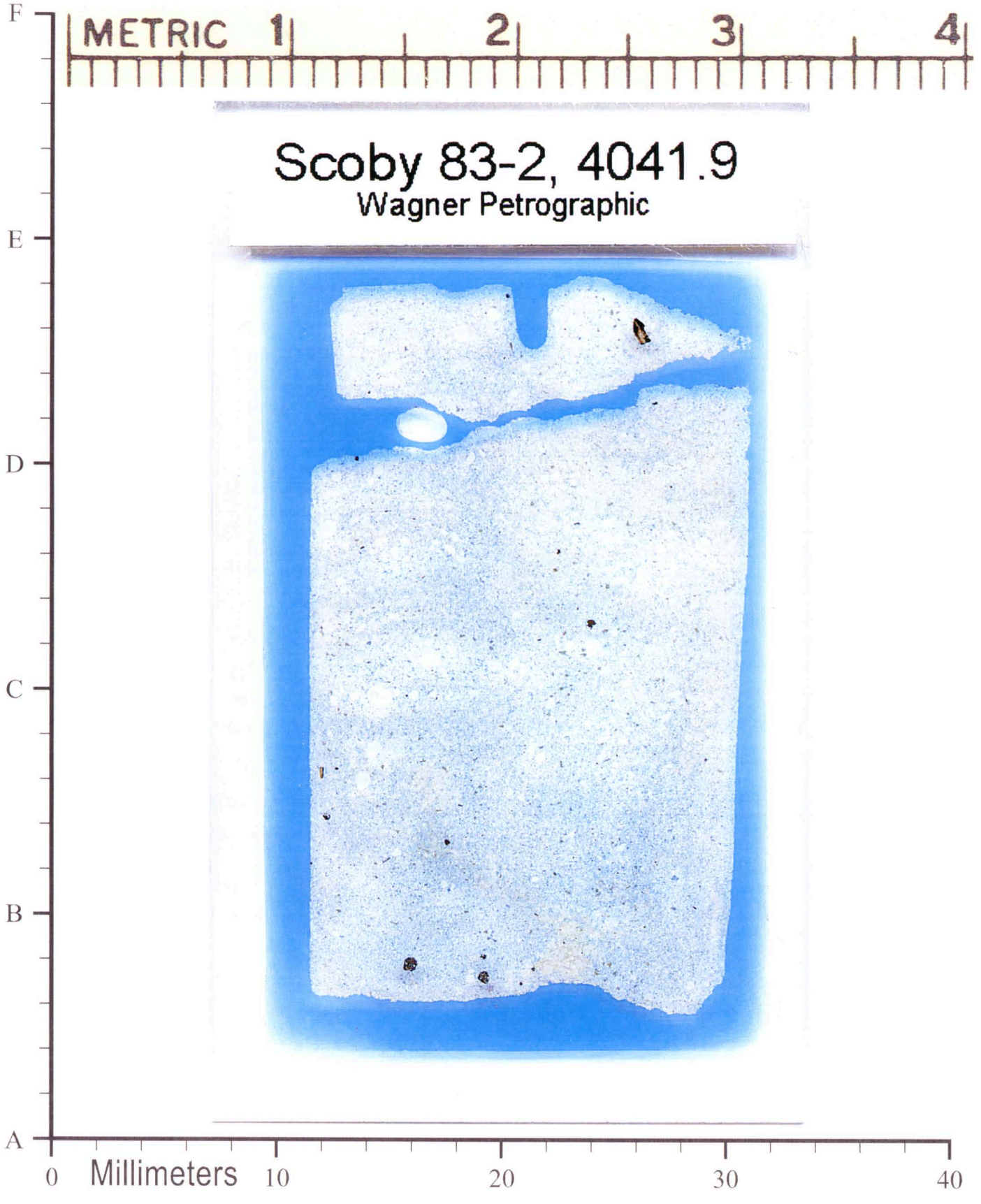
Interval: Simpson Group Kerogenite

Quartz Sand in Burrows and Beds in Reddish-Brown Kerogenite



Norrie-Scoby #83-2, 4041.9 ft
Interval: Simpson Group Sandstone
Porous Bimodal Quartz Sandstone

PLATE 5



Norrie-Scoby #83-2, 4044.0 ft

PLATE 6

Interval: Simpson Group "Ironstone"

Iron-Rich Hematitic Ooids with Phosphatic Debris and Dolomite Cement