IOWA GEOLOGICAL SURVEY

IOWA CITY, IOWA

#27514

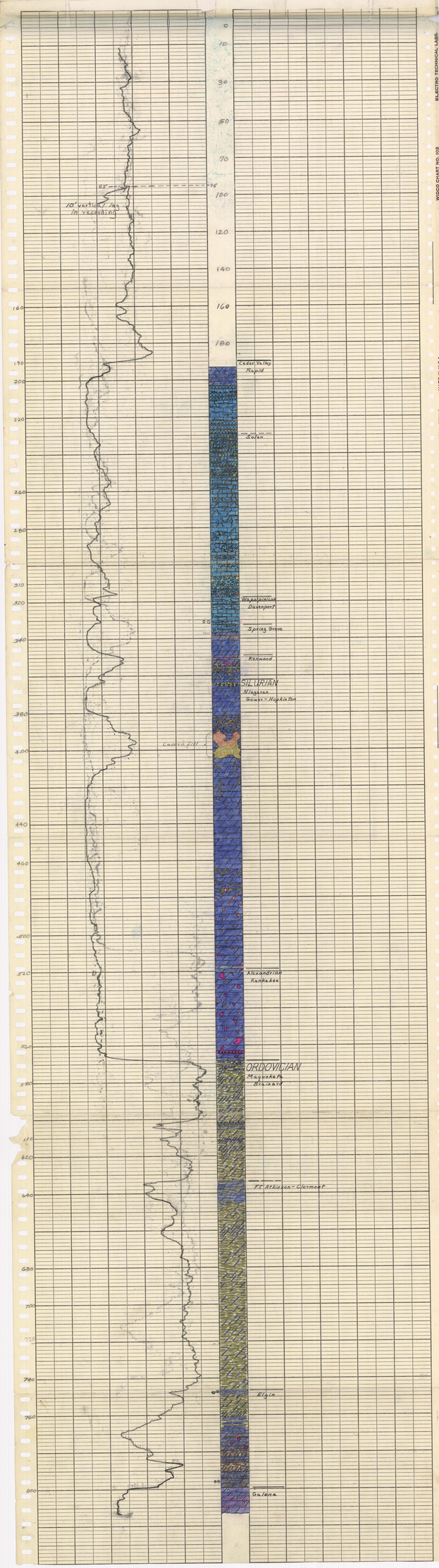
GAMMA RAY

Name . . . . . Mid America Pipeline Company
Stratigraphic Test Hole No. 4, 1964
Location . . . . . NW¼, SE¼, SE¼, sec. 27, T. 79N., R. 5W., Johnson County, Iowa.
Elevation of land surface 730.57
Date Logged . . . . . December 7, 1964, Donald L. Koch

Depth Measured: Driller 815'
Interval Logged: 0 ft. to 813 feet
Depth Scale: 20 ft./in.

Gamma Ray

Scale: .01 μr/hr



ELECTRO-TECHNICAL LABS.
WOOD CHART NO. 102

ELECTRIC LOG

U.S. Geological Survey - WRD

Hole No. MAP Co. # 2 Date 2-7-79 By

Location NW¼ SE¼ SE¼ Sec. 29, T. 79 N., R. 54 W.

T.D. 615' Csg. M.P. Equip. No.

Casing Dia. 4" From 0 To 191 Dia. NX From 186 To 496

Hole Dia. From To Dia. From To

Log Speed 10 ft/min. ↑ ↓ Vert. Scale 20 ft/in. Mud Res.

S.P. Scale 50 mv/in. R. Scale 100 ohms/in. Mud Fasm

Remarks: Mud Density

#27544

0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
400
420
440
460
480
500
520

Water Level

Top of NX casing as calculated from data supplied by driller

Base of 4" ID Csg.

Base NX Csg.

WIDCO CHART NO. 102 MADE IN U.S.A. HOUSTON, TEXAS ELECTRO TECHNICAL LABS.

IOWA GEOLOGICAL SURVEY #27544

IOWA CITY, IOWA

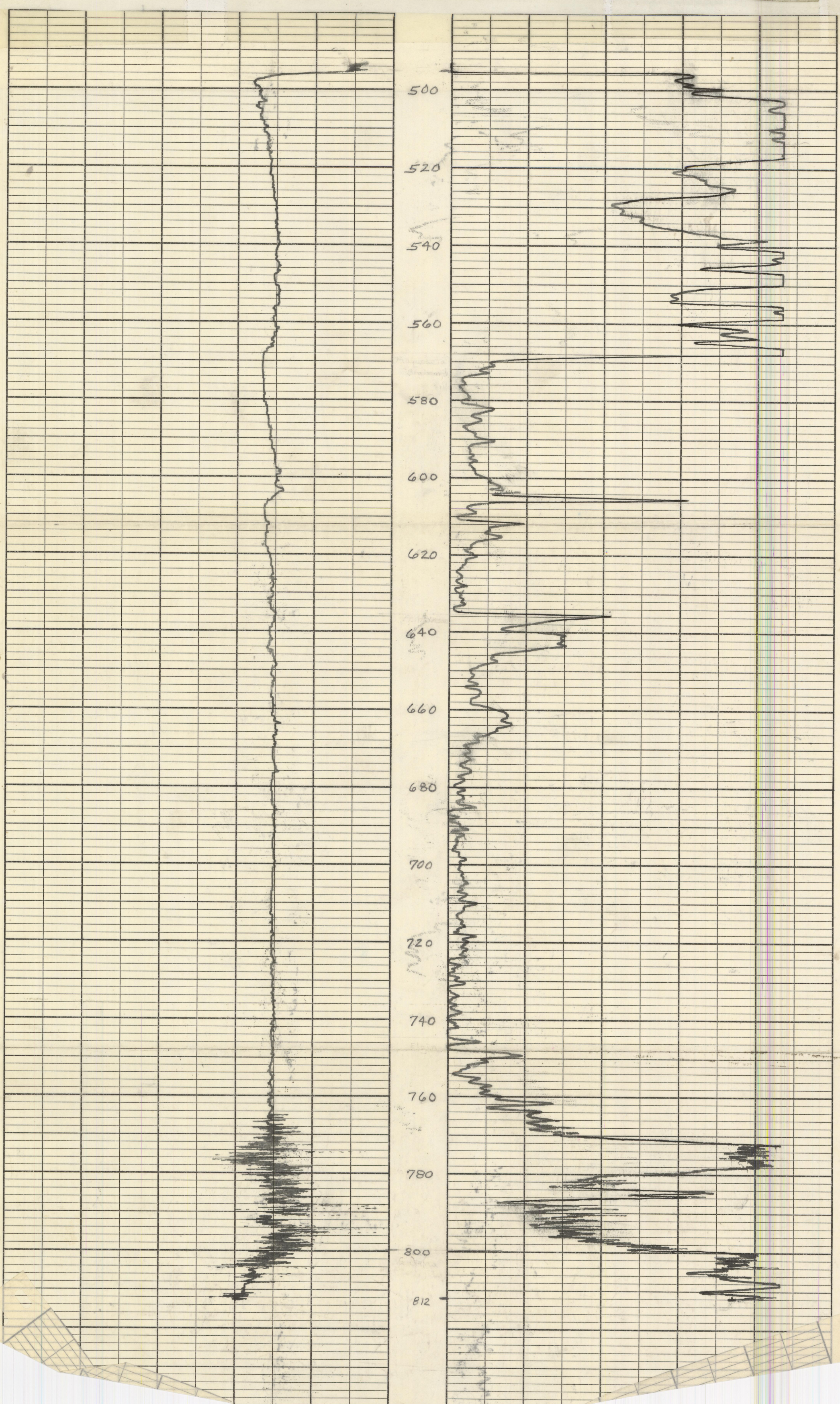
ELECTRICAL LOG

Name . . . . . Mid-America Pipeline Company
Stratigraphic Test Hole No. 4, 1964
Location . . . . . NW¼, SE¼, SE¼, sec. 27, T. 79N., R. 5W., Johnson County, Iowa.
Elevation of land surface 730.57
Date Logged . . . . . December 7, 1964

Depth Measured: Driller 815'
Interval Logged: 0 ft. to 812'
Depth Scale: 20 ft./in.

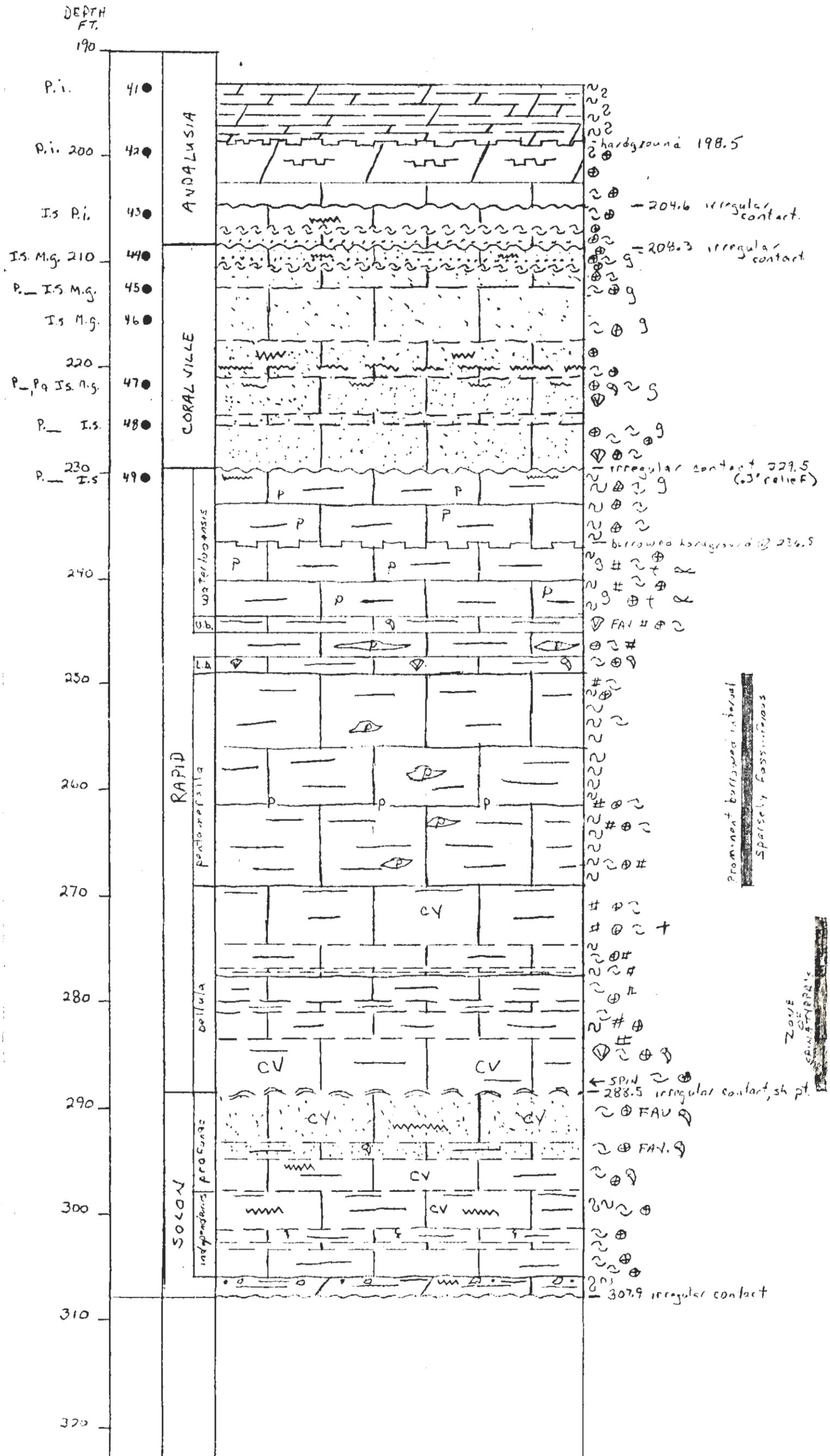
Self Potential
Scale: 100 mv/in.

Resistivity
Scale: 100 ohms/in.



ELECTRO TECHNICAL LABS. HOUSTON, TEXAS MADE IN U.S.A.
WIDCO CHART CO. 102

W-27944
MID-AMERICA PIPELINE #4 MAT
JOHNSON COUNTY NWSESE SEC. 27-T79N-R5W
ELEV. 731 TD 815'
CORE STARTS 193'



W-27944

Mid-America Pipeline #4 MAT

NW SE SE Sec 27 T79N R5W elev 731

Core starts 193'
base Anda.

Top Pa... – base Coral 229.6

base ... 249

Top Solon ~286'.
Vapsi 306
5.6 334.1
Kan 350.7
Ot.s 363
5.1 405
Mpg 569.0
Galena. 800

815

MAT 41 193.0 - 194.4

MAT 42 199.0 - 200.3

MAT 43 205.0 - 205.8

MAT 44 209.0 - 209.3

MAT 45 212.3 - 213.0

46 215.0 - 215.7

47 221.3 - 221.9

225.8 - 226.4

230.0 - 230.7 RAPID

W-2754 #4-MAT

MAT 41 193-194.4

MAT 42 199-200.3

IOWA GEOLOGICAL SURVEY
IOWA CITY, IOWA

Name: Mid-America Pipeline Company, Stratigraphic Test No. 4, 1964
Location: NW¼, SE¼, SE¼, Sec. 27, T. 79 N., R. 5 W., Johnson County, Iowa
Elevation of Land Surface: 730.57'
Core Interval: 193' - 815'
Core Description: D. L. Koch, December, 1964

Bed	Description	Thickness
	DEVONIAN	
	Cedar Valley	
	Rapid	
	193-198.6	
	Dolomite, very light olive gray (5Y 6/1) and medium light gray (N 6), mottled, coarse silt grade, interstitial calcite; slightly to moderately argillaceous, slightly silty, very finely disseminated anhedral pyrite; discontinuous hair-line vertical fractures sealed with calcite; a few internal brachiopod molds, scattered dark yellowish-brown carbonaceous flecks, numerous fragmented scolecodonts; porosity variable, very low to moderate; gradational with bed below.	5.6
	198.6-202.8	
	Dolomite, yellowish-gray (5Y 6.5/2), light olive gray (5Y 6/1), and dark yellowish-brown (10YR 3.5/2), mottled, very fine to fine sand grade, very slightly to non-argillaceous, slightly calcareous, very slightly silty; zones of concentrated pyrite hedra; short, discontinuous vertical fractures; fragmented crinoid and brachiopod molds (solution molds); moderate to high porosity, few small vugs (porosity mostly secondary due to solution of fossil fragments); lower 1.8' dominantly dark to pale yellowish-brown (10Y 4/2 to 10Y 6/2); bottom 0.3' very calcareous; gradational with bed above, sharp contact with bed below.	4.2
	202.8-204.7	
	Limestone, biofragmental, very pale orange (10YR 8.5/2) and pale yellowish-brown (10YR 6/2), mottled, very fine silt grade, dull, earthy, "floating" very fine sand grade dolomite euhedra; fossils include fragmented Atrypa, crinoid ossicles, and corals; low porosity; gradational lower contact.	1.9

Bed	Description	Thickness
4	204.7-207.2 Limestone, very pale orange (10YR 8/2) to pale yellowish-brown (10YR 6/2), fine to very fine silt grade in top 0.4', very fine to fine sand grade below; "floating" very fine sand grade dolomite euhedra; very fossiliferous with comminuted Atrypa and crinoid ossicles; numerous dark yellowish-brown bituminous clay partings from 205.7 to 205.9'; stylolites numerous from 206.0 to 206.3; prominent zone of dusky yellowish-brown highly bituminous limestone with fragmented Atrypa and elongate limestone pebbles from 207.1 to 207.2'.	2.5
5	207.2-210.8' Limestone, biofragmental, pale yellowish-brown (10YR 5.5/2) and very pale orange (10YR 8/2), mottled, composed of fragmented and comminuted Atrypa and crinoid ossicles cemented with pale yellowish-brown calcite; zones of finer grained, less fossiliferous pale yellowish-brown dolomitic limestone; occasional stylolite; gradational with bed below.	3.6
6	210.8-221.9 Limestone, pale yellowish-brown (10YR 6.5/2)to 10YR 5.5/2), very fine sand to coarse silt grade, very slightly to slightly dolomitic; fossiliferous, with fragmented Atrypa and crinoid ossicles; scattered bituminous clay 210.9 to 212.0'; continuous vertical fracture 211.1 to 212.6'; abundant stylolites.	11.1
7	221.9-229.1 Limestone, biofragmental, pale yellowish-brown (10YR 6.5/2), composed of fragmented and comminuted brachiopods and crinoid ossicles and a few tetracorals; occasional stylolite; numerous dusky yellowish-brown bituminous clay partings.	7.2
	Cedar Valley Solon	
8	229.1-252.8 Limestone, biofragmental, medium light gray (N6) to medium gray (N5), slightly argillaceous; fossils are dark gray and include fragmented and comminuted brachiopods, crinoid ossicles, bryozoa, fish teeth, and large fragments of Acervularia; numerous dark gray clay partings; scattered grains of brilliant green (5G 6/6) glauconitic (?) clay; occasional stylolite; zones of light gray (N 7.5) very	

Bed	Description	Thickness
	fine to fine silt grade less fossiliferous limestone; zone of larger fossil fragments and clastic limestone with extremely abundant wavy clay partings from 243.4 to 244.7'; becoming more argillaceous from 247.7 to 249 with many dark gray clay partings; bottom 1.8' is less fossiliferous; thin to massive.	23.7
9	252.8-269.0 Limestone, light gray (N 6.5), medium to fine silt grade, argillaceous; only slightly fossiliferous with scattered crinoid ossicles, brachiopods, and bryozoa, and a trace of flattened spore carps; zones of increased fossil content 254.4 to 254.5, 265.5 to 257.7, and 260.3 to 261.8; pyrite films common; occasional dark gray clay partings and weak stylolites (more abundant in lower 10'); close irregular fractures from 264.0 to 264.4, some sealed with calcite, some with dark gray clay; slickensides at 265.5, 266.4, and 268.4; massive.	16.2
10	269.0-288.8 Limestone, very light olive gray (5Y 7/1), fine silt grade, slightly argillaceous, mottled with dark gray fossil fragments (crinoid ossicles, brachiopods, bryozoa and corals); long vertical fractures, zones of irregular cross-cutting fractures with wide displacements sealed with calcite; occasional weak stylolite; thick to massive.	19.8
11	288.8-293.6 Limestone, very pale yellowish-brown (10YR 7/2), fine to medium silt grade, slightly dolomitic; slightly fossiliferous, with brown calcite crinoid ossicles and occasional brachiopod; few stylolites; macro-in situ brecciation with wide separations in host rock sealed with calcite (occasional incompletely filled fracture opening lined with euhedral calcite).	4.8
12	293.6-306 Limestone, pale yellowish-brown (10YR 6.5/2 to 10YR 7/2), slightly mottled with medium gray (N 5), medium silt to very fine sand grade, anhedral to subhedral; wavy dark brown bituminous clay partings; slightly to very fossiliferous with abundant crinoid ossicles, coral and	

Bed	Description	Thickness
	brachipped fragments; occasional stylolite; finely disseminated pyrite; zones of in situ brecciation with wide displacements sealed with calcite, especially marked at 296.3 to 297.7 and 300.7 to 301.3; thick to massive.	12.4
13	306-313.2 Limestone breccia, macro to micro, variable, composed of angular to subangular fragments of: limestone, very light olive gray (5Y 7/1), fine to medium silt grade, slightly to very dolomitic, subhedral, very dense; and limestone, light gray (N7) to pale yellowish-brown (10YR 6.5/2) sublithographic to lithographic, very dense, tough, sharp-edge conchoidal fracture; lithic fragments cemented with limestone, medium to light gray (N5 to N7), with weakly mottled zones of very pale yellowish-brown (10YR 7/2) medium silt to very fine sand grade limestone containing comminuted fossils and medium quartz sand grains; short vertical fractures sealed with calcite; pyritic zones, scattered dark brown and medium dark gray clay bands; brown bituminous interval 307.4 to 307.6; slickenside at 311.2; bottom 4 feet generally argillaceous with increasing amount of quartz sand; wavy medium dark gray shale partings very numerous in lower 1.5 feet.	7.2
14	313.2-318.3 Limestone breccia, composed of angular to subangular lithic fragments of: limestone, very pale yellowish-brown (10YR 7/2) to pale yellowish-brown (10YR 6/2), sub-lithographic to lithographic, anhedral, sharp-edge conchoidal fracture, very dense; cemented with limestone, yellowish-gray (5Y 7.5/1), medium silt grade, subhedral to anhedral, calcitic; numerous stylolites; interval of light bluish-gray (5B 7/1) drusy, chalcedonic chert, rough and vuggy (vugs lined with euhedral quartz and calcite) from 316.2 to 316.7; cement in lower 1.2' is argillaceous and contains numerous medium dark gray wavy clay partings.	5.1
	Wapsipinicon Davenport	
15	318.3-334.1 Limestone, very pale yellowish-brown (10YR 6.5/2) to very pale orange (10YR 8.5/2), lithographic to sublithographic, sharp-edge conchoidal fracture, very dense;	

Bed	Description	Thickness
	stylolites common in upper part; long vertical fracture 319-320.6; 0.5' seam of olive black, unctuous clay at 322.4; irregular fracturing and slight in situ brecciation 323-324' with openings sealed with calcite; most of unit yields a mild petroliferous odor when pulverized; bottom 1' is less dense, dull, earthy limestone with very closely spaced weak stylolites, and is crowded with ostracod shells; thin to massive.	15.3
	Spring Grove	
16	334.1-337.4 Limestone, pale yellowish-brown (10YR 6.5/2 to 10YR 5.5/2), very fine sand grade, slightly dolomitic at top, grading to calcareous dolomite toward base; numerous weak, closely spaced stylolites lined with dark brown bituminous clay; very strong petroliferous odor when pulverized; three subequal units; gradational below.	3.3
17	337.4-350.7 Dolomite, pale yellowish-brown (10YR 6.2) to grayish-orange (10YR 6/4), very fine sand grade, euhedral, saccahroidal, very slightly to moderately calcareous; moderate to very high porosity; friable zones; upper 3.2 feet shows prominent banding due to closely spaced wavy dark brown bituminous clay partings; very strong petroliferous odor when pulverized; vuggy from 341.1 to 343.5; lower 3.2 feet less porous; thick to massive units.	13.3
	Kenwood	
18	350.7-352.6 Dolomite, medium light gray (N6) and very light gray (N8), mottled, very fine to fine sand grade, slightly calcitic, silty, scattered embedded fine quartz sand grains and fine sand grade medium dark gray chert grains, argillaceous, moderately calcareous; upper 0.5' shows irregular fillings of material identical to that in bed No. 17; lower 0.3' is light yellowish-gray (5Y 8.5/1) medium silt grade calcareous, argillaceous dolomite with very fine to fine quartz sand and chert grains; irregular fractures; numerous stylolites; thin bedded.	1.9

Bed	Description	Thickness
19	352.6-354.2 Dolomite, light gray to medium light gray (N6 to N7), medium silt grade, very silty, small amount of embedded quartz sand and chert grains, slightly to very argillaceous; zone of mixed sandy and cherty limestone and dark gray shale in top 0.5'.	1.6
20	354.2-359.1 Interbedded and mixed: limestone, light gray (N7), fine silt grade, silty, slightly to very sandy, traces of dark chert sand, dolomitic, argillaceous; limestone, very light gray (N8), medium silt grade, very sandy (fine to medium quartz sand), few dark gray chert grains, abundant euhedral calcite; and shale, medium light gray (N6) to medium dark gray (N4), dolomitic to calcareous, interbedded and intercalated with above lithologies.	4.9
21	359.1-362.6 Dolomite, medium gray (N5) and light gray (N7), mottled, medium to fine silt grade, very calcareous, silty, argillaceous, shaley zones; bottom 0.2' banded with medium gray, light gray, and very pale yellowish-brown argillaceous dolomite.	3.5
	SILURIAN Niagaran Gower-Hopkinton	
22	362.6-382.9 Dolomite, medium light gray (N6) to very pale orange (10YR 7.5/2), fine to medium sand grade, sub to euhedral, very slightly calcareous; moderate to high porosity, vuggy, with scalenohedral calcite lining vugs; occasional stylolite; brecciated 364.5 to 365.2 with a matrix of mixed greenish-gray (5GY 6.5/1) clay and coarse sand grade dolomite euhedra; thick to massive units.	20.3
23	382.9-392.7 Dolomite, medium gray (N5) and pale yellowish-brown (10YR 6.5/2), mottled, coarse silt to very fine sand grade, subhedral to anhedral, highly fractured and broken with fractures and pockets filled with very sandy (very fine to medium) pale yellowish-green (10GY 6.5/2) pyritic clay.	9.8

Bed	Description	Thickness
24	392.7-404.5 Cavern fill (karst): 392.7-397.8 Mixed light greenish-gray (5GY 6.5/1) and dark reddish-brown (10R 2.5/4) very sandy (coarse to fine) clay. 397.8-404.5 Greenish-gray (5GY 6.5/1) clay, very sandy (very fine to coarse), pyritic; Portions of cavern wall show dolomite, very pale orange (10YR 7.5/2) to grayish-orange pink (5YR 7/2), medium silt grade, very dense, very hard.	11.8
25	404.5-425.8 Dolomite, yellowish-orange (5Y 8/1) to very light olive gray (5Y 7/1), medium silt grade, slightly calcareous, very tough; disseminated grains and small aggregate growths of pyrite; numerous greenish-gray clay partings and fracture fillings (the clay is slightly to very sandy and pyritic); low to high porosity (secondary porosity due to solution of fossil fragments--mostly crinoid ossicles); stylolites rare; massive.	21.3
26	425.8-492.5 Dolomite, light gray (N7) to yellowish-gray (5Y 8/1), coarse silt grade, subhedral; moderate to very high porosity (secondary due to solution of fossil fragments), vuggy, with euhedral dolomite lining pore spaces and vugs; short vertical fractures in upper 4 feet; stylolites rare; fractured and broken zones filled with sandy green clay from 465.4 to 467.7, 471.4 to 472.6, 475.5 to 476.2, and 478.0 to 478.7; open vugs lined with aggregate growths of euhedral quartz at 476.5, 480.0, 481.0, 483-486, 487.0, and 490.1; massive to thick units.	66.7
27	492.5-511.1 Dolomite, medium light gray (N6.5) (dominant) to yellowish-gray (5Y 8.5/1), medium silt grade, subhedral to anhedral, dense, very hard; moderate to very high porosity, few small vugs; zones of mixed pale green clay; very fossiliferous (solution molds) with crinoid ossicles, Gypidula, and bryozoa; small vuggs lined with aggregate growths of euhedral quartz at 494.0, 495.7, 497.8, 503.3, 504.4, and 508.7; small amount of disseminated pyrite; open vertical fracture 509.4 to 510.3; stylolites rare; massive.	18.6

Bed	Description	Thickness
28	511.1-518.8 Dolomite, medium light gray to light olive gray (5GY 6.5/1) and yellowish-gray (5Y 8.5/1), medium to coarse silt grade, subhedral to anhedral; very hard; moderate to very high porosity (secondary); crowded with large internal molds of Pentamerus; wavy partings of green sandy clay at 514.5; traces of white tripolitic chert and occasional small vug and bedding plane lined with drusy chert and quartz in lower 4'; bottom 1.5' has numerous green clay partings.	7.7
	Alexandrian Kankakee	
29	518.8-567.2 Dolomite, light gray (N7) to very light yellowish-orange (5Y 8.5/1), medium to coarse silt grade, subhedral to anhedral; very hard; cherty, with abundant nodular white, soft, tripolitic and smooth fossiliferous chert; silicified Halysites and Favosites in upper part; few small vugs lined with euhedral quartz; irregular fracture filled with sandy green clay at 519.7, 521.2, 537.7, and 553.6; bedded chert 563.2-563.8; numerous wavy green clay partings in lower part; generally low to moderate porosity; thick to massive.	48.4
	Edgewood?	
30	567.2-569.0 Dolomite, yellowish-gray (5Y 8/1), medium silt grade, subhedral, dense; scattered moderate green (5G 5/6) soft glauconite (?) grains; some very finely disseminated pyrite; small vug lined with euhedral quartz at base; very gradational lower contact.	1.?
	ORDOVICIAN Maquoketa Brainard	
??	569.0-570.4 Shale, light gray to very light olive gray (N7 to 5Y 8/1), dolomitic, mixed and mottled with yellowish-gray (5Y 8/1) coarse silt grade dolomite containing abundant finely disseminated pyrite; becoming more argillaceous toward base.	1.4

Bed	Description	Thickness
32	570.4-571.0 Shale, light olive gray (5Y 6.5/1), greenish-gray (5GY 7/1), and olive gray (5Y 4.5/1), mixed and intercalated, slightly dolomitic; abundant whole and fragmented phosphatic Lingula and very abundant scattered black phosphatic (?) flakes.	0.6
33	571.0-574.7 Shale, light olive gray (5Y 6.5/1), slightly to moderately dolomitic, mixed and mottled with irregular thin stringers of yellowish-gray (5Y 8/1) coarse silt grade argillaceous dolomite; abundant Lingula and scattered black phosphatic (?) flakes; very finely disseminated pyrite; dolomite stringers less abundant in lower part.	3.7
34	574.7-581.7 Shale, greenish-gray (5G 6.5/1), dolomitic, very uniform in color and composition; Lingula very common; some finely disseminated pyrite.	7.0
35	581.7-603.8 Shale, as in bed 32 with olive gray (5Y 4.5/1) the dominant color; harder, more dolomitic zones; bottom 0.2' is dolomite, light olive gray (5Y 5.5/1), coarse silt to fine sand grade, very argillaceous, pyritic, and is crowded with fragmented Lingula, rounded phosphatic pellets up to 1 mm. in diameter, and fragmented trilobite spines.	22.1
36	603.8-604.3 Dolomite, medium dark gray (N4) and medium light gray (N6), mottled, very fine sand to coarse silt grade, subhedral, argillaceous, pyritic zones; mixed with wavy partings and lenses of light olive gray (5Y 6/1) dolomitic shale; scattered small vugs lined with dolomite euhedra.	0.5
37	604.3-605.5 Shale, light olive gray (5Y 6.5/1), and greenish gray (5GY 6.5/1), mixed and mottled, very dolomitic; irregular partings and lenses of medium dark gray (N4) and medium light gray (N6) mottled coarse silt grade dolomite; Lingula and pyritized high-spired gastropods common; dolomite more prominent in lower 0.5'.	
38	605.5-606.6 Dolomite as in bed 36, porous, and with more numerous and larger vugs.	0.9

Bed	Description	Thickness
39	606.6-635.6 Shale, greenish-gray (5G 6.5/1), moderately to very dolomitic, very hard; occasional Lingula, scattered trilobite spines, and black phosphatic(?) flakes, zone of mottled medium dark gray (N4) and medium light gray (N6) argillaceous and shaley dolomite with a few phosphatic pellets from 611.8 to 612.6.	29.2
	Fort Atkinson	
40	635.6-654.7 Dolomite, medium dark gray (N4) and medium light gray (N6), mottled, medium to coarse silt grade, argillaceous shaley, some pyrite; dominantly greenish-gray (5G 6.5/1) dolomitic shale below 645.3.	19.1
41	654.7-748.7 Shale, greenish-gray (5G 5.5/1) to light olive gray (5Y 5.5/1), very dolomitic in top 12 feet, moderately dolomitic below, hard, very uniform; scattered black phosphatic (?) flakes.	94.0
	Elgin	
42	748.7-751.8 Dolomite, pale yellowish-brown (10YR 5.5/2) weakly mottled with light olive gray (5Y 5.5/1), coarse silt grade, subhedral, extremely argillaceous, medium soft; crowded with low-spired gastropods averaging 1/2 mm. in diameter, abundant Lingula fragments; numerous pyrite films.	3.1
43	751.8-757.3 Shale, light olive gray (5Y 5.5/1), very dolomitic, hard; some disseminated pyrite and dark clayey pyritic films; few black phosphatic (?) flakes; gradational below.	5.5
44	757.3-769.3 Shale, olive gray (5Y 5/1), moderately to very dolomitic; abundant pyrite films; scattered Lingula fragments and trilobite spines; occasional 1/4 mm. phosphatic pellets; grades to pale yellowish-brown (10YR 5.5/2) very argillaceous coarse silt grade dolomite from 761.2 to 762.7, 763.8 to 764.7, and 765.2 to 768.3.	12.0

Bed	Description	Thickness
45	769.3-782.4 Dolomite, pale yellowish-brown (10YR 6/2) to dark yellowish-brown (10YR 4.5/2), coarse silt grade, anhedral to subhedral, very slightly to moderately argillaceous; interbedded and mixed at irregular 0.05 to 0.4' alternating intervals with dark yellowish-brown (10YR 4/2) very dolomitic shale containing numerous pyrite films; vuggy dolomite 772.0 to 772.7 lined with euhedral dolomite and pyrite; nodules of pale orange (10YR 7.5/2) to pale yellowish-brown (10YR 6.5/2) chert and siliceous dolomite at 774.0, 775.6, and 779.1.	13.1
46	782.4-784.7 Shale, dark yellowish-brown (10YR 5/2), very dolomitic, very hard; scattered black phosphatic(?) specks and bars; occasional Lingula; gradational above and below.	2.3
47	784.7-787.6 Description as in bed 45	2.9
48	787.6-791.2 Shale, olive gray (5Y 5.5/1 to 5Y 4.5/1), dolomitic, hard; scattered black phosphatic (?) specks and bars; pyrite films numerous; gradational above and below.	3.6
49	791.2-795.7 Dolomite, light olive gray (5Y 6/1) and light olive gray (5Y 5/1), weakly mottled, coarse silt grade, very argillaceous, shaley zones; pyritic films; occasional Lingula; gradational above and below.	4.5
50	795.7-800.1 Dolomite, light olive gray (5Y 6/1) to pale yellowish-brown (10YR 5.5/2), coarse silt to very fine sand grade, very argillaceous to moderately argillaceous; mixed and intercalated with dark yellowish-brown (10YR 4/2) dolomitic and pyritic shale; zone concentrated with 1/2 to 1/4 mm. diameter low-spired gastropods from 796.1 to 796.2 (occasional gastropod throughout interval); trace of phosphatic(?) grains and green clay in bottom 1.8 feet.	4.4
51	←Galena 800.1-815.0 Dolomite, very light olive gray (5Y 7/1) to very pale yellowish-brown (10YR 7/2), very fine to fine sand grade, subhedral to euhedral, slightly calcareous; scattered "cinnamon" (kerogen)	

Bed	Description	Thickness
	flecks (more abundant in top 2 feet); partings and thin bands of moderate brown (5YR 3.5/4) kerogen flakes mixed with greenish-gray (5GY 6/1) clay from 804.4 to 804.5, 804.9 to 805.0, 805.9 to 806.2, 807.0 to 807.1, 807.8 to 808.0, 808.8 to 808.9, at 809.8, and from 811.0 to 811.2; occasional crinoid and brachiopod molds; some pyrite; low to moderate porosity with a few small vugs.	14.9

W-27544

IOWA GEOLOGICAL SURVEY
IOWA CITY, IOWA

Name: Mid-America Pipeline Company, Stratigraphic T. ? No. 4, 1964
Location: NW¼, SE¼, SE¼, Sec. 27, T. 79 N., R. 5 W., Johnson County, Iowa
Elevation of Land Surface: 730.57'
Core Interval: 193' - 815'
Core Description: D. L. Koch, December, 1964

Bed		Description	Thickness
		DEVONIAN	
		Cedar Valley	
	(B.B. Oct 1985)	[redacted]	
1		193-198.6 Dolomite, very light olive gray (5Y 6/1) and medium light gray (N 6), mottled, coarse silt grade, interstitial calcite; slightly to moderately argillaceous, slightly silty, very finely disseminated anhedral pyrite; discontinuous hair-line vertical fractures sealed with calcite; a few internal brachiopod molds, scattered dark yellowish-brown carbonaceous flecks, numerous fragmented scolecodonts; porosity variable, very low to moderate; gradational with bed below.	5.6
MAT 41 (193-194.4)	MEMBER"		
2		198.6-202.8 Dolomite, yellowish-gray (5Y 6.5/2), light olive gray (5Y 6/1), and dark yellowish-brown (10YR3.5/2), mottled, very fine to fine sand grade, very slightly to non-argillaceous, slightly calcareous, very slightly silty; zones of concentrated pyrite hedra; short, discontinuous vertical fractures; fragmented crinoid and brachiopod molds (solution molds); moderate to high porosity, few small vugs (porosity mostly secondary due to solution of fossil fragments); lower 1.8' dominantly dark to pale yellowish-brown (10Y 4/2 to 10Y 6/2); bottom 0.3' very calcareous; gradational with bed above, sharp contact with bed below.	4.2
MAT 42 (199-200.3) P. insita	"ANDALUSIA		
3		202.8-204.7 Limestone, biofragmental, very pale orange (10YR 8.5/2) and pale yellowish-brown (10YR 6/2), mottled, very fine silt grade, dull, earthy, "floating" very fine sand grade dolomite euhedra; fossils include fragmented Atrypa, crinoid ossicles, and corals; low porosity; gradational lower contact.	1.9

Bed		Description	Thickness
4		204.7-207.2 Limestone, very pale orange (10YR 8/2) to pale yellowish-brown (10YR 6/2), fine to very fine silt grade in top 0.4', very fine to fine sand grade below; "floating" very fine sand grade dolomite euhedra; very fossiliferous with comminuted Atrypa and crinoid ossicles; numerous dark yellowish-brown bituminous clay partings from 205.7 to 205.9'; stylolites numerous from 206.0 to 206.3; prominent zone of dusky yellowish-brown highly bituminous limestone with fragmented Atrypa and elongate limestone pebbles from 207.1 to 207.2'.	2.5
5	CORALVILLE MEMBER	207.2-210.8' Limestone, biofragmental, pale yellowish-brown (10YR 5.5/2) and very pale orange (10YR 8/2), mottled, composed of fragmented and comminuted Atrypa and crinoid ossicles cemented with pale yellowish-brown calcite; zones of finer grained, less fossiliferous pale yellowish-brown dolomitic limestone; occasional stylolite; gradational with bed below.	3.6
6		210.8-221.9 Limestone, pale yellowish-brown (10YR 6.5/2 to 10YR 5.5/2), very fine sand to coarse silt grade, very slightly to slightly dolomitic; fossiliferous, with fragmented Atrypa and crinoid ossicles; scattered bituminous clay 210.9 to 212.0'; continuous vertical fracture 211.1 to 212.6'; abundant stylolites.	11.1
7		221.9-229.1 Limestone, biofragmental, pale yellowish-brown (10YR 6.5/2), composed of fragmented and comminuted brachiopods and crinoid ossicles and a few tetracorals; occasional stylolite; numerous dusky yellowish-brown bituminous clay partings.	7.2
		Cedar Valley	
8		229.1-252.8 Limestone, biofragmental, medium light gray (N6) to medium gray (N5), slightly argillaceous; fossils are dark gray and include fragmented and comminuted brachiopods, crinoid ossicles, bryozoa, fish teeth, and large fragments of Acervularia; numerous dark gray clay partings; scattered grains of brilliant green (5G 6/6) glauconitic (?) clay; occasional stylolite; zones of light gray (N 7.5) very	

Bed	Description	Thickness
	fine to fine silt grade less fossiliferous limestone; zones of larger fossil fragments and clastic limestone with extremely abundant wavy clay partings from 243.4 to 244.7'; becoming more argillaceous from 247.7 to 249 with many dark gray clay partings; bottom 1.6' is less fossiliferous; thin to massive.	23.7
9	252.8-269.0 Limestone, light gray (N 6.5), medium to fine silt grade, argillaceous; only slightly fossiliferous with scattered crinoid ossicles, brachiopods, and bryozoa, and a trace of flattened spore carps; zones of increased fossil content 254.4 to 254.5, 265.5 to 257.7, and 260.3 to 261.8; pyrite films common; occasional dark gray clay partings and weak stylolites (more abundant in lower 10'); close irregular fractures from 264.0 to 264.4, some sealed with calcite, some with dark gray clay; slickensides at 265.5, 266.4, and 268.4; massive.	16.2
10	269.0-288.8 Limestone, very light olive gray (5Y 7/1), fine silt grade, slightly argillaceous, mottled with dark gray fossil fragments (crinoid ossicles, brachiopods, bryozoa and corals); long vertical fractures, zones of irregular cross-cutting fractures with wide displacements sealed with calcite; occasional weak stylolite; thick to massive.	19.3
11	288.8-293.6 Limestone, very pale yellowish-brown (10YR 7/2), fine to medium silt grade, slightly dolomitic; slightly fossiliferous, with brown calcite crinoid ossicles and occasional brachiopod; few stylolites; macro-in situ brecciation with wide separations in host rock sealed with calcite (occasional incompletely filled fracture opening lined with euhedral calcite).	4.8
12	293.6-305 Limestone, pale yellowish-brown (10YR 6.5/2 to 10YR 7/2), slightly mottled with medium gray (N 5), medium silt to very fine sand grade, anhedral to subhedral; wavy dark brown bituminous clay partings; slightly to very fossiliferous with abundant crinoid ossicles, coral and	

RAPID MEMBER

SOLON MEMBER

Bed	Description	Thickness
	brachipod fragments; occasional stylolite; finely disseminated pyrite; zones of in situ brecciation with wide displacements sealed with calcite, especially marked at 296.3 to 297.7 and 300.7 to 301.3; thick to massive.	12.4
13	306-313.2 Limestone breccia, macro to micro, variable, composed of angular to subangular fragments of: limestone, very light olive gray (5Y 7/1), fine to medium silt grade, slightly to very dolomitic, subhedral, very dense; and limestone, light gray (N7) to pale yellowish-brown (10YR 6.5/2) sub-lithographic to lithographic, very dense, tough, sharp-edge conchoidal fracture; lithic fragments cemented with limestone, medium to light gray (N5 to N7), with weakly mottled zones of very pale yellowish-brown (10YR 7/2) medium silt to very fine sand grade limestone containing comminuted fossils and medium quartz sand grains; short vertical fractures sealed with calcite; pyritic zones, scattered dark brown and medium dark gray clay bands; brown bituminous interval 307.4 to 307.6; slickenside at 311.2; bottom 4 feet generally argillaceous with increasing amount of quartz sand; wavy medium dark gray shale partings very numerous in lower 1.5 feet.	7.2
14	313.2-318.3 Limestone breccia, composed of angular to subangular lithic fragments of: limestone, very pale yellowish-brown (10YR 7/2) to pale yellowish-brown (10YR 6/2), sub-lithographic to lithographic, anhedral, sharp-edge conchoidal fracture, very dense; cemented with limestone, yellowish-gray (5Y 7.5/1), medium silt grade, subhedral to anhedral, calcitic; numerous stylolites; interval of light bluish-gray (5B 7/1) drusy, chalcedonic chert, rough and vuggy (vugs lined with euhedral quartz and calcite) from 316.2 to 316.7; cement in lower 1.2' is argillaceous and contains numerous medium dark gray wavy clay partings.	5.1
	Wapsipinicon ~~Disconformity~~	
15	318.3-334.1 Limestone, very pale yellowish-brown (10YR 6.5/2) to very pale orange (10YR 8.5/2), lithographic to sublithographic, sharp-edge conchoidal fracture, very dense;	

DAVENPORT MEMBER

Bed	Description	Thickness
	stylolites common in upper part; long vertical fracture 319-320.6; 0.5' seam of olive black, unctuous clay at 322.4; irregular fracturing and slight in situ brecciation 323-324' with openings sealed with calcite; most of unit yields a mild petroliferous odor when pulverized; bottom 1' is less dense, dull, earthy limestone with very closely spaced weak stylolites, and is crowded with ostracod shells; thin to massive.	15.8
	Spring Grove	
16	334.1-337.4 Limestone, pale yellowish-brown (10YR 6.5/2 to 10YR 5.5/2), very fine sand grade, slightly dolomitic at top, grading to calcareous dolomite toward base; numerous weak, closely spaced stylolites lined with dark brown bituminous clay; very strong petroliferous odor when pulverized; three subequal units; gradational below.	3.3
17	337.4-350.7 Dolomite, pale yellowish-brown (10YR 6.2) to grayish-orange (10YR 6/4), very fine sand grade, euhedral, saccahroidal, very slightly to moderately calcareous; moderate to very high porosity; friable zones; upper 3.2 feet shows prominent banding due to closely spaced wavy dark brown bituminous clay partings; very strong petroliferous odor when pulverized; vuggy from 341.1 to 343.5; lower 3.2 feet less porous; thick to massive units.	13.3
	Kenwood	
18	350.7-352.6 Dolomite, medium light gray (N6) and very light gray (N8), mottled, very fine to fine sand grade, slightly calcitic, silty, scattered embedded fine quartz sand grains and fine sand grade medium dark gray chert grains, argillaceous, moderately calcareous; upper 0.5' shows irregular fillings of material identical to that in bed No. 17; lower 0.3' is light yellowish-gray (5Y 8.5/1) medium silt grade calcareous, argillaceous dolomite with very fine to fine quartz sand and chert grains; irregular fractures; numerous stylolites; thin bedded.	1.9

Bed	Description	Thickness
19	352.6-354.2 Dolomite, light gray to medium light gray (N6 to N7), medium silt grade, very silty, small amount of embedded quartz sand and chert grains, slightly to very argillaceous; zone of mixed sandy and cherty limestone and dark gray shale in top 0.5'.	1.6
20	354.2-359.1 Interbedded and mixed: limestone, light gray (N7), fine silt grade, silty, slightly to very sandy, traces of dark chert sand, dolomitic, argillaceous; limestone, very light gray (N8), medium silt grade, very sandy (fine to medium quartz sand), few dark gray chert grains, abundant euhedral calcite; and shale, medium light gray (N6) to medium dark gray (N4), dolomitic to calcareous, interbedded and intercalated with above lithologies.	4.9
21	359.1-362.6 Dolomite, medium gray (N5) and light gray (N7), mottled, medium to fine silt grade, very calcareous, silty, argillaceous, shaley zones; bottom 0.2' banded with medium gray, light gray, and very pale yellowish-brown argillaceous dolomite.	3.5
	SILURIAN Niagaran Gower-Hopkinton	
22	362.6-382.9 Dolomite, medium light gray (N6) to very pale orange (10YR 7.5/2), fine to medium sand grade, sub to euhedral, very slightly calcareous; moderate to high porosity, vuggy, with scalenohedral calcite lining vugs; occasional stylolite; brecciated 364.5 to 365.2 with a matrix of mixed greenish-gray (5GY 6.5/1) clay and coarse sand grade dolomite euhedra; thick to massive units.	20.3
23	382.9-392.7 Dolomite, medium gray (N5) and pale yellowish-brown (10YR 6.5/2), mottled, coarse silt to very fine sand grade, subhedral to anhedral, highly fractured and broken with fractures and pockets filled with very sandy (very fine to medium) pale yellowish-green (10GY 6.5/2) pyritic clay.	9.8

Bed	Description	Thickness
24	392.7–404.5 Cavern fill (karst): 392.7–397.8 Mixed light greenish-gray (5GY 8.5/1) and dark reddish-brown (10R 2.5/4) very sandy (coarse to fine) clay. 397.8–404.5 Greenish-gray (5GY 6.5/1) clay, very sandy (very fine to coarse), pyritic; Portions of cavern wall show dolomite, very pale orange (10YR 7.5/2) to grayish-orange pink (5YR 7/2), medium silt grade, very dense, very hard.	11.8
25	404.5–425.8 Dolomite, yellowish-orange (5Y 8/1) to very light olive gray (5Y 7/1), medium silt grade, slightly calcareous, very tough; disseminated grains and small aggregate growths of pyrite; numerous greenish-gray clay partings and fracture fillings (the clay is slightly to very sandy and pyritic); low to high porosity (secondary porosity due to solution of fossil fragments--mostly crinoid ossicles); stylolites rare; massive.	21.3
26	425.8–492.5 Dolomite, light gray (N7) to yellowish-gray (5Y 8/1), coarse silt grade, subhedral; moderate to very high porosity (secondary due to solution of fossil fragments), vuggy, with euhedral dolomite lining pore spaces and vugs; short vertical fractures in upper 4 feet; stylolites rare; fractured and broken zones filled with sandy green clay from 465.4 to 467.7, 471.4 to 472.6, 475.5 to 476.2, and 478.0 to 478.7; open vugs lined with aggregate growths of euhedral quartz at 476.5, 480.0, 481.0, 483–486, 487.0, and 490.1; massive to thick units.	66.7
27	492.5–511.1 Dolomite, medium light gray (N6.5) (dominant) to yellowish-gray (5Y 8.5/1), medium silt grade, subhedral to anhedral, dense, very hard; moderate to very high porosity, few small vugs; zones of mixed pale green clay; very fossiliferous (solution molds) with crinoid ossicles, Cypidula, and bryozoan; small vugs lined with aggregate growths of euhedral quartz at 494.0, 495.7, 497.8, 503.3, 504.4, and 508.7; small amount of disseminated pyrite; open vertical fracture 509.4 to 510.3; stylolites rare; massive.	18.6

Bed	Description	Thickness
28	511.1-518.8 Dolomite, medium light gray to light olive gray (5GY 6.5/1) and yellowish-gray (5Y 8.5/1), medium to coarse silt grade, subhedral to anhedral; very hard; moderate to very high porosity (secondary); crowded with large internal molds of Pentamerus; wavy partings of green sandy clay at 514.5; traces of white tripolitic chert and occasional small vug and bedding plane lined with drusy chert and quartz in lower 4'; bottom 1.5' has numerous green clay partings.	7.7
	Alexandrian Kankakee	
29	518.8-562.2 Dolomite, light gray (N7) to very light yellowish-orange (5Y 8.5/1), medium to coarse silt grade, subhedral to anhedral; very hard; cherty, with abundant nodular white, soft, tripolitic and smooth fossiliferous chert; silicified Halysites and Favosites in upper part; few small vugs lined with euhedral quartz; irregular fracture filled with sandy green clay at 519.7, 521.2, 537.7, and 553.6; bedded chert 563.2-563.8; numerous wavy green clay partings in lower part; generally low to moderate porosity; thick to massive.	43.4
	Edgewood?	
30	562.2-569.0 Dolomite, yellowish-gray (5Y 8/1), medium silt grade, subhedral, dense; scattered moderate green (5G 5/6) soft glauconite (?) grains; some very finely disseminated pyrite; small vug lined with euhedral quartz at base; very gradational lower contact.	1.8
	ORDOVICIAN Maquoketa Brainard	
31	569.0-570.4 Shale, light gray to very light olive gray (N7 to 5Y 6/1), dolomitic, mixed and mottled with yellowish-gray (5Y 8/1) coarse silt grade dolomite containing abundant finely disseminated pyrite; becoming more argillaceous toward base.	1.4

Bed	Description	Thickness
32	570.4-571.0 Shale, light olive gray (5Y 6.5/1), greenish-gray (5GY 7/1), and olive gray (5Y 4.5/1), mixed and intercalated, slightly dolomitic; abundant whole and fragmented phosphatic Lingula and very abundant scattered black phosphatic (?) flakes.	0.6
33	571.0-574.7 Shale, light olive gray (5Y 6.5/1), slightly to moderately dolomitic, mixed and mottled with irregular thin stringers of yellowish-gray (5Y 8/1) coarse silt grade argillaceous dolomite; abundant Lingula and scattered black phosphatic (?) flakes; very finely disseminated pyrite; dolomite stringers less abundant in lower part.	3.7
34	574.7-581.7 Shale, greenish-gray (5G 6.5/1), dolomitic, very uniform in color and composition; Lingula very common; some finely disseminated pyrite.	7.0
35	581.7-603.8 Shale, as in bed 32 with olive gray (5Y 4.5/1) the dominant color; harder, more dolomitic zones; bottom 0.2' is dolomite, light olive gray (5Y 5.5/1), coarse silt to fine sand grade, very argillaceous, pyritic, and is crowded with fragmented Lingula, rounded phosphatic pellets up to 1 mm. in diameter, and fragmented trilobite spines.	22.1
[illegible]	603.8-604.3 Dolomite, medium dark gray (N4) and medium light gray (N6), mottled, very fine sand to coarse silt grade, subhedral, argillaceous, pyritic zones; mixed with wavy partings and lenses of light olive gray (5Y 6/1) dolomitic shale; scattered small vugs lined with dolomite euhedra.	0.5
37	604.3-605.5 Shale, light olive gray (5Y 6.5/1), and greenish gray (5GY 6.5/1), mixed and mottled, very dolomitic; irregular partings and lenses of medium dark gray (N4) and medium light gray (N6) mottled coarse silt grade dolomite; Lingula and pyritized high-spired gastropods common; dolomite more prominent in lower 0.5'.	
38	605.5-606.6 Dolomite as in bed 36, porous, and with more numerous and larger vugs.	0.9

Bed	Description	Thickness
39	606.6-635.6 Shale, greenish-gray (5G 6.5/1), moderately to very dolomitic, very hard; occasional Lingula, scattered trilobite spines, and black phosphatic(?) flakes, zone of mottled medium dark gray (N4) and medium light gray (N6) argillaceous and shaley dolomite with a few phosphatic pellets from 611.8 to 612.6.	29.2
	Fort Atkinson	
40	635.6-654.7 Dolomite, medium dark gray (N4) and medium light gray (N6), mottled, medium to coarse silt grade, argillaceous shaley, some pyrite; dominantly greenish-gray (5G 6.5/1) dolomitic shale below 645.3.	19.1
41	654.7-748.7 Shale, greenish-gray (5G 6.5/1) to light olive gray (5Y 5.5/1), very dolomitic in top 12 feet, moderately dolomitic below, hard, very uniform; scattered black phosphatic (?) flakes.	94.0
	Elgin	
42	748.7-751.8 Dolomite, pale yellowish-brown (10YR 5.5/2) weakly mottled with light olive gray (5Y 5.5/1), coarse silt grade, subhedral, extremely argillaceous, medium soft; crowded with low-spired gastropods averaging 1/2 mm. in diameter, abundant Lingula fragments; numerous pyrite films.	3.1
43	751.8-757.3 Shale, light olive gray (5Y 5.5/1), very dolomitic, hard; some disseminated pyrite and dark clayey pyritic films; few black phosphatic (?) flakes; gradational below.	5.5
44	757.3-769.3 Shale, olive gray (5Y 3/1), moderately to very dolomitic; abundant pyrite films; scattered Lingula fragments and trilobite spines; occasional 1/4 mm. phosphatic pellets; grades to pale yellowish-brown (10YR 5.5/2) very argillaceous coarse silt grade dolomite from 761.2 to 762.7, 763.8 to 764.7, and 765.2 to 768.3.	12.0

Bed	Description	Thickness
45	769.3-782.4 Dolomite, pale yellowish-brown (10YR 6/2) to dark yellowish-brown (10YR 4.5/2), coarse silt grade, anhedral to subhedral, very slightly to moderately argillaceous; interbedded and mixed at irregular 0.05 to 0.4' alternating intervals with dark yellowish-brown (10YR 4/2) very dolomitic shale containing numerous pyrite films; vuggy dolomite 772.0 to 772.7 lined with euhedral dolomite and pyrite; nodules of pale orange (10YR 7.5/2) to pale yellowish-brown (10YR 6.5/2) chert and siliceous dolomite at 774.0, 775.6, and 779.1.	13.1
46	782.4-784.7 Shale, dark yellowish-brown (10YR 5/2), very dolomitic, very hard; scattered black phosphatic(?) specks and bars; occasional Lingula; gradational above and below.	2.3
47	784.7-787.6 Description as in bed 45	2.9
48	787.6-791.2 Shale, olive gray (5Y 3.5/1 to 5Y 4.5/1), dolomitic, hard; scattered black phosphatic (?) specks and bars; pyrite films numerous; gradational above and below.	3.6
49	791.2-795.7 Dolomite, light olive gray (5Y 6/1) and light olive gray (5Y 5/1), weakly mottled, coarse silt grade, very argillaceous, shaley zones; pyritic films; occasional Lingula; gradational above and below.	4.5
50	795.7-800.1 Dolomite, light olive gray (5Y 6/1) to pale yellowish-brown (10YR 5.5/2), coarse silt to very fine sand grade, very argillaceous to moderately argillaceous; mixed and intercalated with dark yellowish-brown (10YR 4/2) dolomitic and pyritic shale; zone concentrated with 1/2 to 1/4 mm. diameter low-spired gastropods from 796.1 to 796.2 (occasional gastropod throughout interval); trace of phosphatic(?) grains and green clay in bottom 1.8 feet.	4.4
	← Galena	
51	800.1-815.0 Dolomite, very light olive gray (5Y 7/1) to very pale yellowish-brown (10YR 7/2), very fine to fine sand grade, subhedral to euhedral, slightly calcareous; scattered "cinnamon" (kerogen)	

Bed	Description	Thickness
	flecks (more abundant in top 2 feet); partings and thin bands of moderate brown (5YR 3.5/4) kerogen flakes mixed with greenish-gray (5GY 6/1) clay from 804.4 to 804.5, 804.9 to 805.0, 805.9 to 806.2, 807.0 to 807.1, 807.8 to 808.0, 808.8 to 809.9, at 809.8, and from 811.0 to 811.2; occasional crinoid and brachiopod molds; some pyrite; low to moderate porosity with a few small vugs.	14.9

MAT #4 Conodont Samples

	MAT 41		
	MAT 42		
208.3	MAT 43	205.0 - 205.8	→ OVER
CORALVILLE	MAT 44	209.0 - 209.8	
	MAT 45	212.2 - 212.8	
	MAT 46	215.0 - 215.0	
	MAT 47	221.3 - 221.9	
	MAT 48	225.8 - 226.4	→ OVER
229.5			
RAPID	MAT 49	229.9 - 230.6	

MAT 43A 207.3 - 207.9

MAT 48A 227.0 - 227.8

27544

State of Iowa

IOWA NATURAL RESOURCES COUNCIL

Drilling Permit

Permit No. 26 Lease Name Mid-America Pipeline Co.

Date Issued October 28, 1964 Well No. #4

Permission is hereby granted to Fenix & Scisson, Inc., 3905 E. 15th Street, Tulsa 12, Oklahoma, to drill a well for stratigraphic test located SE¼ Sec. 27, T. 79, R. 5 W., Johnson County, Iowa

This permit is granted subject to the provisions of Chapter 84, Code of Iowa, 1962, as amended, and the rules, regulations, requirements, and orders of the Iowa Natural Resources Council and the State Geologist.

H. Garland Hershey
STATE GEOLOGIST

© OGES 7481-

FORM OG-1
9-18-63

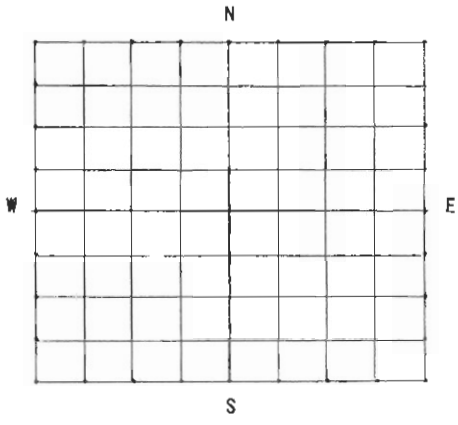
CP-34952

STATE OF IOWA

Iowa Natural Resources Council

APPLICATION TO DRILL OR DEEPEN A WELL FOR OIL, GAS, GEOLOGICAL INFORMATION, STORAGE OF DRY NATURAL GAS OR LIQUID PETROLEUM GAS

FILE WITH: STATE GEOLOGIST, GEOLOGICAL SURVEY BUILDING, IOWA CITY, IOWA 52240



LOCATE WELL AND LEASE ACCURATELY ON THIS SECTION PLAT — 640 ACRES

1. APPLICATION IS MADE TO DRILL A WELL FOR: STRATIGRAPHIC TEST

2. ENCLOSED FEE:

3. LESSEE (OWNER OF LEASE RIGHTS) Fenix & Scisson, Inc.

4. ADDRESS 5805 E. 15th Street-Tulsa, Oklahoma

5. PHONE TE5-9471

6. LESSOR (OWNER OF LAND) Mid-America Pipeline Co.

7. WELL NO. 4

8. DRILLING CONTRACTOR E. J. Longyear Company

9. ADDRESS 76 South 8th St.-Minneapolis, Minn.

10. PHONE FE9-7631

11. OPERATOR

12. ADDRESS

13. PHONE

14. WELL LOCATION: NE, NW, SE, SE ¼ of ¼ of SE ¼, SEC. 27 T. 79 N., R. 5 W

15. COUNTY Johnson

16. ACRES IN DRILLING LEASE 17

17. ELEVATION (GR., D.F., R.T., K.B., ETC.) 730.57

18. LOCATE WELL IN TWO DIRECTIONS FROM NEAREST LINES OF QUARTER SECTION, AND PROPERTY OWNERSHIP LINES:

1320 FT. FROM north of (NORTH-SOUTH) LINE OF ¼ SEC. 748' FT. FROM west of (EAST-WEST) LINE OF ¼ SEC.

50 FT. FROM north (NORTH-SOUTH) PROPERTY LINE 748' FT. FROM east (EAST-WEST) PROPERTY LINE

19. NUMBER OF FEET FROM NEAREST PRODUCING WELL

20. KIND OF TOOLS TO BE USED (CABLE, ROTARY, COMB.) Rotary

21. WELL IS TO BE COMPLETED IN (FORMATION) Galena

22. INTENDED DEPTH OF WELL 800'

23. INTENDED STARTING DATE 11-2-64

24. PROGRAM OF CASING, SEALING, AND COMPLETING WELL WILL BE SUBMITTED WHEN DETERMINED

25. ADDRESS CORRESPONDENCE AND PERMIT TO: Fenix & Scisson, Inc., 5805 E. 15th Street, Tulsa 12, Oklahoma

Applicant agrees to comply with provisions of Chapter 84, Iowa Code 1962, as amended and Rules and Regulations pertaining to the Location, Drilling, Casing, Sealing, Completing, Producing, and Plugging of Wells; and agrees to furnish complete samples, cores, and logs.

Fenix & Scisson, Inc.
(LESSEE OR OPERATOR)

Stanley B. Radack Geologist
(SIGNATURE) (TITLE)

STATE OF Iowa)
)SS.
COUNTY OF Johnson)

Before me, the undersigned, a Notary Public in and for the County and State aforesaid, on this day personally appeared Stanley B. Radack *known to me to be the person whose name is subscribed to the above instrument, who being by me duly sworn on oath states that he is duly authorized to make the above application and that he has knowledge of the facts stated therein and that the facts stated in said application are true and correct:*

Subscribed and sworn to before me this 28 *day of* October, 1964.

Notary Public in and for Johnson County, Iowa

My Commission expires My commission expires 7/4/66

John A. Yocolony
NOTARY PUBLIC

FORM OG-1
9-18-63

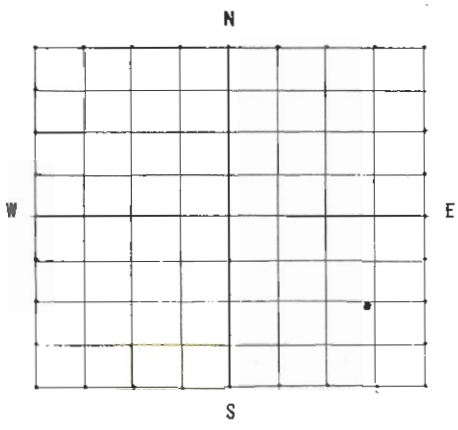
CP-34952

STATE OF IOWA

Iowa Natural Resources Council

APPLICATION TO DRILL OR DEEPEN A WELL FOR OIL, GAS, GEOLOGICAL INFORMATION, STORAGE OF DRY NATURAL GAS OR LIQUID PETROLEUM GAS

FILE WITH: STATE GEOLOGIST, GEOLOGICAL SURVEY BUILDING, IOWA CITY, IOWA 52240



LOCATE WELL AND LEASE ACCURATELY ON THIS SECTION PLAT — 640 ACRES

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4. ADDRESS: **5805 E. 15th Street-Tulsa, Oklahoma**

5. PHONE: **TE5-9471**

6. LESSOR (OWNER OF LAND): **Mid-America Pipeline Co.**

7. WELL NO.: **4**

8. DRILLING CONTRACTOR: **E. J. Longyear Company**

9. ADDRESS: **76 South 8th St.-Minneapolis, Minn.**

10. PHONE: **FE9-7631**

11. OPERATOR

12. ADDRESS

13. PHONE

14. WELL LOCATION: NE, NW, SE SE ¼ of ¼ of SE ¼, SEC. 27 T. 79 N., R. 5 W

15. COUNTY: **Johnson**

16. ACRES IN DRILLING LEASE: **17**

17. ELEVATION (GR., D.F., R.T., K.B., ETC.): **730-57**

18. LOCATE WELL IN TWO DIRECTIONS FROM NEAREST LINES OF QUARTER SECTION, AND PROPERTY OWNERSHIP LINES:

1320 FT. FROM north of (NORTH-SOUTH) LINE OF ¼ SEC. 748' FT. FROM west of (EAST-WEST) LINE OF ¼ SEC.

50 FT. FROM north (NORTH-SOUTH) PROPERTY LINE 748' FT. FROM east (EAST-WEST) PROPERTY LINE

19. NUMBER OF FEET FROM NEAREST PRODUCING WELL

20. KIND OF TOOLS TO BE USED (CABLE, ROTARY, COMB.): **Rotary**

21. WELL IS TO BE COMPLETED IN (FORMATION): **Galena**

22. INTENDED DEPTH OF WELL: **800'**

23. INTENDED STARTING DATE: **11-2-64**

24. PROGRAM OF CASING, SEALING, AND COMPLETING WELL WILL BE SUBMITTED WHEN DETERMINED

25. ADDRESS CORRESPONDENCE AND PERMIT TO: **Fenix & Scisson, Inc., 5805 E. 15th Street, Tulsa 12, Oklahoma**

Applicant agrees to comply with provisions of Chapter 84, Iowa Code 1962, as amended and Rules and Regulations pertaining to the Location, Drilling, Casing, Sealing, Completing, Producing, and Plugging of Wells; and agrees to furnish complete samples, cores, and logs.

Fenix & Scisson, Inc.
(LESSEE OR OPERATOR)

STATE OF Iowa)
)SS.
COUNTY OF Johnson)

/s/ Stanley B. Radacke Geologist
(SIGNATURE) (TITLE)

Before me, the undersigned, a Notary Public in and for the County and State aforesaid, on this day personally appeared Stanley B. Radacke *known to me to be the person whose name is subscribed to the above instrument, who being by me duly sworn on oath states that he is duly authorized to make the above application and that he has knowledge of the facts stated therein and that the facts stated in said application are true and correct:*

Subscribed and sworn to before me this 28 *day of* October, 1964.

Notary Public in and for Johnson County, Iowa

My Commission expires My commission expires 7/4/66

/s/ John A. Novotny
NOTARY PUBLIC

#27544

State of Iowa

IOWA NATURAL RESOURCES COUNCIL

Drilling Permit

Permit No. 26 Lease Name Mid-America Pipeline Co.

Date Issued October 28, 1964 Well No. #4

Permission is hereby granted to Fenix & Scisson, Inc., 5805 E. 15th Street, Tulsa 12, Oklahoma, to drill a well for stratigraphic test located SE¼ Sec. 27, T. 79, R. 5 W., Johnson County, Iowa

This permit is granted subject to the provisions of Chapter 84, Code of Iowa, 1962, as amended, and the rules, regulations, requirements, and orders of the Iowa Natural Resources Council and the State Geologist.

H. Garland Hershey
STATE GEOLOGIST

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LITHO IN U.S.A.

FORM OG-1
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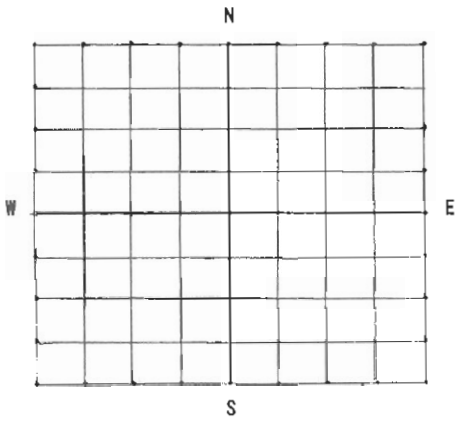
STATE OF IOWA

#27

Iowa Natural Resources Council

APPLICATION TO DRILL OR DEEPEN A WELL FOR OIL, GAS, GEOLOGICAL INFORMATION, STORAGE OF DRY NATURAL GAS OR LIQUID PETROLEUM GAS

FILE WITH: STATE GEOLOGIST, GEOLOGICAL SURVEY BUILDING, IOWA CITY, IOWA 52240



LOCATE WELL AND LEASE ACCURATELY ON THIS SECTION PLAT — 640 ACRES

1. APPLICATION IS MADE TO DRILL A WELL FOR: STRATIGRAPHIC TEST

2. ENCLOSED FEE:

3. LESSEE (OWNER OF LEASE RIGHTS): Fenix & Scisson, Inc.

4. ADDRESS: 5805 E. 15th Street-Tulsa, Oklahoma

5. PHONE: TE5-9471

6. LESSOR (OWNER OF LAND): Mid-America Pipeline Co.

7. WELL NO.: 4

8. DRILLING CONTRACTOR: E. J. Longyear Company

9. ADDRESS: 76 South 8th St.-Minneapolis, Minn.

10. PHONE: FE9-7631

11. OPERATOR

12. ADDRESS

13. PHONE

14. WELL LOCATION: NE, NW, SE, SE ¼ of ¼ of SE ¼, SEC. 27 T. 79 N., R. 5 W

15. COUNTY: Johnson

16. ACRES IN DRILLING LEASE: 17

17. ELEVATION (GR., D.F., R.T., K.B., ETC.): 730.57

18. LOCATE WELL IN TWO DIRECTIONS FROM NEAREST LINES OF QUARTER SECTION, AND PROPERTY OWNERSHIP LINES:

1320 FT. FROM north of (NORTH-SOUTH) LINE OF ¼ SEC. — 748' FT. FROM west of (EAST-WEST) LINE OF ¼ SEC.

50 FT. FROM north (NORTH-SOUTH) PROPERTY LINE — 748' FT. FROM east (EAST-WEST) PROPERTY LINE

19. NUMBER OF FEET FROM NEAREST PRODUCING WELL

20. KIND OF TOOLS TO BE USED (CABLE, ROTARY, COMB.): Rotary

21. WELL IS TO BE COMPLETED IN (FORMATION): Galena

22. INTENDED DEPTH OF WELL: 800'

23. INTENDED STARTING DATE: 11-2-64

24. PROGRAM OF CASING, SEALING, AND COMPLETING WELL WILL BE SUBMITTED WHEN DETERMINED

25. ADDRESS CORRESPONDENCE AND PERMIT TO:
Fenix & Scisson, Inc., 5805 E. 15th Street, Tulsa 12, Oklahoma

Applicant agrees to comply with provisions of Chapter 84, Iowa Code 1962, as amended and Rules and Regulations pertaining to the Location, Drilling, Casing, Sealing, Completing, Producing, and Plugging of Wells; and agrees to furnish complete samples, cores, and logs.

Fenix & Scisson, Inc.
(LESSEE OR OPERATOR)

STATE OF Iowa)
)SS.
COUNTY OF Johnson)

Stanley B. Radacke (SIGNATURE) Geologist (TITLE)

Before me, the undersigned, a Notary Public in and for the County and State aforesaid, on this day personally appeared Stanley B. Radacke *known to me to be the person whose name is subscribed to the above instrument, who being by me duly sworn on oath states that he is duly authorized to make the above application and that he has knowledge of the facts stated therein and that the facts stated in said application are true and correct:*

Subscribed and sworn to before me this 28 *day of* October, 1964.

Notary Public in and for Johnson County, Iowa

My Commission expires ~~My commission expires 7/4/66~~

John A. Moratny
NOTARY PUBLIC

T.F Underground Storage

7544

December 17, 1964

Mr. Jose Machado
Fenix & Scisson, Inc.
5805 East 15th Street
Tulsa, Oklahoma

Dear Mr. Machado:

Copies of the data on the Mid-America Terminal stratigraphic test core program have been forwarded to you under separate cover as follows:

1. Sepia copies of electric logs and gamma ray logs on tests No. 2, 3, and 4.

2. Descriptive lithologic log of test No. 3.

You will receive copies of the descriptive lithologic logs for tests No. 2 and 3 when they are completed. It is understood that none of these data will be reproduced or used without proper credit being given to the Iowa Geological Survey.

The cores will be maintained as a part of the Survey's permanent rock library and will be available for any future study that may be desired. All data will be held as confidential for a period of six (6) months (or for an additional period of one (1) year if requested in writing) but may be placed on open file before the termination of that period if it is released by written authorization from your office.

The cores represent a very valuable addition to our store of information on the geology of Iowa. It has been a pleasure to work with you on this project, and if I can be of other service to you, please feel free to call on me.

Very truly yours,

H. G. Hershey

HGH-DLK/l

#27544

IOWA GEOLOGICAL SURVEY
IOWA CITY, IOWA

Name: Mid-America Pipeline Company, Stratigraphic Test No. 4, 1964
Location: NW¼, SE¼, SE¼, Sec. 27, T. 79 N., R. 5 W., Johnson County, Iowa
Elevation of Land Surface: 730.57'
Core Interval: 193' - 815'
Core Description: D. L. Koch, December, 1964

Bed	Description	Thickness
	DEVONIAN Cedar Valley Rapid 193-198.6 Dolomite, very light olive gray (5Y 6/1) and medium light gray (N 6), mottled, coarse silt grade, interstitial calcite; slightly to moderately argillaceous, slightly silty, very finely disseminated anhedral pyrite; discontinuous hair-line vertical fractures sealed with calcite; a few internal brachipod molds, scattered dark yellowish-brown carbonaceous flecks, numerous fragmented scolecodonts; porosity variable, very low to moderate; gradational with bed below.	5.6
	198.6-202.8 Dolomite, yellowish-gray (5Y 6.5/2), light olive gray (5Y 6/1), and dark yellowish-brown (10YR3.5/2), mottled, very fine to fine sand grade, very slightly to non-argillaceous, slightly calcareous, very slightly silty; zones of concentrated pyrite hedra; short, discontinuous vertical fractures; fragmented crinoid and brachiopod molds (solution molds); moderate to high porosity, few small vugs (porosity mostly secondary due to solution of fossil fragments); lower 1.8' dominantly dark to pale yellowish-brown (10Y 4/2 to 10Y 6/2); bottom 0.3' very calcareous; gradational with bed above, sharp contact with bed below.	4.2
	202.8-204.7 Limestone, biofragmental, very pale orange (10YR 8.5/2) and pale yellowish-brown (10YR 6/2), mottled, very fine silt grade, dull, earthy, "floating" very fine sand grade dolomite euhedra; fossils include fragmented Atrypa, crinoid ossicles, and corals; low porosity; gradational lower contact.	1.9

Bed	Description	Thickness
4	204.7-207.2 Limestone, very pale orange (10YR 8/2) to pale yellowish-brown (10YR 6/2), fine to very fine silt grade in top 0.4', very fine to fine sand grade below; "floating" very fine sand grade dolomite euhedra; very fossiliferous with comminuted Atrypa and crinoid ossicles; numerous dark yellowish-brown bituminous clay partings from 205.7 to 205.9'; stylolites numerous from 206.0 to 206.3; prominent zone of dusky yellowish-brown highly bituminous limestone with fragmented Atrypa and elongate limestone pebbles from 207.1 to 207.2'.	2.5
3	207.2-210.8' Limestone, biofragmental, pale yellowish-brown (10YR 5.5/2) and very pale orange (10YR 8/2), mottled, composed of fragmented and comminuted Atrypa and crinoid ossicles cemented with pale yellowish-brown calcite; zones of finer grained, less fossiliferous pale yellowish-brown dolomitic limestone; occasional stylolite; gradational with bed below.	3.6
5	210.8-221.9 Limestone, pale yellowish-brown (10YR 6.5/2 to 10YR 5.5/2), very fine sand to coarse silt grade, very slightly to slightly dolomitic; fossiliferous, with fragmented Atrypa and crinoid ossicles; scattered bituminous clay 210.9 to 212.0'; continuous vertical fracture 211.1 to 212.6'; abundant stylolites.	11.1
7	221.9-229.1 Limestone, biofragmental, pale yellowish-brown (10YR 6.5/2), composed of fragmented and comminuted brachiopods and crinoid ossicles and a few tetracorals; occasional stylolite; numerous dusky yellowish-brown bituminous clay partings.	7.2
	Cedar Valley Solon	
1	229.1-252.8 Limestone, biofragmental, medium light gray (N6) to medium gray (N5), slightly argillaceous; fossils are dark gray and include fragmented and comminuted brachiopods, crinoid ossicles, bryozoa, fish teeth, and large fragments of Acervularia; numerous dark gray clay partings; scattered grains of brilliant green (5G 6/6) glauconitic (?) clay; occasional stylolite; zones of light gray (N 7.5) very	

Bed	Description	Thickness
	fine to fine silt grade less fossiliferous limestone; zone of larger fossil fragments and clastic limestone with extremely abundant wavy clay partings from 243.4 to 244.7'; becoming more argillaceous from 247.7 to 249 with many dark gray clay partings; bottom 1.8' is less fossiliferous; thin to massive.	23.7
9	252.8-269.0 Limestone, light gray (N 6.5), medium to fine silt grade, argillaceous; only slightly fossiliferous with scattered crinoid ossicles, brachiopods, and bryozoa, and a trace of flattened spore carps; zones of increased fossil content 254.4 to 254.5, 265.5 to 257.7, and 260.3 to 261.8; pyrite films common; occasional dark gray clay partings and weak stylolites (more abundant in lower 10'); close irregular fractures from 264.0 to 264.4, some sealed with calcite, some with dark gray clay; slickensides at 265.5, 266.4, and 268.4; massive.	16.2
10	269.0-288.8 Limestone, very light olive gray (5Y 7/1), fine silt grade, slightly argillaceous, mottled with dark gray fossil fragments (crinoid ossicles, brachiopods, bryozoa and corals); long vertical fractures, zones of irregular cross-cutting fractures with wide displacements sealed with calcite; occasional weak stylolite; thick to massive.	19.8
11	288.8-293.6 Limestone, very pale yellowish-brown (10YR 7/2), fine to medium silt grade, slightly dolomitic; slightly fossiliferous, with brown calcite crinoid ossicles and occasional brachiopod; few stylolites; macro-in situ brecciation with wide separations in host rock sealed with calcite (occasional incompletely filled fracture opening lined with euhedral calcite).	4.8
12	293.6-306 Limestone, pale yellowish-brown (10YR 6.5/2 to 10YR 7/2), slightly mottled with medium gray (N 5), medium silt to very fine sand grade, anhedral to subhedral; wavy dark brown bituminous clay partings; slightly to very fossiliferous with abundant crinoid ossicles, coral and	

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Bed	Description	Thickness
	brachiopod fragments; occasional stylolite; finely disseminated pyrite; zones of in situ brecciation with wide displacements sealed with calcite, especially marked at 296.3 to 297.7 and 300.7 to 301.3; thick to massive.	12.4
13	306-313.2 Limestone breccia, macro to micro, variable, composed of angular to subangular fragments of: limestone, very light olive gray (5Y 7/1), fine to medium silt grade, slightly to very dolomitic, subhedral, very dense; and limestone, light gray (N7) to pale yellowish-brown (10YR 6.5/2) sub-lithographic to lithographic, very dense, tough, sharp-edge conchoidal fracture; lithic fragments cemented with limestone, medium to light gray (N5 to N7), with weakly mottled zones of very pale yellowish-brown (10YR 7/2) medium silt to very fine sand grade limestone containing comminuted fossils and medium quartz sand grains; short vertical fractures sealed with calcite; pyritic zones, scattered dark brown and medium dark gray clay bands; brown bituminous interval 307.4 to 307.6; slickenside at 311.2; bottom 4 feet generally argillaceous with increasing amount of quartz sand; wavy medium dark gray shale partings very numerous in lower 1.5 feet.	7.2
14	313.2-318.3 Limestone breccia, composed of angular to subangular lithic fragments of: limestone, very pale yellowish-brown (10YR 7/2) to pale yellowish-brown (10YR 6/2), sub-lithographic to lithographic, anhedral, sharp-edge conchoidal fracture, very dense; cemented with limestone, yellowish-gray (5Y 7.5/1), medium silt grade, subhedral to anhedral, calcitic; numerous stylolites; interval of light bluish-gray (5B 7/1) drusy, chalcedonic chert, rough and vuggy (vugs lined with euhedral quartz and calcite) from 316.2 to 316.7; cement in lower 1.2' is argillaceous and contains numerous medium dark gray wavy clay partings.	5.1
	Wapsipinicon Davenport	
15	318.3-334.1 Limestone, very pale yellowish-brown (10YR 6.5/2) to very pale orange (10YR 8.5/2), lithographic to sublithographic, sharp-edge conchoidal fracture, very dense;	

Bed	Description	Thickness
	stylolites common in upper part; long vertical fracture 319-320.6; 0.5' seam of olive black, unctuous clay at 322.4; irregular fracturing and slight in situ brecciation 323-324' with openings sealed with calcite; most of unit yields a mild petroliferous odor when pulverized; bottom 1' is less dense, dull, earthy limestone with very closely spaced weak stylolites, and is crowded with ostracod shells; thin to massive.	15.8
	Spring Grove	
16	334.1-337.4 Limestone, pale yellowish-brown (10YR 6.5/2 to 10YR 5.5/2), very fine sand grade, slightly dolomitic at top, grading to calcareous dolomite toward base; numerous weak, closely spaced stylolites lined with dark brown bituminous clay; very strong petroliferous odor when pulverized; three subequal units; gradational below.	3.3
17	337.4-350.7 Dolomite, pale yellowish-brown (10YR 6.2) to grayish-orange (10YR 6/4), very fine sand grade, euhedral, saccahroidal, very slightly to moderately calcareous; moderate to very high porosity; friable zones; upper 3.2 feet shows prominent banding due to closely spaced wavy dark brown bituminous clay partings; very strong petroliferous odor when pulverized; vuggy from 341.1 to 343.5; lower 3.2 feet less porous; thick to massive units.	13.3
	Kenwood	
18	350.7-352.6 Dolomite, medium light gray (N6) and very light gray (N8), mottled, very fine to fine sand grade, slightly calcitic, silty, scattered embedded fine quartz sand grains and fine sand grade medium dark gray chert grains, argillaceous, moderately calcareous; upper 0.5' shows irregular fillings of material identical to that in bed No. 17; lower 0.3' is light yellowish-gray (5Y 8.5/1) medium silt grade calcareous, argillaceous dolomite with very fine to fine quartz sand and chert grains; irregular fractures; numerous stylolites; thin bedded.	1.9

1544

Bed	Description	Thickness
19	352.6-354.2 Dolomite, light gray to medium light gray (N6 to N7), medium silt grade, very silty, small amount of embedded quartz sand and chert grains, slightly to very argillaceous; zone of mixed sandy and cherty limestone and dark gray shale in top 0.5'.	1.6
20	354.2-359.1 Interbedded and mixed: limestone, light gray (N7), fine silt grade, silty, slightly to very sandy, traces of dark chert sand, dolomitic, argillaceous; limestone, very light gray (N8), medium silt grade, very sandy (fine to medium quartz sand), few dark gray chert grains, abundant euhedral calcite; and shale, medium light gray (N6) to medium dark gray (N4), dolomitic to calcareous, interbedded and intercalated with above lithologies.	4.9
21	359.1-362.6 Dolomite, medium gray (N5) and light gray (N7), mottled, medium to fine silt grade, very calcareous, silty, argillaceous, shaley zones; bottom 0.2' banded with medium gray, light gray, and very pale yellowish-brown argillaceous dolomite.	3.5
	SILURIAN Niagaran Gower-Hopkinton	
22	362.6-382.9 Dolomite, medium light gray (N6) to very pale orange (10YR 7.5/2), fine to medium sand grade, sub to euhedral, very slightly calcareous; moderate to high porosity, vuggy, with scalenohedral calcite lining vugs; occasional stylolite; brecciated 364.5 to 365.2 with a matrix of mixed greenish-gray (5GY 6.5/1) clay and coarse sand grade dolomite euhedra; thick to massive units.	20.3
23	382.9-392.7 Dolomite, medium gray (N5) and pale yellowish-brown (10YR 6.5/2), mottled, coarse silt to very fine sand grade, subhedral to anhedral, highly fractured and broken with fractures and pockets filled with very sandy (very fine to medium) pale yellowish-green (10GY 6.5/2) pyritic clay.	9.8

Bed	Description	Thickness
24	392.7–404.5 Cavern fill (karst): 392.7–397.8 Mixed light greenish-gray (5GY 6.5/1) and dark reddish-brown (10R 2.5/4) very sandy (coarse to fine) clay. 397.8–404.5 Greenish-gray (5GY 6.5/1) clay, very sandy (very fine to coarse), pyritic; Portions of cavern wall show dolomite, very pale orange (10YR 7.5/2) to grayish-orange pink (5YR 7/2), medium silt grade, very dense, very hard.	11.8
25	404.5–425.8 Dolomite, yellowish-orange (5Y 8/1) to very light olive gray (5Y 7/1), medium silt grade, slightly calcareous, very tough; disseminated grains and small aggregate growths of pyrite; numerous greenish-gray clay partings and fracture fillings (the clay is slightly to very sandy and pyritic); low to high porosity (secondary porosity due to solution of fossil fragments--mostly crinoid ossicles); stylolites rare; massive.	21.3
26	425.8–492.5 Dolomite, light gray (N7) to yellowish-gray (5Y 8/1), coarse silt grade, subhedral; moderate to very high porosity (secondary due to solution of fossil fragments), vuggy, with euhedral dolomite lining pore spaces and vugs; short vertical fractures in upper 4 feet; stylolites rare; fractured and broken zones filled with sandy green clay from 465.4 to 467.7, 471.4 to 472.6, 475.5 to 476.2, and 478.0 to 478.7; open vugs lined with aggregate growths of euhedral quartz at 476.5, 480.0, 481.0, 483–486, 487.0, and 490.1; massive to thick units.	66.7
27	492.5–511.1 Dolomite, medium light gray (N6.5) (dominant) to yellowish-gray (5Y 8.5/1), medium silt grade, subhedral to anhedral, dense, very hard; moderate to very high porosity, few small vugs; zones of mixed pale green clay; very fossiliferous (solution molds) with crinoid ossicles, Gypidula, and bryozoa; small vugs lined with aggregate growths of euhedral quartz at 494.0, 495.7, 497.8, 503.3, 504.4, and 508.7; small amount of disseminated pyrite; open vertical fracture 509.4 to 510.3; stylolites rare; massive.	18.6

#27549

Bed	Description	Thickness
28	511.1-518.8 Dolomite, medium light gray to light olive gray (5GY 6.5/1) and yellowish-gray (5Y 8.5/1), medium to coarse silt grade, subhedral to anhedral; very hard; moderate to very high porosity (secondary); crowded with large internal molds of Pentamerus; wavy partings of green sandy clay at 514.5; traces of white tripolitic chert and occasional small vug and bedding plane lined with drusy chert and quartz in lower 4'; bottom 1.5' has numerous green clay partings.	7.7
	Alexandrian Kankakee	
29	518.8-567.2 Dolomite, light gray (N7) to very light yellowish-orange (5Y 8.5/1), medium to coarse silt grade, subhedral to anhedral; very hard; cherty, with abundant nodular white, soft, tripolitic and smooth fossiliferous chert; silicified Halysites and Favosites in upper part; few small vugs lined with euhedral quartz; irregular fracture filled with sandy green clay at 519.7, 521.2, 537.7, and 553.6; bedded chert 563.2-563.8; numerous wavy green clay partings in lower part; generally low to moderate porosity; thick to massive.	48.4
	Edgewood?	
30	567.2-569.0 Dolomite, yellowish-gray (5Y 8/1), medium silt grade, subhedral, dense; scattered moderate green (5G 5/6) soft glauconite (?) grains; some very finely disseminated pyrite; small vug lined with euhedral quartz at base; very gradational lower contact.	1.8
	ORDOVICIAN Maquoketa Brainard	
31	569.0-570.4 Shale, light gray to very light olive gray (N7 to 5Y 8/1), dolomitic, mixed and mottled with yellowish-gray (5Y 8/1) coarse silt grade dolomite containing abundant finely disseminated pyrite; becoming more argillaceous toward base.	1.4

Bed	Description	Thickness
32	570.4-571.0 Shale, light olive gray (5Y 6.5/1), greenish-gray (5GY 7/1), and olive gray (5Y 4.5/1), mixed and intercalated, slightly dolomitic; abundant whole and fragmented phosphatic Lingula and very abundant scattered black phosphatic (?) flakes.	0.6
33	571.0-574.7 Shale, light olive gray (5Y 6.5/1), slightly to moderately dolomitic, mixed and mottled with irregular thin stringers of yellowish-gray (5Y 8/1) coarse silt grade argillaceous dolomite; abundant Lingula and scattered black phosphatic (?) flakes; very finely disseminated pyrite; dolomite stringers less abundant in lower part.	3.7
34	574.7-581.7 Shale, greenish-gray (5G 6.5/1), dolomitic, very uniform in color and composition; Lingula very common; some finely disseminated pyrite.	7.0
35	581.7-603.8 Shale, as in bed 32 with olive gray (5Y 4.5/1) the dominant color; harder, more dolomitic zones; bottom 0.2' is dolomite, light olive gray (5Y 5.5/1), coarse silt to fine sand grade, very argillaceous, pyritic, and is crowded with fragmented Lingula, rounded phosphatic pellets up to 1 mm. in diameter, and fragmented trilobite spines.	22.1
36	603.8-604.3 Dolomite, medium dark gray (N4) and medium light gray (N6), mottled, very fine sand to coarse silt grade, subhedral, argillaceous, pyritic zones; mixed with wavy partings and lenses of light olive gray (5Y 6/1) dolomitic shale; scattered small vugs lined with dolomite euhedra.	0.5
37	604.3-605.5 Shale, light olive gray (5Y 6.5/1), and greenish gray (5GY 6.5/1), mixed and mottled, very dolomitic; irregular partings and lenses of medium dark gray (N4) and medium light gray (N6) mottled coarse silt grade dolomite; Lingula and pyritized high-spired gastropods common; dolomite more prominent in lower 0.5'.	
38	605.5-606.6 Dolomite as in bed 36, porous, and with more numerous and larger vugs.	0.9

Bed	Description	Thickness
39	606.6-635.6 Shale, greenish-gray (5G 6.5/1), moderately to very dolomitic, very hard; occasional Lingula, scattered trilobite spines, and black phosphatic(?) flakes, zone of mottled medium dark gray (N4) and medium light gray (N6) argillaceous and shaley dolomite with a few phosphatic pellets from 611.8 to 612.6.	29.2
	Fort Atkinson	
40	635.6-654.7 Dolomite, medium dark gray (N4) and medium light gray (N6), mottled, medium to coarse silt grade, argillaceous shaley, some pyrite; daminantly greenish-gray (5G 6.5/1) dolomitic shale below 645.3.	19.1
41	654.7-748.7 Shale, greenish-gray (5G 5.5/1) to light olive gray (5Y 5.5/1), very dolomitic in top 12 feet, moderately dolomitic below, hard, very uniform; scattered black phosphatic (?) flakes.	94.0
	Elgin	
42	748.7-751.8 Dolomite, pale yellowish-brown (10YR 5.5/2) weakly mottled with light olive gray (5Y 5.5/1), coarse silt grade, s subhedral, extremely argillaceous, medium soft; crowded with low-spired gastropods averaging 1/2 mm. in diameter, abundant Lingula fragments; numerous pyrite films.	3.1
43	751.8-757.3 Shale, light olive gray (5Y 5.5/1), very dolomitic, hard; some disseminated pyrite and dark clayey pyritic films; few black phosphatic (?) flakes; gradational below.	5.5
44	757.3-769.3 Shale, olive gray (5Y 5/1), moderately to very dolomitic; abundant pyrite films; scattered Lingula fragments and trilobite spines; occasional 1/4 mm. phosphatic pellets; grades to pale yellowish-brown (10YR 5.5/2) very argillaceous coarse silt grade dolomite from 761.2 to 762.7, 763.8 to 764.7, and 765.2 to 768.3.	12.0

Bed	Description	Thickness
45	769.3-782.4 Dolomite, pale yellowish-brown (10YR 6/2) to dark yellowish-brown (10YR 4.5/2), coarse silt grade, anhedral to subhedral, very slightly to moderately argillaceous; interbedded and mixed at irregular 0.05 to 0.4' alternating intervals with dark yellowish-brown (10YR 4/2) very dolomitic shale containing numerous pyrite films; vuggy dolomite 772.0 to 772.7 lined with euhedral dolomite and pyrite; nodules of pale orange (10YR 7.5/2) to pale yellowish-brown (10YR 6.5/2) chert and siliceous dolomite at 774.0, 775.6, and 779.1.	13.1
46	782.4-784.7 Shale, dark yellowish-brown (10YR 5/2), very dolomitic, very hard; scattered black phosphatic(?) specks and bars; occasional Lingula; gradational above and below.	2.3
47	784.7-787.6 Description as in bed 45	2.9
48	787.6-791.2 Shale, olive gray (5Y 3.5/1 to 5Y 4.5/1), dolomitic, hard; scattered black phosphatic (?) specks and bars; pyrite films numerous; gradational above and below.	3.6
49	791.2-795.7 Dolomite, light olive gray (5Y 6/1) and light olive gray (5Y 5/1), weakly mottled, coarse silt grade, very argillaceous, shaley zones; pyritic films; occasional Lingula; gradational above and below.	4.5
50	795.7-800.1 Dolomite, light olive gray (5Y 6/1) to pale yellowish-brown (10YR 5.5/2), coarse silt to very fine sand grade, very argillaceous to moderately argillaceous; mixed and intercalated with dark yellowish-brown (10YR 4/2) dolomitic and pyritic shale; zone concentrated with 1/2 to 1/4 mm. diameter low-spired gastropods from 796.1 to 796.2 (occasional gastropod throughout interval); trace of phosphatic(?) grains and green clay in bottom 1.8 feet.	4.4
	← Galena	
51	800.1-815.0 Dolomite, very light olive gray (5Y 7/1) to very pale yellowish-brown (10YR 7/2), very fine to fine sand grade, subhedral to euhedral, slightly calcareous; scattered "cinnamon" (kerogen)	

27544
544

Bed	Description	Thickness
	flecks (more abundant in top 2 feet); partings and thin bands of moderate brown (5YR 3.5/4) kerogen flakes mixed with greenish-gray (5GY 6/1) clay from 804.4 to 804.5, 804.9 to 805.0, 805.9 to 806.2, 807.0 to 807.1, 807.8 to 808.0, 808.8 to 808.9, at 809.8, and from 811.0 to 811.2; occasional crinoid and brachiopod molds; some pyrite; low to moderate porosity with a few small vugs.	14.9

File-Johnson Co. LPG Storage -ACTIVE

27544

MEMORANDUM November 18, 1964

To : Dr. H. G. Hershey
From: D. L. Koch
Re: LPG Storage - test drilling, Mid-America Pipeline Terminal, Iowa City

TD test core # 3 825'

Current depth test core # 4 255'

Remarks:

The #3 core will be ready for pick-up Friday, November 20, and will be studied in detail at the warehouse. The gamma ray - S.P. - R. Logger will be available November 23, at which time I plan to run logs on #3 and 4 holes and #5 if it is completed.

DLK/m
cc: M. C. Parker

File-LPG Storage,Johnson Co. ACTIVE

1544

MEMORANDUM October 28, 1964

To: Dr. H. G. Hershey
From: D. L. Koch
Re: Elevation of #3 and #4 testhole sites, Mid-America Pipeline Company Project, SE¼ sec. 27, T. 79N., R. 5W.

Elevations determined by use of level and tripod as followS:

Test site # 3 737.97

Test site # 4 730.57

DLK/m
cc: M. C. Parker

MEMORANDUM October 28, 1964

To: Dr. H. G. Hershey
From: D. L. Koch
Re: Bond change - Fenix & Scission Engineers (contractor for Mid-America Pipeline Company

Mr. Fred Leppte of Marsh & McLennan, Tulsa, Oklahoma, (consultant in legal affairs to Fenix & Scission) called to make the following request:

Rather than the Survey forwarding new forms for bond conformance, they would like to change the current bond from $5,000 to $15,000 (blanket bond) by sending a rider for each of the 3 original forms giving Marsh and McLennan power of attorney, which, in effect, will cover all additional test-drilling done by Fenix & Scission on their current contract.

The riders will be sent today by air-mail.

DLK/m
cc: M. C. Parker

Test Hole #4

El. Land Surface..... 729.61

#27544

Top of 4" csg. even with ground surface
Top of 1½" csg. is 0.4' above grd.

Date	Time	4" pipe D/W	4" pipe El. Water	1½" pipe D/W	1½" pipe El. Water	Remarks
		66	R			
11-28-64		663.61				
		58.4				
12-30-65	2:30 PM	671.21				
		58.9				
1-3-66	4:30 PM	670.71				
		58.8				
1-6-66	10:50 AM	670.81				
		58.5				
1-21-66	4:30 PM	671.11				
		58.65				
2-7-66	2:00 PM	670.96				
		0				Area under water; clear water in and around csg. — mud observed to move slowly down hole when disturbed by trenches dug to drain area.
2-9-66	12:15 PM	729.61	+			
"		~ 1.5				Estimated depth observed while trenching and when csg. was above water
	12:30 PM	~ 728.11				
		3.89				
"	12:52 PM	725.72				
		5.89				
"	1:00 PM	723.72				
		6.83				
"	1:02 PM	722.78				
		9.11				
"	1:10 PM	720.50				
		10.21				
"	1:15 PM	719.40				
		11.50				
"	1:20 PM	718.11				
		12.75				
"	1:25 PM	716.86				
		13.10				
"	1:27 PM	716.51				
		20.97				
"	2:01 PM	708.64				
		62.97				
2-10-66	9:28 AM	666.64				
		63.05				
"	10:15 AM	666.56				
		63.14				
"	12:56 PM	666.47				
		63.24				
"	3:00 PM	666.37				
		63.79				
2-11-66	8:17 AM	665.82				
		63.99				
"	3:41 PM	665.62				

	2-12-66	10:20 AM	63.91 665.70		
	2-13-66	1:45 PM			Packer set @ 697' w/ 450 psi. (brand new plastic line used)
	"	2:23 PM		45.44 684.17	
	"	2:36 PM	51.41 678.20		
	2-14-66	8:56 AM		65.94 663.67	
	"	9:01 AM	64.3 665.3		Electric line measurement - gel inside 4" csg. is wet and fouls up steel tape and electric line
	"	~1:30 PM			Pressure checked - 450 psi.
	"	4:15 PM		68.25 661.36	steel tape only slightly fouled up with wet gel
	"	4:25 PM	63.87 665.74		
	2-15-66	8:03 AM		70.57 659.04	Gel no longer masking readings
	"	8:11 AM	64.11 665.50		
	"	8:50 AM		71.44 658.17	
	"	8:57 AM	64.14 665.47		
↑	"	9:01 AM			Pressure checked, 445 psi
	"	4:25 PM		71.14 658.47	
	"	4:30 PM	64.26 665.35		
	2-16-66	9:05 AM		71.57 658.04	
	"	9:22 AM	64.81 664.80		Gel fouling up steel tape, difficult to get good rdgs.
	"	4:25 PM		71.70 657.91	
	"	4:35 PM	65.15 664.46		
	2-17-66	8:56 AM		71.97 657.64	
	"	9:20 AM	65.64 663.97		
	"	4:30 PM		71.99 657.62	
	"	4:36 PM	65.69 663.92		

			72.00	
2-18-66	8:35 AM		657.61	
"	8:41 AM	65.89 663.72		Double-checked measurement w/ electric line; obtained reading of 65.75
2-19-66	3:34 PM		72.43 657.18	
"	3:42 PM	66.69 662.92		Water mark sli. questionable - gel fouling up tape.
2-21-66	9:26 AM		72.72 656.89	
"	9:38 AM	67.03 662.58		
2-22-66	9:01 AM		72.68 656.93	
"	9:06 AM	67.11 662.50		
2-23-66	11:22 AM		72.70 656.91	
"	11:36 AM	67.10? 662.51		Tape fouled up w/ gel - 3 attempt
2-24-66	8:42 AM		72.57 657.04	
"	8:51 AM	66.93 662.68		Gel spotting tape, but got a clean water mark
2-25-66	11:45 AM		72.22 657.39	
"	11:49 AM	66.80 662.81		
2-28-66	2:30 PM		72.07 657.54	
"	2:37 PM	66.52 663.09		
3-1-66	11:26 AM		72.07 657.54	
"	11:32 AM	66.91 662.71		
3-2-66	2:18 PM		72.01 657.60	
"	2:23 PM	65.92 663.69		
3-3-66	10:10 AM		71.75 657.86	
"	10:15 AM	66.59 663.02		
3-4-66	10:30 AM		71.40 658.21	
"		65.41		

	10:35 AM	664.20		
3-7-66	11:20 AM		72.00	
"	11:27 AM	67.37		
			67.19	
9-6-66	10:10 AM			
9-26-66	4:35 PM	66.62		
"	4:40 PM		66.48	

CONODONT SAMPLE INVENTORY

WNUMBER	SAMPLE NUMBER	DEPTH_TOP	DEPTH_BOT	WGT_GM	OTHER_ID
27544	MAT 41	193.0	194.4	625	MID-AMERICA PIPLEINE MAT #4
	MAT 42	199.0	200.3	540	
	MAT 43	205.0	205.8	360	
	MAT 43A	207.3	207.9	270	
	MAT 44	209.0	209.8	340	
	MAT 45	212.3	213.0	320	
	MAT 46	215.0	215.7	315	
	MAT 47	221.3	221.9	275	
	MAT 48	225.8	226.4	290	
	MAT 48A	227.0	227.8	365	
	MAT 49	230.0	230.7	350	

JED DAY, 10/15/86

Core

4-Mat

Footage

208.3 B-C Contact

208.2 Variatrypa (R.) scutiformis

208.1 V. (R.) scutiformis, Strophodonta (S.) iowensis.

208.0 V. (R.) scutiformis

207.9 S. (S.) iowensis

207.8 V. (R.) scutiformis

207.8 - 207.2 "

207.2 - 207.0 " Mud rich - argillaceous - echino

207.0 - 206.5 " Packstone - argillaceous echino

206.5 - 205.8 " Wackestone echino.

204.7 - 204.5 ", Strophodonta (S.) iowensis Samples

204.3 - 204.4 ", " Sampled

204.4 - 203.5 ", ", * Spinatrypina @ 203.5
* Tecnocyrtina @ 203.5 - 203.4

Core Mid Am. #3, Box 245.

Footage

JED DAY, 10/15/86

207.3 B-C contact.

207.3-206.5 V.(R.) scutiformis, sample 206.6-206.5

206.5-205.9 " pack-wackestone Arg. in intervals.

205.9-205.0 " wackestone - dolomite (upp. 2/10ths).

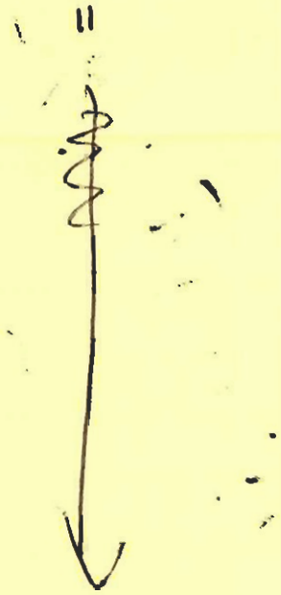
205.0-204.3 Missing

204.3-203.0 V.(R.) scutiformis.

203.0-201.0 "

199.-198.

~~194=19~~



JED DAY, 10/15/86

Core - Mid Am., 1-Mat

Footage

223.5 B-C contact

225.5-224.0 V.(R.) scutiformis } grainstone.

224.0 S.(S.) iowensis sample
& V.R. scutiformis

224- Same fauna throughout rest of Box —