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STRATIGRAPHY AND CONONDONTS OF THE UPPER DEVONIAN SEQUENCE FROM TWO CORES IN NORTHERN IOWA

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PURPOSE AND SCOPE

The purpose of this investigation is to provide some lithostratigraphic and biostratigraphic information for the subsurface Devonian system in north-central and western Iowa. Age determination of lithic units in cores studied is considered the primary objective. Data on conodont faunas recovered from acid residues constitutes the basis for: 1) establishing the chronology, and 2) correlation of the subsurface rock units (herein described) with the recognized formal lithostratigraphic units of the Iowa Devonian outcrop belt.

Two cores were selected for the study:

a) Northern Natural Gas Company, Peterson No. 1, north of Vincent, NE¼, NE¼, NE¼, NW¼, sec. 10, T90N, R27W, Newark Township, Webster County, Iowa.

b) D-28, Larson Lake Core, SE¼, NE¼, SE¼, NE¼, sec. 1, T91N, R39W, Cherokee County, Iowa.

This report contains a complete description of, and provides information on conodont faunas for the Devonian units present within the Larson Lake core. Peterson No. 1 core was studied in conjunction with Kurt Klug, and this report provides information only for part of the Devonian (270'-613') present in the core. For details on the lower 200' of the Devonian Peterson No. 1 core, refer to the companion report of Klug, (1980). Core descriptions are presented in the Appendix, and graphic characterizations are depicted on Plate 1.

STRATIGRAPHY AND CORRELATION

The sequence of formal lithostratigraphic units defined in the Devonian outcrop belt of eastern Iowa is not recognized (by the author) in the subsurface of central and northwestern Iowa. Devonian rocks in the Larson Lake (Cherokee County) and Peterson No. 1 (Webster County) cores appear to constitute distinct lithofacies, indicative of different

deposition environments. The assignment of formal rock names to these lithofacies is not advisable until further regional subsurface studies are conducted.

Detailed biostratigraphic information may be impossible to obtain because the sequences studied are generally not fossiliferous. Conodont faunas recovered during this study are often low in abundance and diversity. Many of the species are undescribed and represent components of different biofacies than those recognized within the Devonian outcrop belt of eastern and north-central Iowa. These facts preclude the use of the refined Middle and Upper Devonian conodont zonal scheme for purposes of precise biostratigraphic correlation.

STRATIGRAPHIC LEAKS

A thin coal unit in the Peterson No. 1 core (358') was processed for a microflora. R. Ravn (1980, personal communication) stated that the spores recovered may be lower Atokan to Morrowan, and appear to be lowest Cherokee or older. A Carboniferous conodont platform element was also recovered (Peterson No. 1, 351.4' - 352.2'). The platform element is probably a species of Cavusgnathus (Chesteran) or Adetognathus (Upper Chesteran → Permian). This flora and fauna constitute stratigraphic leaks that may be the result of karst development during the Pennsylvanian.

LARSON LAKE CORE

The youngest conodont fauna recovered from the Larson Lake core (L.L. 496', see Appendix and Plate 1) contains Siphonodella obsoleta, Polygnathus communis, P. inornata, and P. longipostica. An early Mississippian (Kinderhook) age is assigned to this fauna. The Devonian - Mississippian boundary has been arbitrarily placed at the base of a sandstone (507.9'). The base

of the Devonian system is placed at the top of the Elgin Member of the (Ordovician) Maquoketa Formatin (Witzke, 1979).

Thirty-five samples were processed (Appendix), only eleven produced conodonts. Platform species recovered from Devonian samples include:

1) Pandorinellina cf. insita (Stauffer, 1940) sensu Sandberg and Ziegler (1979, p. 182, pl. 7, figs. 8-10, 12, 15), samples L.L. 770.6-771.3, L.L. 797.2-797.8.

2) Polygnathus decorosa Stauffer (1940), sensu Anderson (1966, pl. 50, figs. 6, 8, 11), sample L.L. 776.4-776.8.

3) Polygnathus sp. A, sample L.L. 715, L.L. 754-754.8. G. Klapper kindly provided informatin that this species has been referred to P. xylus by many conodont workers, but that the species differs from P. xylus, and is an Upper Devonian form.

4) Polygnathus sp. B, sample L.L. 699-799.8; an undescribed form.

5) Ozarkodina spp., sample L.L. 705.5-706.1, L.L. 693.

6) Indeterminant fragments, bars, blades: sample L.L. 496, L.L. 571.7-572.3, L.L. 669-669.8, L.L. 693, L.L. 703.6-794.3, L.L. 705.5-706.1, L.L. 715, L.L. 754-754.8, L.L. 770.6-771.3, L.L. 776.8-776.4, L.L. 797.2-797.8.

Panderinellina cf. insita was recovered near the base of the Devonian within the core. The species is known to range from Lower velifer-Zone through Lower Siphonodella crenulata-Zone (Sandberg and Ziegler, 1979, p. 192); this is well within the Famennian of the Upper Devonian. Klapper (1980, personal communication) states that faunas recovered from the core are consistent with a Late Devonian (Famennian) age assignment for the sequence.

PETERSON No. 1 CORE

Thirty samples were processed for conodonts; most pro ed to be barren. Faunas recovered are listed below by depth in core.

1) 417 - 417.6 — Polygnathus nodocostatus - group, indicates a Famennian age for the unit. The sample also includes several specimens having all the morphological characteristics of Polygnathus webbi (= P. normalis) except that the platform lacks ridges on the upper surface. These forms constitute a new and undescribed species. Also, smooth symmetrical polygnathids (Polygnathus cf. P. decorosa) as seen in samples from the Larson Lake core.

2) 420 - 420.5 — Species of Polygnathus nodocostatus - group are present; Polygnathus cf. P. rhomboidea sensu Helms (1961, pl. 3, fig. 11), as well as other typically Famennian (Sheffield) species of the group. The sample also contains the undescribed species of Polygnathus cf. P. webbi as in sample above.

3) 425,6 - 426 — Nondiagnostic undescribed spathognathodid.

4) 457 - 457.5 — Polygnathus cf. P. brevis, also considered to be an Upper Devonian (Famennian) species.

5) 547 - 547.8 — Polygnathus sp., a distinctive species, but not identifiable. The species may be similar to Polygnathus sp. B (L.L. 669-669.8).

6) 549.2 - 549.6 — "Spathognathodus" (Ozarkodina) gradatus, an Upper Devonian spathognathodid not known to occur in rocks older than Shell Rock (fide Klapper), i.e., Upper Devonian, Frasnian and Famennian.

Therefore, the stratal sequence from 549.6 - 278' is clearly Upper Devonian. Units from 420.5' and above are assignable to the Famennian. Units between 549.6 - 420.5 are either Frasnian or Famennian, but certainly no older; this portion of the core is post Cedar Valley in age.

Lime Creek and Shell Rock Formations are considered to be Frasnian. The interval 549.6 - 420.5 is time equivalent to these units (in their type areas) or younger. No conodonts were recovered between 549.6' and 613'; the age of these rocks can not be determined at this time.

References

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APPENDIX

Conodont Samples

Peterson No. 1 Core
(in feet)

302.6 - 303	Barren
323 - 323.7	worm tube?
325 - 325.4	Barren
325.8 - 326.5	Barren
327 - 327.8	Barren
340.8 - 341.2	Barren
344.4 - 344.6	Barren
344.8 - 345.2	Barren
351.4 - 352.2	Adetognathus?, see text; fish Plates.
361.7 - 362.4	Barren
365.3 - 365.9	sphalerite, Barren
368.2 - 368.8	conodont fragments
417.0 - 417.6	see text; fish plates
420 - 420.5	see text for conodont information; Brachiopods, fish plates, crinoid, gastropods, pyrite.
425.6 - 426	see text for conodont information; scolecodonts, pyrite.
457 - 457.5	see text for conodont information; Brachiopods, ostracodes, Trochiliscus sp. (charophyte oogonia).
508.9 - 509.4	Barren
525.8 - 526.5	fish plates
547.1 - 547.8	see text for conodont information; scolecodonts
549.2 - 549.6	see text for conodont information; scolecodonts, fish plates, small tubular structures.
555.9 - 556.3	Barren
567.6 - 567.7	Barren
567.7 - 568.2	Barren

597.8 - 598	Barren
598.5 - 598.9	Barren
602 - 602.55	Brachiopods
603.95- 604.25	corals, brachiopods
607 - 607.2	Barren
611.9 - 612.5	Stromatoporoids

LARSON LAKE CORE

Faunas and Other
(Depth in feet)

496	see text for conodont species
505.6 - 506.4	scolecodonts
511.3 - 512.2	Barren
521.3 - 522	fish plate; quartz sand and pyrite
524 - 525	quartz sand and pyrite
537.5 - 538.4	Barren
548.5 - 549.5	Barren
568 - 569	Barren
571.7 - 572.3	conodont fragments
576.7 - 577.4	Barren
582.3 - 583	Barren
589 - 589.8	Barren
590.3 - 591.3	Barren
597.65- 598.4	conodont fragments
606.7 - 607.5	Barren
610.1 - 611.2	Barren
623 - 624.4	Scolecodonts, pyrite
628.3 - 629.1	Barren
641.7 - 642.4	Barren
650.9 - 651.5	pyrite
669 - 699.8	see text for conodont species data
669.8 - 670.5	Barren
675.4 - 676.1	Barren
684.2 - 684.8	Barren
693	see text for conodont species information, scolecodonts fish plates

698.5 - 699.4	Barren
700.1 - 700.9	fish plates, pyrite
703.6 - 704.3	conodont fragments
705.5 - 706.1	conodont fragments
706.1 - 707	Barren
715	indet. P-element; scolecodonts
726.8 - 727.2	silica spherules
754 - 754.8	see text for conodont species info.; scolecodonts, spore (Trilete)
770.6 - 771.4	see text for conodont species
788.6 - 789.4	P. cf. insita, scolecodonts, pyrite balls
797.2 - 797.8	P. cf. insita,

Peterson #1 Core Description (Part)

Mark Tynan, June 1980

Northern Natural Gas Company, Peterson #1 Core, N. of Vincent, NE¼, NE¼, NE¼, NW¼, sec. 10, T 90N, R27W, Newark Township, Webster County Iowa.

Depth	Description
272.9 - 273.2	Limestone, med. grained calcarenite, color tan, non-fossiliferous, dolomitic, lower contact marked by stylolite zone and insoluble detrital mineral concentration 273.2 - 273.3.
273.2 - 274.0	Limestone, fine grained calcarenite, slightly dolomitic; color tan to light grey.
274.0 - 275.7	Transitional lithology; limestone, color tan, fine grained interlayered with med. grey fine grained dolostone. Unit is stylolitic; pellets present, brachiopod.
	*
275.7 - 276.3	Siltstone (Mudstone), poorly indurated, calcitic & dolomitic; base of unit is green siltstone containing abundant green limonitic rounded clay clasts. Clay clasts contain pyrite and quartz sand. Quartz sand scattered throughout matrix.
276.3 - 276.6	Siltstone, poorly indurated, limonitic, color green. Quartz sand throughout.
276.6 - 276.75	green shale, pyrite stringers.
276.75 - 277	Argillaceous quartz sandstone; quartz grains frosted. Basal portim contains clasts of green shale from unit below. Limonitic blebs throughout.
277 - 277.45	Shale, color green; Indistinct lamination; pyrite stringers parallel to bedding.
277.45 - 277.75	Missing from core.
277.75 - 279	Dolomite mudstone. Coarsens upward from silty shale to shaley siltstone.
279	Upper contact Maple Mill Formation*
279 - 280.6	Shale, dolomitic; color green; swirled texture; pyrite developed in vertical burrows.
280.6 - 280.7	Siltstone, shale interlayered, swirled texture. Quartz sand and dolomite rhombs. throughout. Evidence suggests soft sediment deformation.

*see Plate 1

280.7 - 280.9	Shaley siltstone; color grey-green; some quartz and scattered throughout, but rare; dolomitic.
280.9 - 281.3	Shale, color green; pyrite disseminated throughout; swirled texture.
281.3 - 281.7	Same as above unit but dolomitic; some interlayered shaley dolomite; flow structure.
281.7 - 282.9	Fine grained dolomite containing dolomitic green shale clasts. Swirled texture, flow features. Pyrite rare and disseminated throughout. Rare "glauconite" blebs.
282.9 - 283.6	Shale, silty, dolomitic; pyrite scattered throughout. Color green.
283.6 - 284	Shale, silty, dolomitic; horizontal burrows pyrite filled.
284 - 284.5	Interlayered dolomitic silty shale and shaley dolomite. (Unit fractured and flowed possible syndepositional or early post depositional phenomena).
284.5 - 287.3?	Shale, silty, dolomitic; color green. Shale interlayered with argillaceous dolostone. Small conical fossils present. Flat pebble shale clasts scattered throughout. Pyrite disseminated throughout.
?287.3 - 293.7	Same as above, but more silty.
293.7	Upper contact of Aplington Formation *
293.7 - 295.6	Dolostone, med. grey-green color; Tan to med. grey dolostone in upper .2 ft. Contact with overlying unit appears gradational. Fossiliferous with brachiopods, echinoderms, gastropods. Vuggy.
295.6 - 296.1	Dolostone, interlayered fine grained, color light grey to light brown. Vugs (porosity) reduced compared to overlying unit. Slightly calcitic. Calcite fills some vugs in part.
296.1 296.4	Dolostone, porous, med. grained; color med. grey to tan. Brachiopod fragments, oncolitic (?).
296.4 - 296.45	Dolostone; fine to med. grained; color grey; vuggy.
296.45 - 296.6	Dolostone, fine grained, light grey to cream colored; wavy laminations. Upper contact sharp, irregular contact with 1cm relief.
296.6 - 297.3	Dolostone, very fine grained, medium grey. Healed fractures. Thin breccia zone at 297'. Relatively dense, non-porous. Calcititic dolostone layers intermixed. Pyrite disseminated throughout. Contains zones of tan vuggy dolostone lenses.

297.3 - 297.45	Dolostone; vuggy, tan as in above unit.
297.45 - 297.6	Dolomitic calcititic; Breccia cemented by blocky spar calcite; fossiliferous, brachiopods, bryozoans.
297.6 - 297.8	Dolostone, calcitic, fine grained; vuggy; fossiliferous, brachiopods.
297.8 - 298.1	Dolostone, fine grained, green-grey. Contains small rounded clasts of cream colored dolostone floating in green-grey argillaceous dolostone matrix. Dense, non-porous.
298.1 - 298.3	Dolostone, as in unit above. Base marked by conglomeratic dolostone unit. Clasts are dolostone, cream colored. Tower contact is erosional. Contact with dolomitic siltstone unit.
298.3 - 300	Note portions of core in this interval are missing.
298.3 - 298.7	Siltstone, dolomitic, green, shaley; bioturbated and/or soft sediment deformation (flow feature).
?298.7 - 299.6?	Missing in part
299.6 - 300.2	Dolostone, tan, calcitic, breeciated; clasts possibly encrusted by algae; clasts composed of dolostone, dense, light brown, (1 cm long), angular. Spar filled vug at 300. Sparsely fossiliferous, brachiopod fragments. Matrix with swirled texture.
300.2 - 300.75	Dolostone, very fine grained, slightly calcitic, silty; light grey color. Large calcite filled vug at 300.6. Vugs lined and filled by calcite spar.
300.75 - 301	Grey laminated dolomitic siltstone at top. Thin breccia at 300.9. At 300.9, intraclast of dolomite with sparry calcite fill below clasts. Clasts are fine grained cream colored dolostone. Irregular erosional surface beneath thin breccia zone at 300.9.
301 - 301.3	Siltstone, dolomitic, green.
301.3 - 301.4	Siltstone, calcitic, light brown to tan color; porous.
301.4 - 301.8	Siltstone, dolomitic, poorly indurated, grey-green color; pyrite stringers and disseminated throughout.
301.8 - 301.9	Thin dolostone breccia; void space calcite filled.
301.9 - 302.1	Tan and grey interlayered fine grained dolostone; fractured.
302.1 - 302.7	Siltstone, dolomitic, shaley partings. Low porosity, grades down into silty dolostone at base. Unit displays wavy laminations. Base of unit marked by irregular surface. Some algal lamination above break.

302.7 - 303	Shale, dolomitic, green grey. Vertical hair fractures sealed by dolomite and calcite. Conodont sample 302.6 - 303.
303	TOP OF SHEFFIELD (SHALE) FORMATION
303 - 304.7	Top is grey-green dolomitic shale and grades downward into argillaceous brown dolomite. Laminated.
304.7 - 304.9	Dolostone, tan, with grey-green shale and argillaceous dolostone clasts. Tops of clasts often algal encrusted.
304.9 - 305.4	Interlayered green dolomitic shale and light brown fine grained dolostone. Shale predominates. Swirled texture, plastic flow feature. Clasts of green shale incorporated within dolostone. Clasts are angular to rounded.
305.4 - 305.8	Shale, grey-green, dolomitic. Mottled, swirled texture.
305.8 - 308.4	Missing from core.
308.4 - 311	At top, evenly laminated dolomitic green shale interlayered with light brown dolostone. Some vertical burrows. Unit becomes swirled toward base, and silty.
311 - 313.9	Silty dark green dolomitic shales. Laminated. [312.4 - 312.8, small offset. Offset occurred before deposition of sediment at top of unit, indicated by sediment draping over offset.] Pyrite scattered throughout fracture zone (with breccia) extend vertically from 313 - 313.9.
313.9 - 314.1	Shale, grey-green, silty, dolomitic, dense.
314.1 - 316.6	Same as above, mottled swirled texture. (Note parts of this unit missing from core).
316.6 - 319	Shale, dark green. Swirled texture; rare fossil fragments, brachiopods, trilobite. Base of unit bioturbated. Burrows evident. Base of unit defined by sharp even inclined surface of unit below.
319 - 322.1	Top of unit is dense grey-green dolomitic shale, silty in part. Grades downward into grey-green argillaceous dolostone at 320' - 321'. Light grey fine grained argillaceous dolostone at 321' - 322'. Pyrite and chalcopyrite concentrated in zone at 321'. Note thin zone of flat pebble dolostone clasts (intraclasts) from 321.9 - 322.1 within a medium grey dolostone. Note fracture from 320 - 322.1 with pyrite, chert and dolomite lining fracture and sealing it.
322.1	Upper contact of Lime Creek Formation– Shell Rock Formation undifferentiated. *

322.1 - 322.4	Dolostone, med. grey, fine grained, calcitic. Clasts abundant, small, angular to rounded. Clasts contain pellets and oolites.
322.4 - 323	Tan dolostone interlayered with medium dark grey limestone. Fine to medium grained; sparry in spots, dense.
323 - 323.8	Same as above, but slightly porous. Stylolite at 323.8 marks base of unit. Worm tube in Conodont sample 323. - 323.7.
323.8 - 324.1	Limestone, argillaceous, grey-green, dolomitic. Fine sand throughout.
324.1 324.5	Tan dolomitic fine grained limestone; intraclasts. Sandy at base.
324.5 - 324.6	Dark green-grey calcitic siltstone.
324.6 - 324.9	Dolostone, grey to brown. Moderate to low porosity. Fracture zone at base with calcite filling fractures.
324.9 - 325	Sandy grey-green siltstone. Upper contact is irregular. Siltstone layers display soft sediment deformation features and pull apart structures.
325 - 325.4	Light green to light grey sandy argillaceous limestone. Fossil fragments scattered throughout. Conodont sample.
325.4 - 325.45	Grey-green, sandy calcitic siltstone. Irregular upper and lower contacts.
324.45 - 326.25	Light grey-green, dolomitic, sandy, argillaceous, pelleted limestone. Conodont sample, 325 - 325.4. Condont sample, 325.8 - 326.5.
326.25 - 327	Dolostone; brecciated. Clasts are tan, calcitic, oolitic dolostone. Matrix consists of quartz sand and dolomite; also calcite void fill and local development of tar-like petroliferous substance. Very porous.
327 - 328.2	Dolostone, brecciated, calcitic. Clasts are angular to rounded. Most clasts are angular. Small clasts are rounded. Clasts and matrix contain oolites and sucrosic dolomite rhombs. Moderate porosity. Calcite void fill. Base marked by stylolite. Conodont sample 327 - 327.8.
328.2 - 328.9	Tan to light brown dolomitic (sucrosic) limestone.
328.9 - 330	Megaclastic unit. Void fill between clasts is dolomitic limestone. Clst are light brown to tan dolomitic limestone. Clasts are light brown to tan dolomitic limestone blocks. Blocks are angular, ½ foot long and possibly larger. Some hair size fractures developed but sealed by calcite.

330 - 333	Tan to light brown calcitic, porous dolostone as above. Swirled texture and small clast size breccia zone. Clasts within this interval contain clasts themselves. Vuggy; calcite lines vugs. Matrix for microbreccia clasts is argillaceous dolostone. Note 331 - 333 contains large clasts as in unit above. Stylolites developed around the "megaclasts" on all sides. Calcite void fill common on lower side of clasts. Shale clasts concentrated at 331.8. Matrix, where porous, often with tarry petroliferous substance.
333 - 333.5	Same as above, but more argillaceous, tan to light grey dolostone. Unit was fractured in place. Calcite void fill in fractures. Concentration of small brown dolomitic limestone clasts at base. Base of unit defined by stylolite.
333.5 - 335.8	Near top, dolostone; calcitic, slightly argillaceous and porous. Unit grades down into light grey to light brown calcitic dolostone characterized by swirled texture and numerous stylolites. Becomes more calcitic toward base. Base of unit defined by stylolite.
335.8 - 337	Intermixed light grey limestone and light brown dolostone. Dolomite rhombs throughout. Small pebble-size rounded clasts of calcitic dolostone scattered throughout. Blocky calcite void fill.
337 - 338	Limestone, slightly dolomitic. Stylolitic, fractured and brecciated. Large voids present and often filled with calcite spar. Clay and tarry petroliferous material in open voids.
338 - 338.6	Light grey to light brown calcitic dolostone. No breccia (as seen above) but mottled in appearance. Large vugs abundant. Vugs are often calcite lined or filled with sparry calcite.
338.6 - 339.2	Same as above, but porosity reduced.
339.2 - 340.3	Dolostone; very fine grained, green to light green. Dense non-porous. Swirled texture.
340.3 - 340.8	Breccia; clasts same as lithology above. Matrix is a tan to light green-grey dolostone. Calcite and shale void fill.

[Note]: Core may be out of order from 340 - 346.

340.8 - 341.6	Light brown to light grey dolomitic limestone. Fine grained. Large void space filled with blocky calcite spar. Conodont sample 340.8 - 341.2.
?341.6 - 344.3?	Interlayered light brown and light grey calcitic dolostone. Indistinct to distinct lamination. Vugs or voids develop parallel to bedding. Sucrosic dolomite scattered throughout.

?344.3 - 344.4	Green dolomitic siltstone.
?344.4 - 344.8?	Green-grey argillaceous limestone, fine grained. Contains thin layer of tan dolostone. Conodont sample 344.4 - 344.6.
?344.8 - 345.2?	Interlayered fine and medium grained limestone, light brown to light grey. Conodont sample.
?345.2 - 345.3?	Green calcitic and dolomitic shale.
?345.3 - 346	Mottled green and light grey dolostone; med. to fine grained. Fractures, some healed by calcite. Irregular upper and lower contacts.
346 - 347.7	Dolostone, light brown, calcitic, medium to fine grained, mottled. Fractures healed by calcite. Moderate to low porosity. Dolomitic clay clasts present 347.4 - 347.7. Clasts are same as in unit below. Some vugs developed, in part calcite filled.
347.7 - 349.3	Tan and green dolostone at 347.7 - 348.4, with green shale at base. 348.4 - 348.9, coal, limestone and chert in green shale (void fill). 348.9 - 349.3, green dolomitic shale. Note that coal represents a stratigraphic leak and has been determined to be Pennsylvanian (Pre-Cherokee) in age. This suggests most of this unit may be void fill material.
349.3 - 349.6	Dolostone, green, shaley, mottled at top; brown porous dolostone at base also mottled.
349.6 - 351.4	Dolostone; green argillaceous and mottled. Silty at base.
351.4 - 352.6	Mottled light grey limestone and light brown dolostone; medium to fine grained, dense. Conodont sample 351.4 - 352.2.
352.6 - 352.65	Green calcitic siltstone.
352.65 - 353.4	Dolostone, light brown to light grey, medium grained. Some small open voids developed parallel to lamination, may be birdseye.
353.4 - 353.7	Limestone, argillaceous, dolomitic, green. Some stylolites.
353.7 - 3551.1	Dolostone; medium grained, calcitic, light brown, moderate porosity. Irregular to wavy laminations present. Breccia zone in basal 1 cm. Clasts similar to unit below.
355.1 - 356.5	Dolostone, light grey to pale green, calcitic. Vuggy. Vugs lined by rhombs of dolomite. Lower contact defined by stylolite. Green clays and silt concentrated adjacent to stylolite.

356.5 - 359	Dolostone, coarse grained (sucrosic), light brown, argillaceous in part. Dense to moderately porous. Vertical fractures healed by blocky calcite void fill. Unit has numerous stylolites.
359 - 360.2	Dolostone, calcitic, light brown. Laminated from 359.55 - 359.75. Base marked by stylolite.
360.2 - 362.7	Limestone, dolomitic, slightly argillaceous; mottled green, med. grey, and tan. Pyrite and limonitic material throughout. Numerous stylolites. Blocky spar void fill. Base defined at stylolite. Conodont sample, 361.7 - 362.4.
362.7 - 364	Dolostone, calcitic, slightly argillaceous, swirly texture in parts. Vugs elongated parallel to bedding. Dolomite rhombs throughout.
364 - 365.1	Gradational contact with unit above. Dolostone, calcitic, med. to fine grained. Dolomite rhombs throughout. Crinoid columnals. Moderate porosity. Large stylolites at 364.2, 364.9 and 365.1.
365.1 - 366	Dolomitic limestone. Voids filled by blocky spar. Brachiopods. Mottled at base. Base of unit marked by stylolite with concentration of carbonaceous residue (coal?). Conodont sample, 365.3 - 365.9.
366 - 367	Same as above, fine grained, no fossils, some open voids.
367 - 367.1	Stylolite zone, residue of carbonsaceous material. Brecciated.
367.1 - 367.4	Dolostone, calcitic, light brown, fine grained, slightly argillaceous in parts, mottled. Vuggy.
367.4 - 367.8	Dolostone; calcitic, light grey to tan. Vugs with some dog-tooth spar developed. Porous; dolomite rhombs throughout; fossiliferous (crinoids) moldic.
367.8 - 368.8	Mottled medium blue-grey limestone and grey to tan calcitic dolostone. Vuggy. Numerous stylolites. Fracture zone at 368.3. Conodont samples, 368.2 - 368.8.
368.8 - 369	Limestone; medium grey, fine grained. Stylolite with associated carbonaceous material. Fracture and voids filled by blocky calcite spar. Porosity moderate.
369 - 369.4	Limestone; dolomitic and as above, but low to moderate porosity (dense in part).

369.4 - 369.8	As above but with mottled tan dolomite associated.
369.8 - 370	As in unit above with alternating bands of tan dolomite and grey limestone. Insoluble detretal and carbonaceous material concentrated along stylolites.
370 - 370.3	Laminated interlayered light grey and light blue-grey limestone with some bands of tan dolomite. Fine grained, dense. Fractures and voids headed by calcite.
370.3 - 372	Dolostone; calcitic, light greay and light brown. Shaley parting at 371.7.
372 - 372.6	Dolostone and dolomitic limestone; light brown and light grey. Mottled. Shaley parting at 372.6.
?372.6 - 375.3?	Limestone, light grey, fine grained, with clay clasts. Vuggy in part. Void fill by calcite spar and pyrite. Dolomitic at base.
?375.3 - 377.4?	Dolostone; light brown, fine grained, slightly calcitic. Dense to slightly porous. Stylolite at 377.3. Sandy (quartz sand) at 377.4.
?377.4 - 378.8?	Dolostone; light grey and light brown, fine grained, calcitic, vuggy and porous. Flat pebble clay clasts throughout. Pyrite and "glaconite" throughout.
?378.8 - 379.5?	Dolostone; sucrosic to fine grained, light brown. Vuggy, very porous.
?379.5 - 382.7?	Interlayered medium to light grey dolostone and light brown sucrosic dolostone. Slightly calcitic, fine to medium grained.
?382.7 - 383?	Sucrosic brown dolostone; slightly calcitic. Vuggy.
?383 - 391	No recovery.
391 - 395	Dolostone; interlayered grey and brown, fine to medium grained, matrix with large dolomite rhombs scattered throughout. Vuggy. Vugs lined by dolomite rhombs. Cross beds apparent. Porosity moderate.
395 - 402.2	Dolostone; light brown coarse grained, sucrosic, calcitic. No vugs.
402.2 - 406.6?	As above but vuggy. Porosity moderate. Pyrite disseminated throughout. Large stylolite in center of unit.
?406.6 - 407.6?	Limestone; med. grained, light grey, stylolitic, fractured. Fractures filled with carbonaceous and tarry material.
?407.6 - 408.1?	Limestone (as above) with tan dolostone. Fractured, brecciated. Solution collapse features.

?408.1 - 413.6?	Missing from core.
?413.6 - 414.1?	Dolostone, light grey, fine to medium grained. Vuggy with some dogtooth spar developed. Hair size fractures.
414.1 - 415?	Dolostone; light brown, medium to coarse grained. Large void at 414.6. Unit is calcitic.
415? - 415.5	Mottled tan dolostone and grey limestone. Vugs rare, unit fairly dense.
415.5 - 416.6	Dolostone; light grey, fine to medium grained, calcitic. Vugs developed, same spar filled or lined. Moderate porosity.
416.6 - 419.3	Limestone; light grey, medium to coarse grained, dolomitic. Dense. Stylolite with green clay and black carbonaceous material. Conodont sample 417 - 417.6.
419.3 - 419.6	Brecciated zone with calcitic dolostone and limestone clasts.
419.6 - 420.3	Limestone; light grey to light brown. Stylolitic, low porosity, pellets rare. Grain size coarsens toward base. Lower contact very irregular.
420.3 - 420.8	Green calcitic shale. Limonitic. Fine quartz sand and dolomite rhombs throughout. Conodont sample, 420 - 420.5.
420.8 - 422.1	Dolostone; grey-green, shaley, silty. Cross laminated. Moderate porosity.
422.1 - 424	Missing from core.
424 - 424.5	Argillaceous dolostone; green grey, fine grained. Dense. Unevan lower contact.
424.5 - 425	Dolostone breccia. Clasts are light brown very fine grained dolostone. Matrix is med. grey coarse grained limestone with blocky spar void fill. Crinoid columnals. Some black carbonaceous material also fills void space between clasts.
425 - 426.1	Dolostone; medium grey and light brown mottled. Fine to medium grained. Solution collapse features (breccia) at basal .1 foot. Aulopora - like corals. Conodont sample 425.6 - 426.
426.1 - 427.2	Dolostone; argillaceous, green to medium grey, fine to medium grained. Fossiliferous, with brachiopods, rugosans (solitary and colonial). Stylolitic vuggy. Calcite void fill. Intraclasts at base.

427.2 - 430	Dolostone; vuggy, but most void space is calcite filled. Crinoid debris and other small fossil fragments. Brachiopods (spiriferids) common. Becomes argillaceous toward base. (Wackestone)
430 - 433.1	Dolostone; fine to medium grained, medium to dark brown. Fossiliferous, bryozoans, corals, brachiopods. Blocky calcite void fill. Geopedal structures common.
433.1 - 433.2	Dolostone; brown and brecciated. Solution collapse feature(?).
433.2 - 433.3	Dolostone; fine to medium grained, medium grey, slightly argillaceous.
433.3 - 434.3	Shale; dolomitic, medium grey. Swirled texture, some clasts of lighter colored dolomitic shale scattered throughout.
434.3 - 438	Limestone, mottled medium grey and light brown, fine to medium grained, small branching tubular corals. Shaley partings. Dense, low porosity. Note some clasts of dolostone that contain small clasts of dolostone; larger clasts rimmed by stylolites.
438.0 - 438.8	Light brown to tan clasts (small) of dolostone in a light grey limestone matrix.
438.8 - 439	Upper contact of unit marked by stylolite. Limestone; coarse grained, vuggy.
439 - 443	Missing from core.
443 - 443.7	Dolostone; shaley, calcitic, light brown. Angular small clasts of dolostone at top and more rounded toward base.
443.7 - 444	Dolostone; mixed medium grey and light grey. Narrow voids developed parallel to bedding, often calcite filled.
444 - 444.8	Dolostone; argillaceous, fine grained, light grey. Spiriferial brachhiopods, moldic. Vuggy; wakestone. Green shale parting.
444.8 - 448	Missing from Core
448 - 448.5	Dolostone; quartz sand, swirled texture, medium grey and light brown, intraclasts, medium to fine grained. Very vuggy and porous. Clasts are light brown dolostone.
448.5 - 450.4	As above but no quartz sand. Brachiopods.
450.4 - 450.5	Siltstone; dolomitic, green.
450.5 - 454.8	Missing from core.
454.8 - 458.3?	Shale; dolomitic, silty, grey-green, limonitic. Conodont sample 457 - 457.5.

?458.3 - 460.8?	Missing from core.
?460.8 - 463.4?	Dolostone; grey-green, fine grained. Large open void rimmed with dogtooth calcite spar. Note thin breccia zone at 462.2 - 462.3. Unit is Stylolitic. Other than large voids, unit is dense.
?462.4 - 465.7	Missing from core.
465.7 - 467	Dolostone; coarse grained, light brown, porous, some vugs.
467 - 467.4	Dolostone; very shaley, green.
467.4 - 467.9	Limestone; dolomitic, argillaceous, mixed light grey and light green.
467.9 - 468	Dolostone; gradational transition from unit above.
468 - 479	Missing from core.
479 - 481.0	Shale; dolomitic, medium grey. Interlayered with shaley dolostone. Gradational contact with unit below.
481 - 481.5	Dolostone; fine grained. Contains small clasts of flat pebble tan dolostone and green shale.
481.5 - 482.8	Dolostone and dolomitic shale in mixed texture. Argillaceous, mottled. Grey-green dolostone and shale.
482.8 - 483.5	Dolostone, argillaceous, light grey. Swirled texture. Intraclasts at base.
483.5 - 483.7	Dolostone, tan, porous, fine grained. Shale partings at upper and lower part of unit.
483.7 - 484.2	Dolostone; very shaley, green-grey and tan interlayered.
484.2 - 487.9	Dolostone; green-grey, slightly calcitic, fine grained, argillaceous. Dark shale seams or insoluble material concentrated along slylolite.
487.9 - 488.1	Breccia; clasts are of dolostone, matrix is dolostone and shale void fill. Dolomite rhombs throughout.
488.1 - 490.3	Dolostone; grey-green, medium to fine grained. Vuggy with some green (clay) shale, dolomite and calcite void fill. Stylolite at 489.

490.3 - 493.4	Missing from core.
493.4 - 494.5	Dolostone; medium grey to grey-green, sucrosic dolomite rhombs throughout. Vuggy, with green shale void fill. Stylolite at 494.1 with thin zone of tan dolostone beneath.
494.5 - 501.8	Dolostone; fine to medium grained, medium grey. Very vuggy, some fractures. Fractures and void space lined by white dolomite rhombs. Stylolitic and porous. Vugs often interconnected.
501.8 - 503.0	Dolostone; coarse grained, slightly argillaceous, green-grey. Low to moderate porosity.
503 - 504.8	Dolostone; sucrosic, mottled medium to light grey, coarsely crystalline to fine grained. Some vugs; stylolitic. Porous.
504.8 - 505.7	Same as above, but somewhat finer grained and reduced porosity.
505.7 - 507.3	Alternating layers of light grey to medium grey fine to medium grained dolostone and bands of sucrosic vuggy porous light grey dolostone. Very slightly argillaceous. Stylolite at 506.8.
507.3 - 508	Dolostone; medium dark grey, medium to fine grained, microstylolitic. Vuggy. Large (2-3 in.) clasts of tan dolostone. Large fragments of colonial corals and stromatoporoids.
508 - 508.1	Dolostone; medium to fine grained, green grey, slightly argillaceous. Some vugs. Vugs filled with gypsum.
508.1 - 510	Upper contact with unit above is gradational. Dolostone and limestone. Medium grey dolostone at top grades down into brown fine to medium grained dolostone alternating with grey laminated dolomitic limestone. Argillaceous, stylolitic. Unit fractured and recemented in part. Chest, gypsum and calcite fill void space. Basal .9 feet, dense fine grained, laminated, tan dolostone. Conodont sample 508.9 - 509.4.
510 - 510.4	Dolostone, grey-green, slightly argillaceous, fine grained. Pyrite and limonitic zones throughout. Dense.
510.4 - 511	Dolostone; light brown to tan and grey, fine to medium grained irregularly laminated. Vuggy at top, slightly calcitic, and shale partings. Swirled texture near base.

511 - 520	Missing from core.
520 - 523	Breccia. Dolostone. Clasts are angular pieces of light grey dolostone in medium grained, porous light brown dolostone matrix. Shale clasts throughout and green shale void fill in places. Some vugs. Numerous small stylolites.
523 - 527?	Missing from core.
527? - 529.5	Dolostone; mottled sucrosic tan dolostone and medium grained light grey dolostone. Coarse grained dolostone porous.
529.5 - 530?	Dolostone; light brown, medium to fine-grained. Microstylolites. Swirled texture. Grades into unit above.
530? - 530.3	Dolostone; light brown, fine to medium grained, argillaceous in part. [Zone of soft sediment deformation (?), layers stretched and cracked during compaction; some plastic deformation of intraclasts resulted.]
530.3 - 530.8	Dolostone; medium grey, dense. Small area of sucrosic dolostone.
530.8 - 531.4	Dolostone; fine grained, mottled light grey and dark grey. At 531, possible receptaculitid.
531.4 - 531.7	Dolostone as above, but very stylolitic with concentration of pyrite and dark (detrital insoluble?) material.
531.7 - 531.8	Dolostone; silty brown, shale chips, small stylolites. Crinkly lamination, dense.
531.8 - 532.2	Interlayered dolostone and siltstone, green and grey-green.
532.1 - 536	Siltstone; dolomitic, green, even laminations.
536 - 536.9?	Green Siltstone containing chips of tan dolostone.
536.9 - 538.4?	Dolostone; argillaceous, grey-green to tan. Dense, and stylolitic near base. Gradational into unit above.
538.4? - 538.5?	Dolostone; cream color, fine grained laminated, stylolitic.
538.5? - 539?	Mottled grey-green and tan dolostone; some vugs. Microgreccia at base of unit.

539? - 541.6	Missing from core.
541.6 - 542.7	Dolostone; light to medium grey, argillaceous.
542.7 - 543.1	Dolostone; fine to medium grained, tan, dense.
543.1 - 545.5	Dolostone; fine grained, medium to light grey. Brachiopod molds at 545. Large stylolite 544.3 - 544.9 with concentration of insolubles.
545.5 - 546.9	Dolostone; brown and grey mottled, fine grained. Stylolite at 546.
546.9 - 547.2	Dolostone; argillaceous, fine to medium grained. Vuggy.
547.2 - 549.2	Dolostone; light brown, fine to medium grained. Vuggy. Some void space filled bu calcite. Condont sample 547.1 - 547.8.
549.2 - 549.9	Dolostone; fine grained, medium grey, calcite in places, mottled appearance. Stylolitic. [Dolowackestone]. Vuggy. Some void space filled by green clay. Bioturbation apparent; some burrows, crinoid columnals. Conodont sample 549.2 - 549.6.
549.9 - 551	Dolostone; shaley, fine grained, dense, grey. Grades into dolomitic siltstone near base.
551 - 552.6	Siltstone; dolomitic, light grey, green shale partings. Flat pebble tan dolomite clasts (cream colored) at base represents diagenetic product. Dolomite layers stretched and fractured (in situ) from 551.9 - 552.6; lower part of unit with microstulolites.
552.6 - 553.7	Interlayered medium grey fine grained dolostone and light brown coarse grained, vuggy dolostone.
553.7 - 554.6	Dolostone; slightly argillaceous, green-grey, fine grained, dense. Swirled texture. Shale parting at 554.6. Some thin layers of light brown, fine grained dolostone near base. Gradational into unit below.
554.6 - 555.6	Dolostone, light to medium brown, fine to medium grained. Some small intraclasts. Solution collapse fracture, i.e., local zones with micro breccia developed where light brown clasts partly detached and displaced from "roof" of void (?) space, floating in medium brown dolostone void fill.

555.6 - 556	Dolostone; medium brown, medium to coarse grained. small vugs, porous.
556 - 556.3	Dolostone; fine grained, meduim grey. Some small vugs. Base marked by stylolite. Conodont sample 55.9 - 556.3.
556.3 - 564.6	Dolostone; medium to fine grained, light brown, very stylolitic, vuggy. Some patches of micro-breccia, solution collapse fractures. Vugs may be calcite filled. Small brachiopod fragments common. "Auloporid" corals at 561.5. Mottled zone of intraclastic dolostone at 563 - 564.
564.6 - 565.1	As above but grades into a light grey dolostone.
565.1 - 565.5	Dolostone; light to medium grey, fine grained. Microstylolitic. Some vugs. Vugs filled or lined by dolomite rhombs.
565.5 - 566.4	Dolomite; calcitic, fine grained, medium grey. Layering apparent in past. Dense. Clay concentrated along stylolites. Possible pellets? Very low porosity; in past swirled texture.
566.4 - 567.6	Dolostone; light brown, fine to medium grained, massive, dense.
567.6 - 567.7	Limestone; argillaceous, dark grey. Chert. Stylolite zone. Conodont sample 567.6 - 567.7.
567.7 - 568.15	Limestone; dark grey, argillaceous, laminated. Shaley partings. Grades down into brown fine grained limestone. Stylolites at 568.1. Conodont sample 567.7 - 568.2.
568.15 - 569	"Coaly" material at top associated with stylolite. Dolostone; chalky in appearance. Green shale in void spaces. Dolomite rhombs throughout.

Note: Parts of core from 568 - 573 are missing.

569 - 569.3	Dolostone; sucrosic, porous, mixed grey and medium brown.
569.3 - 575	Dolostone; vuggy, slightly calcitic, light brown fine to medium grained. Dolomite rhombs throughout Vugs are large, may contain dog-tooth spar.
575 - 578.6	As above, but vugs reduced in number and size. Brachiopod and echinoderm debris, moldic.
578.6 - 580.1	Dolostone; light grey, fine to medium grained. Dense. Few vugs. Small stylotites.

Peterson #1 Core

580.1 - 580.6	Dolostone; medium grained, light brown to light grey, silty. Dense, but some small vugs.
580.6 - 584.2	Silty dolostone and dolomitic siltstone. Shaley. Beds about 6 in., interlayered. Shaley zones laminated; silty and dolomitic layers mottled or swirled texture.
584.2 - 584.8	Dolostone; very light brown, silty, shaley, swirled texture, small stylolites.
584.8 - 584.95	Shale; green, fissile, slightly dolomitic, polygonal mudcracks.
584.95 - 585.8	Dolostone; breccia. Clasts are light brown and laminated. Clasts enveloped by stylolites. Matrix consists of coarse porous sucrosic dolostone. Some clasts contain microbrecciated material. Stylolitic areas show concentration of black shaley material and pyrite.
585.8 - 587	At top, fine to medium grained dense, light grey to medium grey dolostone. Contans some small "flat pebble" clasts of lighter colored dolostone. Swirled texture. Becomes laminated toward base, dense, and argillaceous. Microstylolites.
587 - 587.9	Dolostone; calcitic and argillaceous in part, fine to medium grained. Brecciated in parts with laminated intraclasts at base. Stylolitic.
587.9 - 588.4	Dolostone; laminated, light brown, fine to medium grained. Contains small "flat pebble" clasts of laminated dolostone.
588.4 - 589	Interlayered limestone breccia and laminated light brown dolostone. Clasts in limestone are dolomitic, and angular to rounded. Matrix is light grey dolomitic limestone.
589 - 589.8	Dolostone; light brown, medium grained, porous. Vuggy at 589.7 - 589.8. Microstylolites.
589.8 - 590	Dolostone; laminated, fine to medium grained, light brown.
590 - 591.5	Dolostone, grey-brown, fine grained, swirled texture, burrows (?). Dense.
591.5 - 592.8	Dolostone; vuggy, medium brown, mottled, fine grained. Dolomite rhombs throughout. Vugs are about 1 in. in diameter and form in bands.

592.8 - 595.5	Dolostone; calcitic, medium to fine grained, interlayered medium to light brown.
595.5 - 596	Dolostone; argillaceous, green-grey to light brown interlayers. Dense. Swirled texture.
596 - 596.2	Dolostone intraclasts in grey-green argillaceous dolostone matrix at top, then unit is light brown, fine grained dolostone.
596.2 - 596.6	Dolostone; medium brown, medium to fine grained. Microstylolites abundant.
596.6 - 597.1	Dolostone; fine grained, medium brown, dense. Chert nodule at 597.
597.1 - 598.3	Dolostone; mottled brown and grey-green, in part argillaceous, fine grained. Stylolitic with insoluble concentrated as dark residue.
598.3 - 598.8	Dolostone; medium grey, fine to medium grained. Dense, microstylolitic.

Note: Core as labelled for footage differs from amount of core present. Description will not correspond between 591 and 601. Extra footage is indicated below by footage repeat in order.

598 - 600	Dolostone; calcitic, argillaceous, medium grey to grey-green, mottled, fine to medium grained. Conodont sample 598.5 - 598.9.

Note: Extra core included in stratigraphic order as units A.

600A - 600.8A	Limestone; argillaceous, shale clasts throughout, medium brown, some indistinct lamination.
600.8A - 600.9A	Limestone; light grey. Contains shale and shale clasts. Limonitic.
600.0 - 600.3	Limestone; chalky white color, flat pebble conglomerate. Porous. Pyrite, sphalerite. Very low density in upper part, almost a chalk.
600.3 - 602.9	Limestone; dolomitic and brown interlayered with tan calcitic dolostone. Conodont sample 602 - 202.55.
602.9 - 603.95	Interlayered argillaceous dolostone and limestone; grey green to brown color.
603.95 - 605.4	Limestone, brown to dark grey, fine grained, fossiliferous. Corals, stromatoporoids, brachiopods, bryozoans. Stolotic at top. Conodont sample, 203.45 - 604.25.

605.4 - 607	Dolostone; calcitic, grey-green, slightly argillacerous, evenly laminated. Interlayers of brown dolostone and limestone.
607 - 207.5	Limestone; medium grained, brown, laminated calcilutite.
607.5 - 608.8	Dolostone; argillaceous, calcitic, green. Sharp upper contact. Mottled at base.
608.8 - 610.4	Dolostone; dark brown, calcitic, fine grained.
610.4 - 611.2	As above, but more calcitic. Coral fragments. Microstylolites at 611.2.
611.2 - 611.6	Dolostone; fine to medium grained, very calcitic, brown. Fractured (sealed).
611.6 0 611.9	Missing from core.
611.9 - 612.5	Dolomitic limestone; chocolate brown, fine grained, fossiliferous. Stromatoporoids, corals. Solution collapse fractures; sealed void space to sparry calcite. Conodont sample.
612.5 - 613.5	Argillacerous dolostone; grey-green, fine grained, swirled texture, slightly calcitic. "Speckled" on surface and within rock.

Core Description of the Devonian System

M.C. Tynan

August, 1980

For D-28, Larson Lake, Cherokee County, Iowa, SE¼, NE¼, SE¼, NE¼, sec. 1, T 91N, R 39W. To be used as compliment to Preliminary description of core by B. Witzke, October, 1979.

MISSISSIPPIAN (PART)

499 - 507.8	Dolostone, lt. grey, fine grained, porous, some vugs and rare crinoid plates and columnals, green shale void fill and sandy for 499-507. Conodont sample 505.6-506.4. 507-507.9 Dolostone as above, argillaceous; sandstone at base. 507.9 is base of sandstone unit and marks the arbitrary point chosen for Devonian-Mississippian boundary. From 507.9-508.7, Dolostone, light grey to tan, argillaceous, shale clasts.

Devonian:

508.7 - 510.4	Alternating layers of medium grey and green grey dolomitic sandy shale. Small green shale clasts throughout; sand at base.
510.4 - 511.1	Breccia, light grey, fine grained dolostone with sand void fill.
511.1 - 511.4	Fractured light brown dolostone, vugs and open void.
511.4 - 512.2	Green and grey sands shale, green shale clasts at base.
512.2 - 512.4	Dolostone, medium to light grey, fine grained, porous. Void space lined by calcite & quartz. Sandy in upper .2 feet.
512.4 - 513.3	Dolostone, dense, fine grained, medium to light grey color. Rare small vugs.
513.3 - 514.2	Fractured dolostone, medium grey, fine to medium grained; sand and shale fill along fractures.
514.2 - 524	Dolostone breccia. Dolostone is medium grey, dense fine grained some vugs. Void space along fractures filled with small clasts of dolostone and shale with sand.

524 - 525	Dolostone, light grey, brecciated in upper 3 inches; dense, fine grained, argillaceous. Base marked by shale part at stylolite. 524-525 Conodont sample.
525 - 527.1	Dolostone breccia with sand and green shale fracture fill.
527.1 - 527.8	Dolostone, dense, white to light grey interlayers, fine grained.
527.8 - 528.3	Dolostone, light grey, dense, slightly argilllaceous. Evidence of brecciation prior to lithification, clasts angular, rounded and some deformed plastically.
528.3 - 528.4	Shale, dolomitic, green. Contains small dolostone clasts.
528.4 - 528.7	Light grey dolostone clasts in green dolomitic shale.
528.7 - 531.2	Green shale with light grey and tan dolostone clasts.
531.2 - 532.0	Calcitic shale with clasts of light to medium grey limestone.
532.0 - 536.5	Dolomitic shale breccia, dense. Clasts consist of green shale and tan dolostone.
536.5 - 537.6	Dolostone breccia, argillaceous, dense, light grey to tan, fine grained. Clasts are dark grey porous dolostone; pyrite concentrated in clasts.
537.6 - 538.5	Mixed grey-green and green-grey argillaceous dolostone containing clasts of light grey and tan dense dolostone.
538.5 - 542	Brecciated Dolostone, dense, light brown; clasts of grey and tan dolostone and limestone. Green shale void fill.
542 - 543.3	Shale, green-grey, with dolostone and (void fill?) limestone clasts. Dolostone clasts are white to light grey.
544.4 - 544.8	Dolostone, in part clacitic, dense, light to medium grey. Vertical fractures sealed by calcite. Breccia zone at 544.7-544.8.
544.8 - 551.7	Brecciated dolomitic limestone, light to medium grey, mostly dense and non-porous; some void space sealed by calcite. Limestone medium to coarse grained, rare stylolites; interlayed limestone units, some micro-breccias. Shale partings and fracture fill. Some large void filled with blocky spar.

551.7 - 553.3	Limestone, fine grained, light brown to light grey. 552.6, green shale parting; 552.3, shale part.
553.3 - 553.5	Dolostone, light brown, fine grained.
553.5 - 553.8	Grey-green shale mixed with tan dolostone.
553.8 - 555.5	Shale, med. grey and green with rounded to angular limestone clasts. Limestone clasts are light brown to light grey.
555.5 - 556.5	Brecciated limestone, light brown, dense; some shale and calcite void fill.
556.5 - 558.3	Shale, grey-green, silty; contains small limestone clasts.
558.3 - 559.3	Dolostone, light brown, mottled, calcitic; speckled. Some clasts of medium grey limestone.
559.3 - 569.4	Shale, med grey-green; contains scattered to abundant limestone and dolostone clasts. 568.4-568.6, thin dolostone bed, breccia.
569.4 - 571.7	Shale, grey-green, dolomitic, swirled texture. Contains lt. grey dolostone and limestone clasts.
571.7 - 572.3	Same as above; limestone clasts more abundant and larger. Conodont sample.
572.3 - 575.1	Shale as above; some med grey dolomitic shale.
575.1 - 576.8	Mottled dolostone and grey-green shale, dense, some microbrecciated zones.
576.8 - 579.9	Dolostone and limestone breccia with some grey-green argillaceous dolostone layers. Dolostone clasts fine grained, clacitic. Matrix is grey argillaceous calcite dolostone. Some vugs; pyrite throughout.
579.4 - 580.7	Dolostone, alternating layers of fine to medium grained, tan and light grey dolostone.
580.7 - 582	Dolostone breccia. Clasts vary in color; size range up to 2". Matrix is argillaceous limestone.
582 - 588.9	Shale, calcitic, medium green-grey; contains dolostone and limestone clasts. Small spear filled voids. Conodont sample 582.3-583.
588.9 - 589.4	Mottled tan dolostone and medium grey limestone. Fine grained. Conodont sample 589-589.3.

589.4 - 592.9	Limestone and dolostone breccia; dolostone, tan, fine grained; limestone, medium grey, fine grained. Pyrite throughout. Conodont sample 590.3-591.3.
592.9 - 596.4	Interlayered shale and dolostone; microbreccia. Shale, medium to dark green. Dolostone is argillaceous. Silty at 595. Small light grey and tan dolostone clasts.
596.4 - 608.4	Dolostone, light to medium grey, calcitic, in part argillaceous, fine to medium grained. Green-grey shale parts. Dolostone in part microbreccia.
608.4 - 611.1	Limestone, dolomtiic, interlayered medium to fine grained; fine grained layers are grey; medium grained layers are tan. Conodont sample 610.1 - 611.2.
611.1 - 615	Dolostone, mottled tan and medium grey. Some brecciated zones. Unit fractured; fractures filled with shale and small dolostone clasts.
615 - 617.4	V. fine gravined dense, argillaceous, tan and medium grey dolostone. Swirled texture.
617.4 - 621.5	Dolostone, argillaceous as above. Thin shale parts. Some vugs, low porosity. Shale partings contain limestone clasts.
621.5 - 621.9	Breccia; large clasts of calcitic dolostone and dolomitic limestone.
621.9 - 625	Dolostone; mottled medium grey and tan; fine grained. Some vugs. Calcite void fill. Shale part and breccia at base. Conodont sample 623.7 - 624.4.
625 - 641.5	Shale; green grey, swirled. Abundant dolostone and limestone clasts. Thin dolostone layers. Clasts are light grey, cream colored and brown.
641.5 - 653	Calcitic dolostone and dolomitic limestone; medium to coarse grained, tan, yellow-tan and light grey. Calcite void fill 645-652. Solution collapse features evident, well developed in lower part of unit. Rare stylolites. Breccia in lower 2 feet. Rest of unit displays moderate porosity. Conodont samples 641.7-642.4 and 650.9-651.5.
653 - 666.7	Thin .05 inch green-grey dolomitic shale at top. Dolostone, light grey, argillaceous with green clay void fill. Dolostone is fractured fractures sealed by calcite or filled with green clay. Some shale parts. Basal portion of unit is a dolostone breccia with clay fill.

666.7 - 671.0	Dolostone, calcitic, porous, medium to coarse grained, tan. Some fractures with clay fill and shale parts. Base of unit is brecciated. Conodont samples. 668.8-669.5, 667.8-668.8.
671 - 674.3	Shale, green-grey, slightly calcitic and dolomitic with small dolostone clasts throughout. Swirled texture. Probably void fill.
674.3 - 675.6	Argillaceous dolostone breccia, dense, non porous. Rare voids with clay fill.
675.6 - 682	Dolostone; calcitic, light brown and tan, medium to fine grained, vuggy. Some calcite void fill. Stylolitic. Thin zones of microbreccia. Conodont sample 675.4-676.1.
682 - 683.1	Dolostone, fine grained, dense, argillaceous, grey to grey-green. Basal contact at fracture in micro-brecciated dolostone.
683.1 - 697.5	Dolostone; dense; tan, grey and light brown. Thin lenses of medium grained dolostone. Upper 2 feet calcitic. Unit is vuggy; basal foot very vuggy. Gastropod, (coral and brachiopod fragments). Conodont sample 684.2-684.8.
697.5 - 698.5	Dolostone; calcitic, light grey. Upper .1 ft., micro-breccia. Lower .7 ft. chalky.
698.5 - 699.4	Upper .2 ft. is light brown dolostone. Rest of unit is fractured argillaceous, medium grey, fine grained limestone.
699.4 - 700.1	Shale; slightly indurated, contains dolostone & lime-stone clasts. Probably solution void fill.
700.1 - 701.5	Dolostone; light grey, fine grained, mottled, fractured. Fracture fill with spar.
701.5 - 707.8	Limestone; light grey, stylolitic. Large voids with dog tooth spar. Gastropod at 706.3. Basal .2 ft. dolomitic.
707.8 - 709.2	Shale; green and grey with tan dolostone clasts.
709.2 - 711.3	Dolostone; light grey, argillaceous, brecciated with swirled texture. Shale parts, some vugs in upper foot. "Speckled". Basal .2 ft. in argillaceous dolostone as unit below.
711.3 - 717.3	Dolostone; medium to fine grained; speckled. Some grey-brown dolostone. Rare small vugs. Mottled fine to medium and coarse grained porous zones. Coarse zones may be burrows. Breccia at 715.

717.3 - 718.9	Dolostone; calcitic, vuggy, medium to coarse grained, grey.
718.9 - 720.1	Dolostone; mottled, medium grey, argillaceous, "brecciated". Some small vugs; clay fill.
720.1 - 722	Mottled argillaceous tan dolostone; thin layers evident. Shale; dark green to black with dolostone microbreccia at base.
722 - 730.1	Dolostone; argillaceous, calcitic, tan and light grey interlayers. Limestone at 726.8-727.2 (Conodont sample).
730.1 - 731.2	Dolostone; rust brown, fine to medium grained. Some small vugs, one large void.
731.2 - 734.4	Dolostone; calcitic, fine to medium grained light grey-brown. Some large vugs.
734.4 - 735.4	Limestone; light grey, stylolitic. Laminated at top. Dark shale parts. Dolostone layer at base.
735.4 - 748.2	Dolostone; calcitic, "speckled", tan to light grey, medium to coarse grained, porous; in part laminated; thin microbreccia zones; rare vugs. Laminated layers are light brown. Quartz sand void fill; frosted. Some calcite spar void fill.
748.2 - 763.7	Dolostone; fine grained, mottled, grey, calcitic, argillaceous; alternates with layers of tan and light grey calcitic, vuggy, medium grained dolostone. Brecciated at base with quartz sand void fill. Conodont sample 754.0-748.
763.7 - 769.4	Dolostone; mottled, grey and tan, argillaceous, fine grained. Thin breccia zones throughout, with tan dolostone clasts in a grey dolostone matrix. Shale parts.
769.4 - 771.4	Dolostone; light grey and light brown, fine to medium grained. Some vugs. Calcite void fill. Conodont sample 770.6-771.4.
771.4 - 772.05	Microbrecciated dolostone, grey, argillaceous, vuggy.
772.05 - 777.1	Dolostone; mottled light grey and green-grey, argillaceous. Intensely brecciated. Shale parts probably void fill. Pyrite throughout. Thin bed of tan dolostone at 774.0-774.4. Unit becomes dense, non porous at base. Conodont sample 776.4-776.8. Unti grades into shale unit below.

771.1 - 782.0	Shale; green-grey, mottled, small tan dolostone clasts, dense. Pyrite throughout. Some sand.
782 - 783	Missing from core.
783 - 784.5	Shale; dolomitic, dense. Thin Breccia zone at base.
784.5 - 791.6	Dolostone; fine to medium grained, light grey, slightly argillaceous, fractured. Solution void fill by dark grey dolomitic shale. Calcite void fill. Low to moderate porosity. Conodont sample 788.6-789.5.
791.6 - 793.1	Dolostone; fine grained, light grey, and light brown, laminated in part. Contact gradational with unit below. Some clay shale partings.
793.1 - 796.4	Dolostone; light grey, dense, fine grained, slightly argillaceous, mottled. Shale, parting at base.
796.4 - 800	Dolostone; fine grained, dense, very light grey; calcite and pyrite void fill. Shaley toward base. Shale partings dark grey. Conodont sample 797.2-797.8.
800 - 802	Shale; green-grey, sandy. Base of unit marks lower limit of Devonian system. Unit overlies Elgin Member of Maquoketa Formation (fide' Witzke).

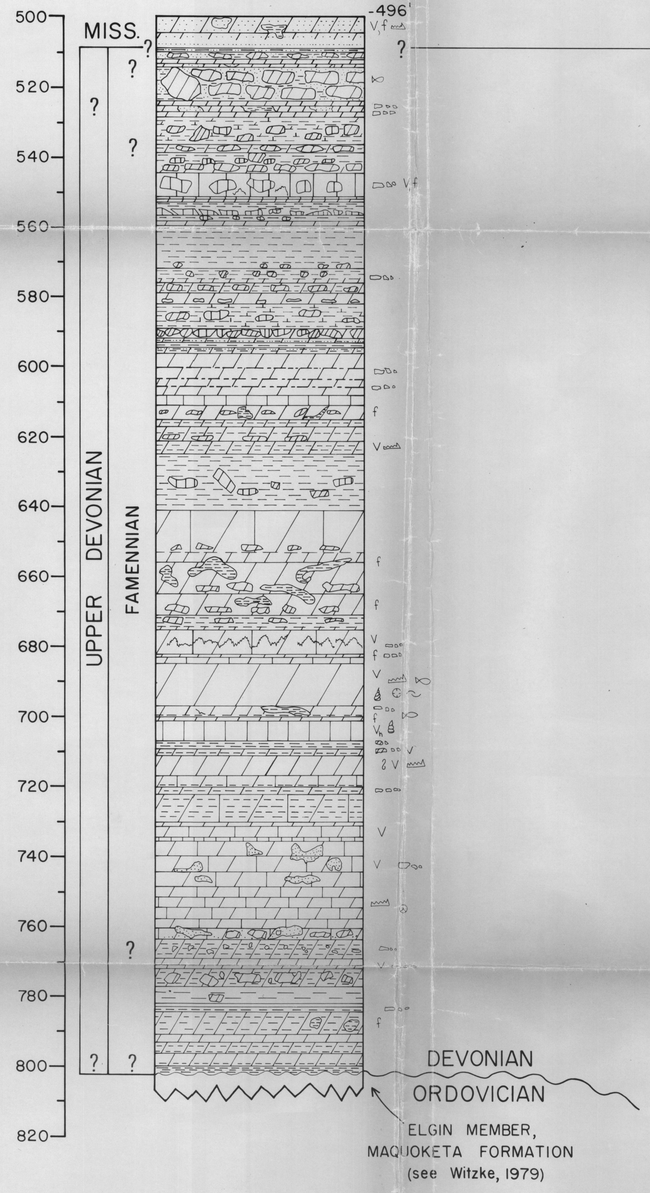
Plate 1

SUBSURFACE DEVONIAN STRATIGRAPHY, CHEROKEE AND WEBSTER COUNTIES, IOWA

Mark C. Tynan, September, 1980

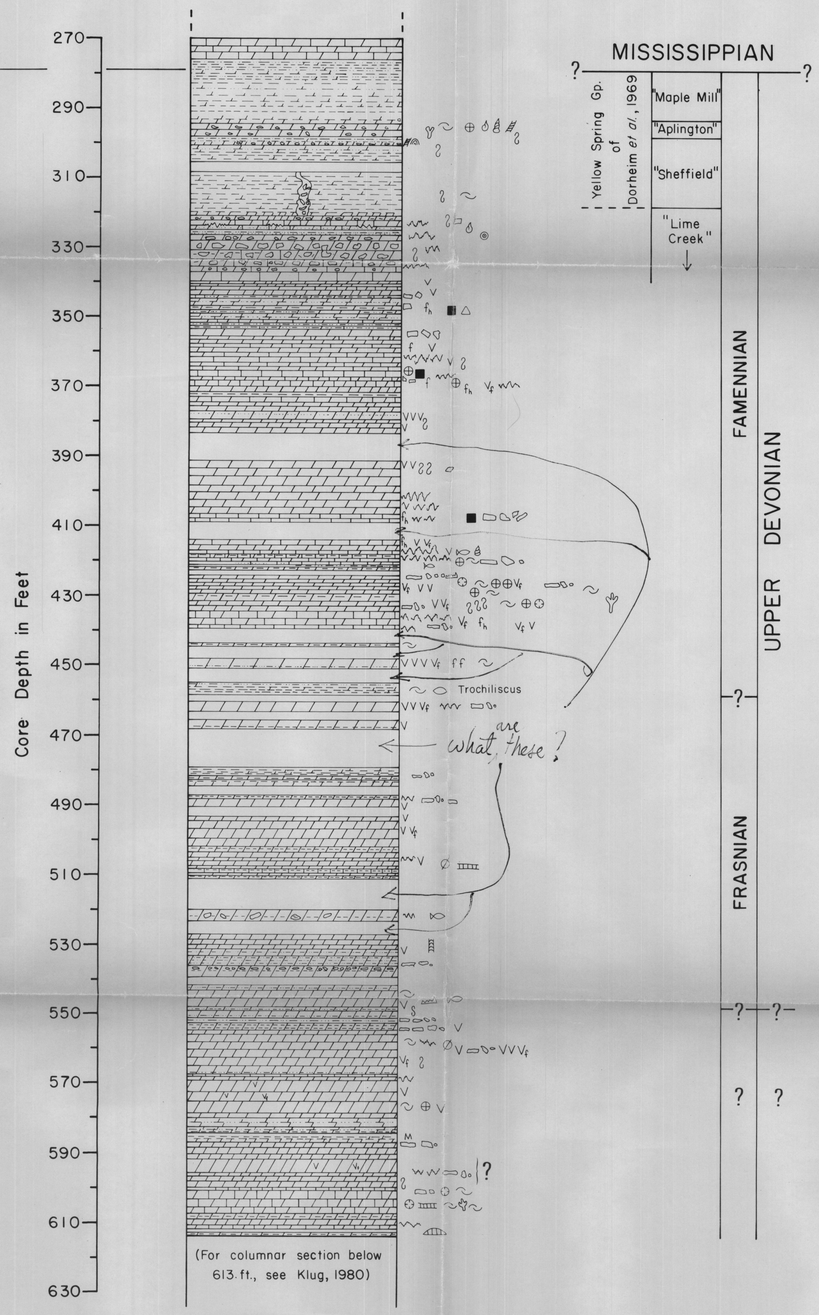
W

LARSON LAKE
CHEROKEE COUNTY, IOWA



E

PETERSON NO. 1 (part)
WEBSTER COUNTY, IOWA



LEGEND

- Shale
- Siltstone
- Dolomitic siltstone
- Calcitic siltstone
- Calcitic shale
- Dolomitic shale
- Sandstone
- Limestone
- Dolostone
- Sandy limestone
- Shaley or argillaceous limestone
- Calcitic dolostone or Dolomitic limestone
- Breccia
- Breccia and microbreccias
- Brachiopods
- Bryozoans
- Corals
- Crinoids
- Fish remains
- Algae
- Gastropods
- Stromatoporoid
- Ostracode
- Sporomorphs
- Coal
- Chert
- f, f_h Fractures, healed fractures
- V, V_f Vugs, vugs with some fill
- M Mudcracks
- Ooids
- Stromatolitic
- Stylolites
- Burrows
- Fossil hash
- Scolecodents
- Ostracodes