

**KANSAS GEOLOGICAL SURVEY
OPEN-FILE REPORT 93-35**

**STRATIGRAPHIC SECTIONS--
WOODSON COUNTY, KANSAS**

by

Christopher G. Maples

Disclaimer

The Kansas Geological Survey does not guarantee this document to be free from errors or inaccuracies and disclaims any responsibility or liability for interpretations based on data used in the production of this document or decisions based thereon. This report is intended to make results of research available at the earliest possible date, but is not intended to constitute final or formal publications.

Kansas Geological Survey
1930 Constant Avenue
University of Kansas
Lawrence, KS 66047-3726

**STRATIGRAPHIC SECTIONS--
WOODSON COUNTY, KANSAS**

Christopher G. Maples

**Kansas Geological Survey
Open-file Report 93-35**

Buffalo Quadrangle
Map Sta:

Chris Maples

4-26-92

- 1) Sandstones and shales of Weston Shale Member exposed along south and west edges of SW 1/4, SE 1/4, sec. 35, T26S, R15E.

Buffalo Quadrangle
Map Sta:

Chris Maples

7-19-93

- 2) Stanton-Weston contact exposed on both sides of low-water crossing on east-west road near midpoint, south edge SE 1/4, SE 1/4, sec. 28, T26S, R16E, at '905' (hand level to spot elevation). Examined with S.A. Marcus.
- 3) Exposure in west-flowing creek about 200' north of midpoint, south edge sec. 27, T26S, R16E. Approximately 6" micritic limestone with pyrite and small (mm scale) charcoal clasts overlies 6" + of dark gray, sandy, micaceous shale. The micrite becomes more brown and argillaceous upward (from dark gray). The micrite is overlain by 5' + of cm-scale, ripple-bedded siltstone with small trace fossils (aff. Planctichnus, Planolites, and Mermia). This probably is Stanton-Weston transition. Top of micrite at '919' (estimated from spot elevation). Examined with S.A. Marcus.

Buffalo Quadrangle
Map Sta:

Chris Maples

7-20-93

- 4) Poor exposure of shale, siltstone, and sandstone on roadcut of abandoned part of old US75 near midpoint, east edge SW 1/4, sec. 31, T26S, R16E. Strike N3°W; dip 8°NE. Probably Weston Shale. Examined with S.A. Marcus.

- 1) Ireland Sandstone Member of Lawrence Shale exposed along east-west portion of highway 105 in cut-bank at east end of Toronto Dam; NW 1/4, NE 1/4, SW 1/4, sec. 31, T26S, R14E; strike $N6^{\circ}E$, dip $22^{\circ}WNW$ (west end of exposure, south side of road); strike $N5^{\circ}E$, dip $19^{\circ}WNW$ (east end of exposure, south side of road).
- 2) Ireland(?) Sandstone and Haskell Limestone Members exposed in Verdigris River in NW 1/4, SE 1/4, SE 1/4, sec. 36, T26S, R13E. Haskell at $\bar{863}'$ (hand level to topographic line). I've run into a bit of a dilemma at this and nearby exposures--discerning small-scale structure from large-scale syndimentary deformation. For the moment, I'm assuming that what I'm seeing is structural in origin. The Ireland(?) Sandstone spars the Verdigris River at this locality. Strikes and dips, from northeast bank to mid-river, taken in the sandstone are: $N8^{\circ}W$, $45^{\circ}SW$; $N72^{\circ}E$, $38^{\circ}NW$; $N74^{\circ}E$, $34^{\circ}NW$. Within 20' southeast of this structure (syncline?), all strata flatten somewhat and re-assume what seems to be an overall regional structural trend: $N1^{\circ}E$, $26^{\circ}ESE$ (measured in Haskell Limestone Member). The Ireland(?) feature is difficult to place in an overall context, so it may be syndepositional, but more exposures are needed to be sure.
- 3) Exposure of lowermost Ireland(?) Sandstone Member and Haskell Limestone Member in Verdigris River 200'-300' south of Toronto Dam in center, N 1/2, NW 1/4, SE 1/4, sec. 36, T26S, R13E. The floor of the Verdigris here is undulating Haskell Limestone Member with up to 6' of relief seen and dips in all directions up to nearly 20° , Haskell here is at $\bar{863}'$ (hand level to topographic line). Two major joint sets in the Haskell here vary from due east to $N65^{\circ}E$ and from $N15^{\circ}E$ to $N40^{\circ}E$. On the east bank, the Haskell is structurally doubled (or maybe tripled). The lowermost Haskell is the floor of the Verdigris that undulates, but generally has unmeasurable strike and dip. The middle Haskell has a representative strike and dip of $N50^{\circ}E$, $27^{\circ}SE$. The upper Haskell has a representative strike and dip of $N30^{\circ}E$, $48^{\circ}SE$. This is overlain by the Ireland(?) Sandstone, which has a strike and dip of $N53^{\circ}E$, $52^{\circ}SE$.
- 4) Ireland(?) Sandstone Member exposed on east side of north-south road, on west edge of SW 1/4, NW 1/4, SW 1/4, SW 1/4, sec. 32, T26S, R14E. The sandstone here (as it generally is everywhere) is so flat that strike and dip are not measurable on outcrop.
- 5) Ireland(?) Sandstone Member exposed on southeast side of Woodson Cove, about 200'-400' north of center sec. 31, T26S, R14E. Strike and dip are $N2^{\circ}E$, $22^{\circ}SE$. At point southwest across small unnamed cover (about 300'), dips are clearly toward the northwest.

- 6) Ireland(?) Sandstone Member exposed on west side of point on west side of Woodson Cove, in NE 1/4, SE 1/4, NW 1/4, sec. 31, T26S, R14E. Strike in dip approximately due east and 7° N.

Coyville Quadrangle
Map Sta:

Chris Maples

1-11-92

- 7) Exposure of Ireland Sandstone Member east of Toronto Dam near south mouth of Woodson Cove in SE 1/4, SE 1/4, NW 1/4, sec. 31, T26S, R14E. Two strikes and dips taken at this locality: $N70^{\circ}$ E, 19° NW and $N50^{\circ}$ E, 14° NW.

Gridley Quadrangle
Map Sta:

Chris Maples

8-27-93

- 1) Excellent exposures of limestones and shales along South Big Creek and north-flowing creek in E 1/2, SE 1/4, SE 1/4, NE 1/4, sec. 20 and W 1/2, SW 1/4, SW 1/4, NW 1/4, sec. 21, T23S, R14E. Two main limestone beds at 1086' and 1100' (hand level from spot elevation) separated by a shale with abundant Neochonetes and diverse brachiopods in the upper 2'; zone of myalinids about 4' below lower limestone. Both limestones are coated-grain grainstones. This probably is in the Big Springs-Beil interval. Examined with S.A. Marcus.
- 2) Poor exposure of limestone conglomerate and argillaceous, fossiliferous micrite (probably all less than 2' thick) in east-west road at 1178' (hand level to topographic line). Exposure near midpoint, south edge SW 1/4, SE 1/4, sec. 29, T23S, R14E. Examined with S.A. Marcus.
- 3) Good exposure of thin (<6") fossiliferous micritic limestone with some grainstone/packstone beds (<2") in center, SW 1/4, SW 1/4, sec. 29, T23S, R14E. This looks a lot like the limestone above the conglomerate at MS2 and probably is the lower part of the Avoca. Exposure at 1170' (estimated from topographic map); examined with S.A. Marcus.
- 4) Sandstone exposed in roadcuts and creeks along north-south road separating sec. 29 and sec. 30, T23S, R14E. Examined with S.A. Marcus.
- 5) Exposure (poor) of upper Beil through upper Avoca along north-south road on west edge NW 1/4, sec. 20, T23S, R14E. Top of Beil at 1116', base of Beil estimated at 1114'; yellow nodular zone in King Hill Shale at 1117'; base of lower Avoca Limestone Member at 1126'; base of upper Avoca Limestone Member at 1131' (all hand level to spot elevation). Examined with S.A. Marcus.

Gridley Quadrangle
Map Sta:

Chris Maples

9-23-93

- 6) Exposures along north-south road on west edge SW 1/4, NW 1/4, sec. 23, T23S, R13E. Rock Bluff-Ervine Creek Limestone Members poorly exposed in roadway at 1172'; Hartford Limestone Member poorly exposed at 1204' (both hand level to topographic line).
- 7) Exposure in north-south road, approximately 100' north of midpoint, west edge SW 1/4, sec. 23, T23S, R13E. Exposure seems to be Rock Bluff Limestone Member.

- 8) Hartford Limestone Member exposed in north-south road and field in northeast corner SE 1/4, SE 1/4, sec. 26, T23S, R13E, at 1225' (hand level from spot elevation).
- 9) Sandstone exposed on north side of east-west road at 1146' (hand level to spot elevation).
- 10) ?Big Springs/Spring Branch Limestone Member exposed in east-west road near midpoint, south edge SE 1/4, SE 1/4, sec. 30, T23S, R14E, at 1141' (hand level from spot elevation). Abundant syringoporoid limestone float along road to west for approximately 1/4 mile.
- 11) Upper Avoca limestone exposed in ditch on east side of north-south road near midpoint, west edge SW 1/4, sec. 30, T23S, R14E, at 1148' (hand level to topographic line). Lower Avoca limestone may be only 1' or less below the upper Avoca at this locality.
- 12) King Hill-Avoca poorly exposed along north-south road at 1124' and 1132', respectively (both hand level from topographic line). Exposure on south side of South Big Creek near midpoint, west edge NW 1/4, sec. 30, T23S, R14E.
- 13) Big Springs-Beil Limestone Members exposed in creek in northwest corner sec. 30, T23S, R14E. Good exposure with green Queen Hill Shale Member exposed between the two limestones. Base of Big Springs at 1112' (hand level to spot elevation).

Gridley Quadrangle

Chris Maples

9-24-93

Map Sta:

- 14) Lower Avoca Limestone Member exposed on east side of north-south road along west edge SW 1/4, SW 1/4, NW 1/4, sec. 32, T23S, R14E, at 1151' (hand level to spot elevation). Examined with S.A. Marcus.

1. Toronto Limestone Member (about 5' thick) exposed along east-west road near mid-point, south edge SW 1/4, sec. 15, T23S, R15E, at ~1052' (hand level from topographic line).
2. Toronto Limestone Member exposed along east-west road near mid-point, SE 1/4, SE 1/4, sec. 16, T23S, R15E, at ~1044' (hand level to topographic line).
3. Leavenworth Limestone Member exposed on south side of east-west road near midpoint, north edge NW 1/4, SW 1/4, sec. 4, T23S, R15E, at ~1043' (hand level from topographic line). Thin (<1") molluscan/myalinid limestone occurs within 1' of Leavenworth base.
4. Sandstone and shale exposed north and west of road in southeast corner NW 1/4, sec. 4, T23S, R15E.

10-13-90

- 4a. Leavenworth Limestone Member exposed in SW 1/4, SW 1/4, SW 1/4, SW 1/4, SE 1/4, sec. 21, T22S, R15E, at ~1019' (hand level to spot elevation). Sequence overlain by >5' of chert gravel. Some black shale chips seen above Leavenworth in chert gravel.
5. Partial section of poorly exposed Plattsmouth Limestone Member at ~1024' (hand level to topographic line). Exposure in southeast corner NE 1/4, SE 1/4, sec. 21, T22S, R15E. Section overlain by >5' of chert gravel.

11-10-90

6. Exposure near midpoint, east edge NE 1/4, sec. 18, T23S, R15E; sandstone (yellowish-brown, fine- to medium-grained, bioturbated in part, about 5' thick) at ~1120' (hand level to spot elevation).
7. Sandstone exposed to top of hill near midpoint, south edge, SE 1/4, SW 1/4, sec. 15, T23S, R15E. Is this a sandstone (with subsequently thickened section) in the Snyderville, or have I missed the Leavenworth-Plattsmouth interval? My suspicion is the former, although I cannot rule out the latter.

11-11-90

8. Sandstone-siltstone-shale float along east-west road on top of hill in SW 1/4, SW 1/4, SW 1/4, sec. 18, T23S, R15E.

9. Sandstone, 2'-3' thick, poorly exposed on north side of east-west road at ~1094' (hand level to topographic line). Exposure along south edge SE 1/4, SE 1/4, SW 1/4, SE 1/4, sec. 13, T23S, R14E.
10. Sandstone, same as MS9, poorly exposed on north side of east-west road at ~1083' (hand level from topographic line). Exposure along south side of SE 1/4, SE 1/4, SW 1/4, sec. 13, T23S, R14E.
11. Limestone, coated-grain, molluscan grainstone, about 2' thick, exposed on north side of east-west road at ~1080' (hand level to spot elevation). Sandstone exposed below(?) this limestone to creek level. Exposures along south edge SE 1/4, SW 1/4, SW 1/4, sec. 13, T23S, R14E. Thin-bedded, ripple-marked, bioturbated sandstone exposed in ditch along north edge NE 1/4, NW 1/4, NW 1/4, NW 1/4, sec. 24, T23S, R14E. The limestone seems to be one of those usually discontinuous limestones that occur in predominantly siliciclastic sediments (e.g., the limestone in the Calhoun Shale).
12. Avoca Limestone Member, lower and upper beds, poorly exposed along south edge SE 1/4, SW 1/4, sec. 15, T23S, R14E. Lower bed dark, weathers chippy, with brown fusulinids, at ~1150'; upper bed lighter colored, with abundant syringoporoid coral slabs scattered on the hilltops, at ~1158' (both hand level from topographic line). SAMPLE: GSE12.1, syringoporoid from upper Avoca.
13. Curve ball. Sandstone and silty shale exposed in gully at ~1118'; two, about one-foot thick limestone beds, separated by <1' of cover; lower bed fusulinid-rich, dark limestone; upper bed lighter in color and contains more echinodermal debris. Overlain by about 2' of covered interval, then yellow, earthy, unfossiliferous limestone seen elsewhere near the top of the King Hill Shale, below the Avoca Limestone. Lower limestone bed at ~1130', yellow bed at ~1135' (all hand level from spot elevation). Exposures along east edge, NW 1/4, SW 1/4, sec. 15, T23S, R14E. Are the two limestones all that remains of the Beil/Big Springs interval?

14. Exposures along north-south roading, extending from east edge SE 1/4, SE 1/4, SE 1/4, sec. 9, T23S, R14E, to east edge N 3/4, N 1/2, NE 1/4, sec. 16, T23S, R14E. Poor to good exposure along entire road. White, fossiliferous grainstone about 2'-3' thick exposed at ~1078'; yellow-weathering, coarse-grained, fossiliferous grainstone to packstone about 2' thick, with fusulinids decreasing in abundance upward, at ~1084' (could this be the Clay Creek?); sandstone, yellow to cream colored, fine to medium grained, crossbedded, same bioturbation, about 1'-2' thick at ~1092'; sandstone, about 1' thick, weathers light gray with some yellow, mostly fine grained, at ~1110'; limestone, about 2'-4' thick, yellow weathering to medium-gray weathering, coarse fossiliferous packstone/grainstone to fusulinid grainstone, at ~1127' (all hand level from topographic line). This upper limestone may be the Beil.

(Revisited - 11-3-91) - The lower limestone couplet that I called questionably Clay Creek is one of those coated-grain pack-grainstones that shows up in thick siliciclastic sequences, which means it may equate with no named limestone.

15. Excellent exposures along intermittent stream in N 1/2, SE 1/4, sec. 16, T23S, R14E. All sandstone and shale from road on east to center of section; sandstone more common in upper 1/2 of unit; reddish shale more common in lower 1/2 of unit.

11-17-90

16. Exposures of thin (<2') dark, fossiliferous wackestone/packstone examined with Al Robb. Dark limestone is single bed, weathers slabby, looks like Avoca, at ~1099'; overlain by sandstone, very poorly exposed, at ~1113' (both hand level to topographic line). Exposure in creek valley along east edge SE 1/4, SE 1/4, NW 1/4, sec. 33, T22S, R14E.

(Revisited - 10-11-91 - with Ronald R. West, Kansas State University). This is Big Springs-Beil, with about 1' of Doniphan between the two.

17. Very poor exposure of dark, argillaceous, yellow-brown weathering wackestone on south side of east-west road at ~1125' (hand level to spot elevation). Exposure examined with Al Robb, situated on north edge of NW 1/4, NW 1/4, NE 1/4, sec. 3, T23S, R14E.

(Revisited - 10-11-91) This may be Ozawkie or Avoca. Revisited with Ronald R. West (Kansas State University). A few general comments about this Big Springs-Ozawkie interval: The Big Springs looks a lot like the Ozawkie (yellow weathering, small fusulinids); the Avoca is more massive, dark, and contains larger fusulinids. There is a sandstone either within (i.e., between upper and lower) or above the Avoca in this area, which I have not seen before.

2-10-91

18. Exposure of west side of north-south road about 300' north of southeast corner sec. 19, T22S, R15E. Yellowish-orange crinoidal-brachiopod-coated-grain packstone about 1'-2' thick at ~1118' (hand level from spot elevation). This looks like more of the Clay Creek interval.

10-11-91

19. Sandstone exposed along south edge SW 1/4, SW 1/4, SW 1/4, sec. 25, T22S, R14E. Thin veneer (<2') of chert gravel on top of sandstone. Visited with Ronald R. West (Kansas State University).
20. Ozawkie Limestone Member (I think) exposed on east end of farm pond in SE 1/4, SW 1/4, SW 1/4, SW 1/4, sec. 26, T22S, R14E, at ~1108' (hand level to spot elevation). Visited with Ronald R. West (Kansas State University). After a further look at MS21 we think this is the Big Springs-Beil interval instead.
21. Big Springs--Beil interval exposed on east side of Varvel Creek, about 15' north of east-west highway near midpoint, south edge SE 1/4, SW 1/4, SW 1/4, sec. 27, T22S, R14E, at ~1086' (hand level to topographic line). Visited with Ronald R. West (Kansas State University).
22. Exposure along dead-end road on west edge SW 1/4, NW 1/4, SE 1/4, sec. 34, T22S, R14E. Big Springs-Beil at ~1093'; Avoca at ~1109' (both hand level from topographic line). Visited with Ronald R. West (Kansas State University).

11-3-91

23. Sandstone exposed on south side of east-west road near midpoint, north edge NE 1/4, sec. 9, T23S, R14E.

11-29-91

24. Chert gravel on both sides of east-west highway near midpoint north edge NW 1/4, NW 1/4, sec. 34, T22S, R15E. Contact covered, but estimated to be at about 1055' (purely arbitrary and completely indefensible).
25. Chert gravel on north side of east-west highway in southwest corner SE 1/4, SW 1/4, sec. 28, T22S, R15E. No lower contact seen and none estimated.

26. Chert gravel on north side of east-west road and in dam (from pond excavation) along south edge SW 1/4, sec. 29, T22S, R15E. No Lower contact seen and none estimated.
27. Chert gravel on both sides of east-west road near midpoint, south edge SE 1/4, sec. 30, T22S, R15E. No Lower contact seen and none estimated.
28. Chert gravel in dam from pond excavation in NW 1/4, NW 1/4, NE 1/4, sec. 6, T23S, R15E. No lower contact seen and none estimated.
29. Sandstone with abundant ripple marks and trace fossils (similar to sandstone in Stull Shale near Waverly) exposed on southwest bank of creek in NE 1/4, NE 1/4, NE 1/4, sec. 31, T22S, R15E, at ~1050' (hand level to spot elevation).
30. Chert gravel, mostly on west side of north-south road extending from near midpoint east edge SE 1/4 to near midpoint east edge NE 1/4, sec. 31, T22S, R15E. No lower contact seen and none estimated.
31. Shale with thin (mostly < 1") sandstone and ironstone (hematite/limonite) beds scattered throughout; about 40' of nearly continuous exposure along both sides of north-south road along west edge SW 1/4, NW 1/4, sec. 7, T23S, R15E. Trace fossils common (but not very diverse) throughout. Small (~60' x 15') soft-sediment on "pop-up" structure exposed in ditch on west side of road. Orientation of structure about N20 degrees E; about 3' of relief on each bed.
32. Same unit seen at MS31 exposed mostly on east side of north-south road along west edge SW 1/4, SW 1/4, sec. 7, T23S, R15E.
33. Exposure of gray, silty shale with thin (< 1/2"), sandy, bioturbated intervals exposed in floor of Varvel Creek near its confluence with South Big Creek on east side of north-south road at bridge 250'-300' north of southwest corner sec. 1, T23S, R14E. Shale overlain by 7' of chert gravel and 5' of alluvium (all considered to be Qal). Contact of chert gravel and shale at ~1032' (hand level to spot elevation).
34. Sandy, slightly molluscan carbonate, about 1' thick, very poorly exposed at ~1060' (hand level to spot elevation). Exposure on east side of north-south road near midpoint west edge SW 1/4, NW 1/4, sec. 12, T23S, R14E.
35. Limestone, crinoidal and molluscan ("oatmeal rock") packstone with shale clasts; about 3' thick with 1'-1 1/2' thick shale in middle part, at ~1043' (hand level to topographic line). Exposure on northeast edge of road NE 1/4, NE 1/4, SE 1/4, SW 1/4, sec. 1, T23S, R14E. This limestone probably does not equate with a named limestone member. I make the statement because this lithotype tends to be randomly occurring in thick siliciclastic units throughout the Coffey County section.

36. Limestone, dark with very common Crunithyris and some mollusks and trilobites, underlain with dark calcareous shale, overlain by thin yellowish-orange calcareous shale and limestone beds. Below dark shale (with chonetids) is a thin (<1/2") molluscan limestone with some myalinids. Brachiopod collection GSE 36.1 from the total sequence (~10'). Exposure fairly poor on top of hill along east edge, midpoint NE 1/4, SE 1/4, sec. 11, T23S, R14E. Dark limestone at ~1115' (hand level from spot elevation). This is the Spring Branch-Big Springs-Beil interval (I think).
37. Limestone as at MS35 and MS34 exposed on south side of east-west road near midpoint north edge NW 1/4, NW 1/4, SW 1/4, sec. 12, T23S, R14E, at ~1060' (hand level to spot elevation).

12-21-91

38. Sandstone in float of old railroad cut in SW 1/4, SE 1/4, SW 1/4, SE 1/4, sec. 31, T22S, R15E.

Gridley SE Quadrangle
Map Sta:

Chris Maples

11-27-92

- 1) Toronto Limestone quarry in SE 1/4, NW 1/4, SW 1/4, sec. 28, T23S, R15E. Base of Toronto here at 1049' (hand level to topographic line). Toronto is about 11' thick here.
- 2) Toronto Limestone Member exposed on east side of north-south road, south of Duck Creek, near midpoint, west edge NW 1/4, SW 1/4, sec. 28, T23S, R15E, at 1035' (hand level to spot elevation).
- 3) Toronto Limestone Member exposed on east side of unnamed, south-flowing tributary into Duck Creek at 1032' and on west side of Duck Creek, south of bridge on east-west road at 1024' (both hand-level to spot elevation). Exposures near center NE 1/4, sec. 29, T23S, R15E.
- 4) Leavenworth Limestone Member exposed in ditch on east side of north-south road at 1058' (hand level from topographic line). Exposure near midpoint, west edge NW 1/4, SW 1/4, sec. 29, T23S, R15E.
- 5) Toronto Limestone Member poorly exposed in north-south road near midpoint, east edge NE 1/4, SE 1/4, sec. 32, T23S, R15E, along south side of east-flowing tributary to Turkey Creek, at 1046' (hand level from topographic line).
- 6) Sandstone poorly exposed in and on both sides of east-west road near midpoint, north edge NW 1/4, NW 1/4, NE 1/4, sec. 36, T23S, R14E.
- 7) Thin (<3"), argillaceous, Neospirifer- and Linoproductus- bearing limestone poorly exposed in and along east-west road at 1130' (hand level to topographic line). This looks like one of those limestones that occurs near the tops of thick siliciclastic packages; these limestones commonly have limited lateral extent (compared with named units). Exposure near midpoint, north edge NW 1/4, sec. 31, T23S, R15E.

Gridley SE Quadrangle
Map Sta:

Chris Maples

8-26-93

- 8) Plattsmouth Limestone Member exposed in bedding planes along floor of south-flowing creek near east edge NW 1/4, NW 1/4, sec. 20, T23S, R15E. Fossils weathering from shale partings from ripples, dunes, and bars in creek bed. Judging from the fossil fauna (brachiopods, echinoderm debris, bryozoans, and sponges), this looks like upper Plattsmouth to Heumader transitional strata.
- 9) Sandstone float poorly exposed in field-access road near midpoint, north edge, NE 1/4, NW 1/4, sec. 28, T23S, R15E.
- 10) Sandstone float poorly exposed in dead end farm road near midpoint, north edge, SW 1/4, SW 1/4, sec. 19, T23S, R15E.

- 11) Fine-grained, ripple-marked, bioturbated, thin-bedded sandstone and shale/siltstone exposed in ditch on east side of north-south road along west side SW 1/4, NW 1/4, sec. 24, T23S, R14E.
- 12) Sandstone exposure and float on south side of east-west road and in northeast-flowing creek in NW 1/4, NE 1/4, NW 1/4, sec. 35, T23S, R14E.
- 13) Sandstone poorly exposed in roadway near midpoint, north edge, NE 1/4, NE 1/4, sec. 34, T23S, R14E.
- 14) Jurasenia-rich limestone (< 1") overlain by myalinid-rich limestone/mudstone at ~1090' (estimated from topographic map) in ditch on west side of north-south road in southeast corner NE 1/4, NE 1/4, NE 1/4, sec. 27, T23S, R14E. May be in Stull Shale.

Gridley SE Quadrangle
Map Sta:

Chris Maples

8-27-93

- 15) Sandstone float and poor exposures on hill and hill slopes in W 1/2, SW 1/4, sec. 34 and E 1/2, SE 1/4, sec. 33, T23S, R14E. Examined with S.A. Marcus.
- 16) Coated-grain, molluscan, echinodermal grainstone (< 1') poorly exposed in north-south road about 200' north of the southwest corner of sec. 27, T23S, R14E, at ~1116' (hand level from topographic line). Examined with S.A. Marcus.
- 17) Sandstone exposed in creek cuts in SE 1/4, SE 1/4, NE 1/4, sec. 21, T23S, R14E and SW 1/4, SW 1/4, NW 1/4, sec. 22, T23S, R14E. Examined with S.A. Marcus.

LeRoy Quadrangle

Chris Maples

11-9-91

Map Sta:

- 1) Sandstone in Lawrence Shale exposed on both sides of north-south highway US75. Exposure along west edge SW 1/4, NW 1/4, NW 1/4, sec. 26, T23S, R15E.
- 2) Shale with abundant small chips of siltstone/fine-grained sandstone exposed on both sides of north-south highway US75; abundant trace fossils on chips. Exposure on west edge NW 1/4, NW 1/4, SW 1/4, sec. 26, T23S, R15E.
- 3) Upper Lawrence-Toronto exposed on both sides of north-south highway US75 along west edge NW 1/4, NW 1/4, sec. 35, T23S, R15E. Fossiliferous (*Juresania*, clams, bryozoans--all sparse) sandy interval (*Amazonia* equivalent?) overlain by interval of calcareous, micritic, yellow-weathering, septaria-like nodules (reminds me of the yellow carbonate in the King Hill Shale, but not as weathered) at ~1071'; Williamsburg coal poorly exposed at ~1075'; Toronto Limestone Member at ~1082' (all hand level from spot elevation).

LeRoy Quadrangle

Chris Maples

11-7-92

Map Sta:

- 4) Toronto Limestone Member poorly exposed in graded roadway at ~1100' (hand level to spot elevation). Exposure in northeast corner sec. 24, T23S, R15E.
- 5) Shale and sandstone/siltstone exposed in roadcut on north side of east-west road in southeast corner sec. 27, T23S, R16E.
- 6) Sandstone and shale exposed along N-S road from midpoint east edge sec. 27 to midpoint east edge SE 1/4 sec. 22, T23S, R16E.
- 7) Sandstone and shale exposed along east-west road on south edge sec. 28, T23S, R16E.
- 8) Sandstone and shale exposed along north-south road on east edge sec. 29, T23S, R16E.
- 9) Toronto Limestone Member exposed on east side of north-south road at ~1118' (hand level to spot elevation). Exposure about 200' south of midpoint west edge NW 1/4, sec. 36, T23S, R15E.
- 10) Questionable occurrence of Toronto float at ~1134' (hand level from topographic line) in NE 1/4, NE 1/4, sec. 36, T23S, R15E.
- 11) Toronto Limestone Member exposed in east-west roadway at ~1108' (hand level from spot elevation). Exposure about 100' west of southeast corner sec. 26, T23S, R15E.

- 12) Toronto Limestone Member exposed in east-west road at ~1100' (hand level from spot elevation). Exposure near midpoint, south edge, SW 1/4, SE 1/4, sec. 26, T23S, R15E.

LeRoy Quadrangle
Map Sta:

Chris Maples

11-27-92

- 13) Sandstone of Lawrence Formation exposed in north-flowing creek in south side of east-west road in NW 1/4, SW 1/4, SE 1/4, sec. 27, T23S, R15E.

Middleton Quadrangle

Chris Maples

1-11-92

Map Sta:

- 1) Westphalia and Haskell Limestone Members exposed in east-west roadway in S 1/2, SW 1/4, SE 1/4, SW 1/4, sec. 35, T26S, R14E, at 954' and 960', respectively (hand level from topographic line). The Westphalia at this locality is a very argillaceous, sandy, coated-grain wackestone to packstone with a clotted and slightly "oatmeal" texture. The Haskell is very dense, micritic, and hard at this locality.

Middletown Quadrangle

Chris Maples

4-25-92

Map Sta:

- 2) Tonganoxie(?) Sandstone Member exposed at top of hill in SE 1/4, SE 1/4, SE 1/4, sec. 29, T26S, R15E. Property of Clyde Hill; brought to site by Don Clarke. Joint pattern of sandstone is N6°E to N70°E (5 readings).

Middleton Quadrangle

Chris Maples

4-26-92

Map Sta:

- 3) Sandstones and shales of Weston Shale Member exposed on hills in SE 1/4, sec. 33, T26S, R15E. Strike and dip are too flat to measure.
- 4) Limestone exposed in east-west road near midpoint, south edge, SW 1/4, SE 1/4, SE 1/4, sec. 32, T26S, R15E, at 964' (hand level to spot elevation). This is the top of the Stanton Limestone and I assume it is the South Bend Limestone Member. Although not well exposed here, the South Bend appears to be a slabby (<2" thick), sandy, brownish-weathering grainstone that is about 5' thick here.
- 5) Micro Lite phlogopite quarry, situated in NE 1/4, NW 1/4 and NW 1/4, NE 1/4, sec. 32, T26S, R15E. Metamorphosed shales, siltstones, and sandstones of Weston Shale Member. Strikes and dips from within the quarry: N60°W, 18°NE; N65°W, 20°NE; N65°W, 19°NE. Baked zone seems very localized. Strike and dip from tidal-flat siltstones in creek (diverted?) near E 1/2, NE 1/4, NW 1/4, sec. 32, T26S, R15E, is N64°W, 10°NE. These flatten Weston Shale Member units seem less baked than within the quarry, proper. Thin, molluscan (pectin-rich), decalcified shale at top of dike/sill near top of hill in north end of quarry.
- 6) Westphalia and Haskell Limestone Members exposed on south side of tributary to Sandy Creek, along north-south road, about 250'-300' south of center, W 1/2, sec. 34, T26S, R14E, at 897' and 905', respectively (hand level to topographic line). Sandstones of Weston Shale Member exposed in creek below Westphalia Limestone Member. Algal coated brachiopods and myalinids weathering out of Vinland Shale Member.

Neosho Falls Quadrangle
Map Sta:

Chris Maples

11-29-92

- 1) Sandstone and shale exposed on north side of east-west road along SE 1/4, SW 1/4, SW 1/4, sec. 23, T23S, R16E.

Piqua Quadrangle
Map Sta:

Chris Maples

11-8-92

- 1) Gravel pit on quadrangle in S 1/2, NW 1/4, SW 1/4, sec. 34, T24S, R17E, is really abandoned quarry in Stanton Limestone--now water filled.
- 2) Top of Stanton Limestone (base of Weston Shale Member?) exposed on both sides of north-south road and above water in "gravel pit" (really abandoned Stanton quarry) near midpoint, west edge SW 1/4, SW 1/4, sec. 3, T25S, R17E, at $\bar{1026}$ ' (hand level to spot elevation). I'm not completely sure about members of the Stanton Limestone, but the limestone here reminds me of the Captain Creek Member.
- 3) Stanton Limestone exposed on both sides of north-south road along west edge NW 1/4, SW 1/4, SW 1/4, sec. 10, T25S, R17E. The limestone here is more grain supported and seems more South Bend-like.
- 4) Stanton Limestone-Vilas Shale contact exposed in ditch on east side of north-south road near midpoint, west edge sec. 1, T25S, R17E, at $\bar{1012}$ ' (hand level from topographic line).
- 5) Stanton Limestone-Vilas Shale contact poorly exposed on both sides of east-west road about 300' east of midpoint, south edge sec. 11, T25S, R17E, at $\bar{1033}$ ' (hand level to spot elevation).
- 6) Stanton Limestone exposed in creek on west side of north-south road in northeast corner SE 1/4, SE 1/4, SE 1/4, sec. 3, T25S, R17E.

Piqua Quadrangle
Map Sta:

Chris Maples

11-29-92

- 7) Thin bedded sandstone and shale exposed on west edge of north-flowing creek, north of east-west road in SE 1/4, SE 1/4, SE 1/4, SW 1/4, sec. 35, T23S, R16E.
- 8) Sandstone and shale exposed in and along east-west road on south edge SE 1/4, SE 1/4, sec. 35 and SW 1/4, SW 1/4, sec. 36, T23S, R16E.
- 9) Sandstone and shale exposed on both sides of north-south road on west edge SW 1/4, SW 1/4, SW 1/4, sec. 1, T24S, R16E.
- 10) Top of Stanton-base of Weston Shale Member exposed in Rock Creek in SW 1/4, SE 1/4, SE 1/4, sec. 17, T24S, R17E, at $\bar{990}$ ' (hand level to topographic line).

- 11) **Top of Stanton-base of Weston Shale Member exposed along east side of north-south road along west edge SW 1/4, NW 1/4, NW 1/4, NW 1/4, sec. 15, T24S, R17E, at '980' (hand level from spot elevation). Additional limestone exposed in base of Rock Creek in NE 1/4, NE 1/4, NE 1/4, NE 1/4, sec. 16, T24S, R17E.**
- 12) **Stanton Limestone poorly exposed on hillslope in NE 1/4, NE 1/4, NW 1/4, NE 1/4, sec. 10, T24S, R17E. Top estimated at '983' (hand level to topographic line).**

Quincy Quadrangle
Map Sta:

Chris Maples

9-24-93

- 1) Rock Bluff Limestone Member poorly exposed in north-south roadway at top of hill near midpoint, west edge NW 1/4, NW 1/4, sec. 6, T24S, R14E, at ~1230' (estimated from topographic map). Sandstone very poorly exposed downhill to south at ~1221' (hand level to topographic line). I cannot find Ozawkie Limestone Member anymore--is this sand the lateral equivalent? Examined with S.A. Marcus.
- 2) Lower and upper Avoca Limestone Members exposed on west side of north-south road about 150' north of midpoint, east edge sec. 1, T24S, R13E, at ~1171' (hand level to topographic line). Upper and lower Avoca are separated by less than 2' here; upper Avoca contains profuse syringoporoids here and at other localities in the area. Examined with S.A. Marcus.

Rose Quadrangle
Map Sta:

Chris Maples

4-25-92

- 1) Haskell Limestone exposed on Don Clarke's property in SE 1/4, NE 1/4, SE 1/4, NE 1/4, sec. 15, T26S, R15E, at 1040' (hand level from topographic line).

Rose Quadrangle
Map Sta:

Chris Maples

12-31-92

- 2) Sandstone and shale exposed on west side of US75 near midpoint, east edge, NE 1/4, sec. 22, T25S, R15E. Sandstone is fine grained; soft-sediment deformational features very common.
- 3) Haskell Limestone Member exposed in southeast-flowing creek in NE 1/4, NE 1/4, NW 1/4, SW 1/4, sec. T26S, R15E, at 1036' (hand level to topographic line). Top of Haskell exposed only; thickness estimated at 2'.
- 4) Shale; dark gray, slate-like; a few plant impressions seen. Exposure in ditch on east side of north-south road near midpoint, west edge, SW 1/4, NW 1/4, sec. 18, T26S, R16E.
- 5) Haskell Limestone Member float exposed in east-west road at 1095' (hand level from topographic line). Exposure near midpoint, north edge NE 1/4, NW 1/4, NW 1/4, sec. 7, T26S, R16E. This exposure is very, very poor and may be nothing more than large (> 1') blocks dumped on the road, but I don't know why anyone would do that.
- 6) Sandstone exposed in east-west road near midpoint, north edge, NE 1/4, sec. 7, T26S, R16E.
- 7) Sandstone and shale poorly exposed along west edge, sec. 6, T26S, R16E.
- 8) Shale with very thin siltstone well exposed on north side of east-west road along south edge SE 1/4, SE 1/4, sec. 1, T26S, R15E.
- 9) Haskell Limestone Member exposed in north-south road at 1083' (hand level from topographic line). Exposure near midpoint, west edge NW 1/4, sec. 7, T26S, R16E.
- 10) Shale and thin-bedded sandstone, ripple marking common; some soft-sediment deformational features seen; exposure on west side of north-south road near midpoint east edge NE 1/4, SE 1/4, sec. 12, T26S, R15E. Strike N80°W, dip 2°NE; may be misleading owing to soft-sediment slumps.
- 11) Shale and thin-bedded sandstone exposed on north side of east-west roadcut near midpoint, south edge SE 1/4, SW 1/4, sec. 12, T26S, R15E. Strike N5°W, dip 4°SW; may be misleading owing to soft-sediment slumps.

- 12) Shale and thin-bedded, ripple-marked, bioturbated (Psammichnites common), fine-grained sandstone exposed on east side of north-south road near midpoint, west edge NW 1/4, sec. 13, T26S, R15E. Strike N60°E, dip 4°NW.
- 13) Very thin bedded sandstone and shale exposed on both sides of north-south road through hill in SE 1/4, NE 1/4, sec. 27 and SW 1/4, NW 1/4, sec. 26, T26S, R15E.
- 14) Exposure of Stanton Limestone, from near the top, exposed in south-flowing creek along west edge, NW 1/4, sec. 24, T26S, R15E.
- 15) Flooded quarry exposure in E 1/2, SW 1/4, SW 1/4, sec. 13, T26S, R15E. Stanton Limestone exposed in quarry; uppermost 5' is thin bedded limestone and calcareous shale (Stoner Limestone Member?). Exposure to surface. Top of Stanton/base of Weston estimated at ~1010'.
- 16) Stanton Limestone exposed along east-west road along north edge, E 2/3, sec. 19, T26S, R16E. Top estimated at ~1016' (hand level from spot elevation).
- 17) Float of oolitic, rip-up limestone conglomerate on west side of US75. Probably South Bend Limestone Member lithology. Top of Stanton estimated at 1020' (hand level to spot elevation).

Rose Quadrangle
Map Sta:

Chris Maples

7-19-93

- 18) Stanton-Weston contact exposed in ditch on west side of railroad track in northeast corner SE 1/4, sec. 18, T26S, R16E, at ~1028' (hand level to spot elevation). Examined with S.A. Marcus.
- 19) Sandstone and shale (?Weston) exposed in road and ditch on north side of east-west road on north edge NW 1/4, NW 1/4, NE 1/4, sec. 20, T26S, R16E. Examined with S.A. Marcus.
- 20) Sandstone and shale (?Weston) exposed in north-south road and west-flowing drainage on west side of road along east edge SE 1/4, NE 1/4, sec. 20, T26S, R16E. Examined with S.A. Marcus.
- 21) Shale exposed on west side of north-south road along east edge NE 1/4, NE 1/4, sec. 29, T26S, R16E. Good soil profile seen--no chert gravel present. Some siltstone and sandstone with finely comminuted plant debris present. Probably Weston. Examined with S.A. Marcus.

Rose Quadrangle
Map Sta:

Chris Maples

7-20-93

- 22) Quarry in Stanton Limestone in SW 1/4, NW 1/4, sec. 19, T26S, R16E. Captain Creek and Stoner Limestone Members exposed--no Eudora Shale Member seen. Captain Creek here is 30' + of phylloidal limestone. Dip not measurable, but towards the south. Top of Stanton at 1027' (hand level to topographic line). Examined with S.A. Marcus.
- 23) Shale, siltstone, and sandstone in Weston Shale--excellent exposure; siltstones and sandstones thin bedded (< 3 cm), ripple-marked, bioturbated. Strike N5° W; dip 16° SW. Dip apparently flattens out southward across exposure face. Examined with S.A. Marcus.
- 24) Sandstone and shale exposed on both sides of north-south road in SE 1/4, NE 1/4, sec. 27, T26S, R15E and midpoint NW 1/4, sec. 26, T26S, R15E. Probably more Weston. Small-normal fault with about 2' of throw and downdip side south seen on west side of road. Examined with S.A. Marcus.
- 25) Poor exposure of sandstone in north-south road near top of hill near midpoint, west edge NW 1/4, sec. 15, T26S, R16E.
- 26) Poor exposure of sandstone in north-south road near top of hill along west edge, NW 1/4, SW 1/4, SW 1/4, sec. 22, T26S, R16E. Examined with S.A. Marcus.

Rose Quadrangle
Map Sta:

Chris Maples

1-3-94

- 27) Sandstone exposed along east-west and north-south roads on east edge, E 1/2, SE 1/4 and south edge W 3/4, sec. 23, T25S, R15E.
- 28) Sandstone poorly exposed along south edge sec. 13, T25S, R15E.
- 29) Westphalia Limestone Member exposed in ditch on north side of east-west road along south edge SW 1/4, SW 1/4, sec. 24, T25S, R15E, at ~1049' (hand level to topographic line).
- 30) Sandstone exposed along south edge SE 1/4, sec. 27, T25S, R15E.

Rose Quadrangle
Map Sta:

Chris Maples

2-5-94

- 31) Sandstone, thin (< 3" beds), ripple-bedded, exposed along hills on east edge sec. 17, T26S, R16E. Examined with S.A. Marcus.
- 32) Sandstone and shale very poorly exposed along east-west road on south edge sec. 21, T26S, R16E. Examined with S.A. Marcus.

Rose Quadrangle
Map Sta:

Chris Maples

3-6-94

- 33) Sandstone poorly exposed along east-west road near midpoint, north edge NE 1/4, NE 1/4, sec. 2, T26S, R15E. Examined with S.A. Marcus.

Toronto Quadrangle

Chris Maples

11-9-91

- 1) Exposure on south side of condemned bridge along north-south road near midpoint west edge NW 1/4, sec. 29, T25S, R14E, at '990' (hand level to topographic line). This may be the Amazonia Limestone Member, but if it is, it is getting thicker (2'-3') and beginning to look at bit like the Toronto; otherwise the Toronto really dives toward the northwest.
- 2) Toronto Limestone Member very poorly exposed along north-south road near midpoint, west edge NW 1/4, NW 1/4, sec. 32, T25S, R14E, at '1016' (hand level from topographic line).
- 3) Toronto Limestone Member exposed on both sides of east-west highway US54 along south edge SE 1/4, SE 1/4, SW 1/4, sec. 30, T25S, R14E, at '995' (hand level from spot elevation).
- 4) Toronto Limestone Member exposed on both sides of east-west highway US54, along south edge SW 1/4, SE 1/4, SE 1/4, sec. 25, T25S, R13E, at '982' (hand level to spot elevation). Williamsburg Coal occurs about 3' below Toronto at this locality (coal about 4"-6" thick).

Toronto Quadrangle

Chris Maples

11-30-91

- 5) Toronto Limestone Member exposed on both sides of east-west road along south edge SE 1/4, SW 1/4, SW 1/4, sec. 25, T25S, R13E. Williamsburg Coal poorly exposed near top of Lawrence Shale (about 10' total Lawrence Shale exposure). Base of Toronto at '970' (hand level to spot elevation).
- 6) Exposure of Toronto Limestone on both sides of east-west road along south edge SE 1/4, SW 1/4, SW 1/4, sec. 26, T25S, R13E, at '953' (hand level from topographic line). Greenish shale with thin limestone/siltstone beds (<1") contains some mollusks and brachiopods over a 3' interval at '931' (hand level to topographic line). Exposure in creek cut about 600' west of west edge of Toronto exposure.
- 7) Toronto Limestone Member exposed on both sides of northeast-southwest part of north-south road at '973' (hand level to spot elevation). Exposure near center, E 1/2, SW 1/4, sec. 35, T25S, R13E.
- 8) Sandstone cliff (40'+ exposed) on west cut-bank of Cedar Creek in NW 1/4, NW 1/4, NW 1/4, NE 1/4, sec. 2, T26S, R13E. This probably would be called Ireland Sandstone Member.
- 9) Sandstone cliff on south cut-bank of Cedar Creek in NW 1/4, SW 1/4, NE 1/4, sec. 2, T26S, R13E (Ireland Sandstone Member).

- 10) Sandstone (Ireland) poorly exposed on east side of north-south road along west edge SW 1/4, SW 1/4, SE 1/4, sec. 2, T26S, R13E.
- 11) Toronto Limestone Member poorly exposed in NW 1/4, SW 1/4, SW 1/4, sec. 7, T26S, R14E, along both sides of northwest-southeast road and in abandoned north-south road, at '990' (hand level to topographic line).
- 12) Ireland Sandstone Member exposed in east-west roadway about 250'-300' east of east edge of Toronto Cemetary, near midpoint, south edge SW 1/4, SW 1/4, sec. 12, T26S, R13E.
- 13) Toronto Limestone Member float along east-west road on south edge SE 1/4, SE 1/4, SW 1/4, sec. 12, T26S, R13E. Toronto elevation at '990' (estimated from topographic map because I'm working with float).
- 14) Toronto Limestone Member exposed on both sides of north-south road along west edge SW 1/4, SW 1/4, SW 1/4, sec. 13, T26S, R13E, at '980' (hand level from spot elevation).
- 15) Toronto Limestone Member very poorly exposed in east-west road along south edge SW 1/4, SW 1/4, SE 1/4, SE 1/4, sec. 2, T26S, R13E, at '995' (hand level to topographic line).
- 16) Toronto Limestone Member very poorly exposed in east-west road near midpoint, south edge, SW 1/4, SW 1/4, sec. 1, T26S, R13E, at '992' (hand level from topographic line).
- 17) Toronto Limestone Member poorly exposed in east-west road near midpoint SW 1/4, SE 1/4, sec. 1, T26S, R13E, at '991' (hand level from topographic line).
- 18) Toronto Limestone Member exposed in and on south side of east-west road near midpoint, north edge sec. 18, T26S, R14E, at '998'; coal smudge at '987' (both hand level to topographic line).
- 19) Toronto Limestone Member very poorly exposed in northeast corner sec. 18, T26S, R14E, at '998' (estimated from spot elevation).
- 20) Toronto Limestone Member poorly exposed in and on north side of east-west road near midpoint, south edge SW 1/4, sec. 8, T26S, R14E, at '1001' (hand level from topographic line).
- 21) Toronto Limestone Member exposed on both sides and in east-west road at '1021' (hand level from spot elevation). Exposure about 400' east of northeast corner sec. 17, T26S, R14E.

- 22) Sandstone (Ireland) exposed in creek in SE 1/4, SE 1/4, NE 1/4, sec. 17, T26S, R14E.
- 23) Thin (<1') remnant of limestone exposed mostly on northeast side of highway in NW 1/4, NW 1/4, NE 1/4, SE 1/4, sec. 18, T26S, R14E, at '970' (hand level from topographic line). There really isn't enough limestone to tell if this is Toronto of Amazonia, but my guess is Toronto. Syringoporoid (T23.1) collected.
- 24) Toronto Limestone Member exposed on both sides of north-south road at '972' (hand level to spot elevation). Exposure about 400' south of northwest corner sec. 19, T26S, R14E.
- 25) Toronto Limestone Member exposed on both sides of north-south road at '972' (hand level to spot elevation). Exposure about 400' south of northwest corner sec. 19, T26S, R14E.
- 25) Abundant Toronto float along east-west roadway in SE 1/4, SW 1/4, NE 1/4, sec. 24, T26S, R13E, at '970' (estimated from topographic map).
- 26) Very poor exposure of Toronto Limestone Member in north-south road in southeast corner NE 1/4, SE 1/4, sec. 13, T26S, R13E, at '985' (hand level from spot elevation).
- 27) Toronto Limestone Member exposed on north-south road at '997' (hand level to spot elevation). Exposure near midpoint west edge NW 1/4, SW 1/4, sec. 6, T26S, R14E.

Toronto Quadrangle

Chris Maples

12-8-91

- 28) Amazonia Limestone Member, Toronto Limestone Member, Snyderville Shale Member exposed along northwest-southeast roadway in SW 1/4, NW 1/4, NW 1/4, sec. 26, T25S, R13E. Amazonia exposed in south cut-bank of Brazil Creek at '906'; base of Toronto slumped and obscure, but at '930' (both hand level to spot elevation). Top of hill (up to 970' +) held up by sandstone in Snyderville Shale interval.
- 29) Leavenworth Limestone Member poorly exposed on north side of east-west road along south edge SE 1/4, SW 1/4, SW 1/4, sec. 14, T25S, R13E, at '966' (hand level to topographic line).
- 30) Toronto Limestone Member exposed in east-west road and along northwest bank of Brazil Creek at '937' (hand level to spot elevation). Lower contact covered and estimated. Sandstone in Snyderville Shale Member. Exposure near midpoint, south edge SW 1/4, SE 1/4, sec. 14, T25S, R13E.

- 31) Toronto Limestone Member-Snyderville Shale Member exposed on east side of north-south road, southeast of bridge over Brazil Creek, near center sec. 23, T25S, R13E, at 929' (hand level to topographic line). Snyderville has shale/sandstone throughout; Toronto is 14'-16' thick here.
- 32) Sandstone in Snyderville Shale Member exposed over interval of about 1000' north and south of midpoint, north edge sec. 26, T25S, R13E. Exposure along north-south road.
- 33) Leavenworth Limestone Member float blocks on top of hill at end of east-west farm road about 300' east of northwest corner sec. 25, T25S, R13E, at 1003' (hand level from spot elevation).
- 34) Toronto Limestone Member float exposed in north-south road near midpoint, west edge NW 1/4, sec. 4, T26S, R14E, at 1015' (hand level from topographic line).
- 35) Toronto Limestone Member at 1013' (hand level to spot elevation). Exposure in north-south road about 250' north of southwest corner sec. 4, T26S, R14E.
- 36) Toronto Limestone Member very poorly exposed at 1030' (hand level from topographic line). Exposure in and on east side of north-south road near midpoint, west edge NW 1/4, sec. 9, T26S, R14E.
- 37) Toronto Limestone Member exposed in north-south road at 1012' (hand level from topographic line). Exposure along west edge NW 1/4, NW 1/4, SW 1/4, sec. 9, T26S, R14E.
- 38) Sandstone exposed in east-west road along south edge NE 1/4, NE 1/4, NW 1/4, sec. 28, T26S, R14E.

Toronto Quadrangle Chris Maples 4-3-92
 Map Sta:

- 39) Toronto Limestone Member exposed near midpoint, west edge sec. 17, T26S, R14E, at 980' (hand level from topographic line). Weathered Williamsburg Coal bloom exposed in ditch on north side of hill. Exposure along north-south road.

Toronto NE Quadrangle
Map Sta:

Chris Maples

11-27-92

- 1) Poor exposure of shale and very fine-grained sandstone and siltstone on south side of east-west road along north edge NW 1/4, NE 1/4, NW 1/4, sec. 8, T24S, R15E.
- 2) Leavenworth Limestone Member exposed in drainage in southeast corner NE 1/4, NE 1/4, sec. 1, T24S, R14E, at 1075' (hand level to topographic line).
- 3) Leavenworth Limestone Member exposed in pasture in southwest corner SE 1/4, SW 1/4, sec. 31, T23S, R15E, at 1074' (hand level to topographic line). Approximately 4' of very weathered greenish-gray shale exposed below Leavenworth; a few scraps of myalinids seen in shale.

Toronto SE Quadrangle
Map Sta:

Chris Maples

11-9-91

- 1) Toronto Limestone Member exposed in north-south road at $\bar{1118}$ ' (hand level to topographic line). Exposure near midpoint, west edge, SW 1/4, sec. 17, T25S, R15E. Abundant Derbyia in uppermost Lawrence Shale directly below Toronto, lesser numbers of Juresania, etc. Williamsburg Coal exposed about 3' below Toronto.
- 2) Amazonia Limestone Member poorly exposed in north-south road near midpoint, east edge SE 1/4, SE 1/4, SE 1/4, sec. 18, T25S, R15E, at $\bar{1096}$ ' (hand level from topographic line).
- 3) Toronto Limestone Member exposed on both sides of east-west road at $\bar{1102}$ '; Amazonia Limestone Member very poorly exposed at $\bar{1085}$ '; nodular, yellow float present below Toronto (both hand level from topographic line). Exposure along south edge SW 1/4, SE 1/4, SE 1/4, sec. 18, T25S, R15E. Massive, crossbedded sandstone in creek bottom near midpoint south edge SE 1/4, SE 1/4, sec. 18, T25S, R15E.
- 4) Amazonia Limestone Member at $\bar{1091}$ '; Toronto Limestone Member at $\bar{1111}$ ' (both hand level from spot elevation). Exposure near midpoint, south edge SW 1/4, sec. 17, T25S, R15E, along north side of east-west road. Abundant brachiopods (mostly chonetids, Derbyia, and Jurassania) in shale beneath Toronto.
- 5) Toronto Limestone Member very poorly exposed on northwest side of highway US54 in NW 1/4, SW 1/4, SW 1/4, sec. 26, T25S, R14E, at $\bar{1062}$ ' (hand level to topographic line).
- 6) Amazonia Limestone Member exposed on both sides of east-west highway US54, mostly east of Missouri Pacific railway overpass, along south edge SE 1/4, SE 1/4, SE 1/4, sec. 28, T25S, R14E, at $\bar{1048}$ ' (hand level to spot elevation).

Toronto SE Quadrangle
Map Sta:

Chris Maples

12-8-91

- 7) Sandstone and sandstone float exposed along east-west road from south edge SE 1/4, SW 1/4, sec. 29, T25S, R15E to south edge SW 1/4, sec. 27, T25S, R15E. Best exposures on south edge of sec. 29.
- 8) Sandstone and shale (Lawrence Shale and Ireland Sandstone) exposed around recently constructed Yates Center Lake in N 1/2, sec. 31 and S 1/2 sec. 30, T25S, R15E.

- 9) Limestone in and on the south side of east-west road near mid-point north edge NE 1/4, sec. 36, T25S, R14E, at '1055' (hand level to topographic line). I think this is a thin (<5') exposure of Toronto Limestone Member rather than a thick exposure of Amazonia Limestone Member.
- 10) Sandstone, shale, and cover along south edge sec. 26, T25S, R14E.
- 11) Toronto Limestone Member exposed on east and west sides of south-flowing creek (in east-west roadway) at '1052' (hand level to spot elevation). Exposure on north edge NE 1/4, NE 1/4, sec. 23, T25S, R14E.
- 12) Sandstone exposed in ditch on east side of north-south road on west edge of SW 1/4, SW 1/4, SW 1/4, SW 1/4, sec. 21, T25S, R15E.
- 13) Sandstone and cover along west edge sec. 5, T26S, R15E.
- 14) Sandstone exposed along road in SW 1/4, sec. 32, T25S, R15E.
- 15) Sandstone exposed along east-west road in N 1/2, NE 1/4, NW 1/4, sec. 6, T26S, R15E.
- 16) Leavenworth Limestone Member float and break in slope along east-west road at '1077' (hand level from spot elevation). Exposure near midpoint south edge SE 1/4, SE 1/4, sec. 15, T25S, R14E.
- 17) Large (>3") limestone gravel in road near midpoint west edge SW 1/4, sec. 19, T25S, R15E, at '1085' (estimated from topographic map). This is all float and a bit large for gravel. Calling this a map station is a reflection of the exposures in this area (the terms desperate and pithetic come to mind). I assume this is Toronto.

Toronto SE Quadrangle
Map Sta:

Chris Maples

1-12-91

- 17) Spillway and creek east and south of dam at Woodson County State Park has low exposure of Westphalia and Haskell Limestone Members overlain by Lawrence Shale and Ireland Sandstone Member to top of hill. Exposures in E 1/2, SW 1/4, NE 1/4, sec. 14, T26S, R14E. Westphalia at '925'; Haskell at '932' (both hand level to topographic line). Haskell with well-developed burrows in uppermost 1"; Westphalia is mixture of fusulinid and coated-grain packstone about 3' thick here; Haskell is single bed, about 2' thick, of fossiliferous mudstone.

Toronto SE Quadrangle
Map Sta:

Chris Maples

3-13-92

- 18) Sandstone exposed on top of hill in NW 1/4, NW 1/4, NW 1/4, sec. 35, T25S, R14E. Given what I see here and at MS10 and MS6, I think MS5 may be Amazonia instead of Toronto.
- 19) Toronto Limestone Member, with coaly smudge directly beneath, exposed along both sides of north-south road near midpoint, west edge SW 1/4, sec. 35, T25S, R14E, at 1050' (hand level to topographic line). Based on this map station, MS5 probably is Toronto and the sandstone at MS18 is in the Snyderville Shale Member.
- 20) Toronto Limestone Member exposed near center N 1/2, sec. 2, T26S, R14E, at 1058' (south hill) and 1054' on hill about 200' north (both hand level to topographic line).
- 21) Amazonia Limestone Member (Juresania and a few pectins in thin sandy units) dug up in and around oil-storage tanks on south side of east-west road at 1057' (hand level to topographic line). Exposure in N 1/2, NW 1/4, NE 1/4, SE 1/4, sec. 2, T26S, R14E. This may be fossiliferous sandstone/shale above the Williamsburg Coal instead of Amazonia.

Toronto SE Quadrangle
Map Sta:

Chris Maples

4-25-92

- 22) Toronto Limestone Member exposed on east side of north-south road near northwest corner SW 1/4, NW 1/4, sec. 15, T26S, R14E, at 1039' (hand level to topographic line).
- 23) Sandstone in Lawrence Shale (=Ireland?) from top of hill downward 30'-40'. Exposure is 400'-600' east of center sec. 22, T26S, R14E.
- 24) Haskell and Westphalia Limestone Members exposed about 150'-200' east of midpoint, west edge sec. 23, T26S, R14E, at 923' and 916', respectively (both hand level to spot elevation). The Westphalia here is about 3.5' of fusulinid and coated-grain grainstone; the Vinland Shale member is about 3.5' thick and has an algal coated fossil assemblage in its upper half; the Haskell is about 2.5' thick.
- 25) Good exposure of thin-bedded fine-grained sandstone and shale in upper Weston Shale Member along northwest cut bank of Sandy Creek, due east of Big Sandy Cemetery, in SE 1/4, NE 1/4, NW 1/4, SW 1/4, sec. 23, T26S, R14E.

- 26) Westphalia Limestone Member exposed in road near center, SE 1/4, NW 1/4, sec. 23, T26S, R14E, at 925' (hand level to topographic line). Nothing but sandy soil and sandstone seen overlying Westphalia here. Below Westphalia, on north side of road, is exposure of upper Weston Shale Member with some flat-topped ripplemarks and large (1'-3') convolute bedding.

Toronto SE Quadrangle
Map Sta:

Chris Maples

4-25-92

- 27) Westphalia and Haskell Limestone Member exposed in and on north side of east-west road near midpoint, north edge SE 1/4, SE 1/4, sec. 14, T26S, R14E, at 932' and 939', respectively (hand level from spot elevation). Vinland Shale Member is about 4' thick here.
- 28) Sandstone float at top of hill in SE 1/4, SW 1/4, sec. 14, T26S, R14E. This is in Lawrence Formation (=Ireland?).
- 29) Westphalia and Haskell Limestone Members exposed in and on northwest side of northeast-southwest road in SW 1/4, NW 1/4, SW 1/4, sec. 13, T26S, R14E, at 941' and 951', respectively (hand level from spot elevation).
- 30) Haskell Limestone Member exposed in ditch on northwest side of northeast-southwest road near midpoint, north edge, NW 1/4, SW 1/4, sec. 13, T26S, R14E, at 959' (hand level to topographic line).

Toronto SE Quadrangle
Map Sta:

Chris Maples

4-26-92

- 31) Toronto Limestone Member exposed in and on north side of east-west road near midpoint south edge SE 1/4, SW 1/4, sec. 10, T26S, R14E, at 1040' (hand level from spot elevation).
- 32) Toronto Limestone Member exposed in and on both sides of north-south road about 200'-250' south of center, sec. 10, T26S, R14E, at 1030' (hand level to topographic line).
- 33) Sandstone in Snyderville Shale Member exposed 100'-150' east and west of midpoint, north edge, sec. 10, T26S, R14E.
- 34) Toronto Limestone Member exposed in small abandoned quarry on north side of east-west road in SE 1/4, SW 1/4, SW 1/4, SE 1/4, sec. 3, T26S, R14E, at 1019' (hand level to spot elevation).

- 35) Sandstone in Lawrence Formation exposed at top of hill in NE 1/4, NW 1/4, sec. 14, T26S, R14E.
- 36) Sandstone in Lawrence Formation exposed to top of hill in NE 1/4, SE 1/4, SE 1/4, sec. 11, T26S, R14E.
- 37) Westphalia Limestone Member exposed in ditch on north side of east-west road near midpoint, south side SW 1/4, SE 1/4, NW 1/4, sec. 13, T26S, R14E, at '955' (hand level to topographic line).
- 38) Westphalia and Haskell Limestone Members exposed on north side, in ditch, of east west road along south edge of SE 1/4, SW 1/4, sec. 7, T26S, R15E, at '966' and '979', respectively (hand level to spot elevation).
- 39) Westphalia Limestone Member exposed in ditch on north side of east-west road near center NE 1/4, sec. 18, T26S, R15E, at '979' (hand level from topographic line). Good exposure of upper 5'-10' of West on Shale Member exposed in ditch below Westphalia Limestone Member. Haskell Limestone Member exposed in ditch about 500' east at '994' (hand level to topographic line).
- 40) Sandstones and shales in Lawrence Formation to top of hill in E 1/2, SE 1/4, NE 1/4, sec. 17, T26S, R15E.
- 41) Sandstones in Lawrence Formation to top of hill in SE 1/4, SE 1/4, sec. 5, T26S, R15E.
- 42) Toronto Limestone Member float poorly exposed on west side of north-south road near midpoint, east edge, NE 1/4, NE 1/4, sec. 29, T25S, R15E, at '1128' (hand level to topographic line).
- 43) Toronto Limestone Member float at top of hill, in plowed fields, in E 1/2, SE 1/4, sec. 17, T25S, R15E. Contact with Lawrence Formation at '1120' (estimated contact; estimated from topographic map).
- 44) Westphalia and Haskell Limestone Members exposed in and on west side of north-south road along east side of SE 1/4, NE 1/4, SE 1/4, sec. 16, T26S, R15E, at '1024' and '1032' (both hand level to spot elevation).
- 45) Sandstones and shales in Weston Shale Member(?) exposed along south edge SE 1/4, sec. 21, T26S, R15E.
- 46) Sandstones and shales in the Weston Shale Member(?) exposed along east edge SE 1/4, sec. 21, T26S, R15E, to top of hill.

- 47) Sandstones and shales to tops of hills from midpoint, west edge sec. 21 to midpoint, west edge NE 1/4, NE 1/4, sec. 21, T26S, R15E. Some uncertainty where the Haskell and Westphalia have crossed the road, but I'm pretty sure these exposures are in the Weston Shale Member.

Vilas Quadrangle
Map Sta:

Chris Maples

7-19-93

- 1) Stanton (?Captain Creek) Limestone exposed in east-west road 50'-200' west of southwest corner sec. 31, T26S, R17E, at ~1025' (estimated from topographic map). Limestone is echinoderm-rich grainstone in part; other parts look like phylloidal algal detritus. Examined with S.A. Marcus.
- 2) Quarry (abandoned) in Captain Creek and Stoner Limestone Members of Stanton Limestone (no Eudora Shale Member seen). Quarry is in NW 1/4, NE 1/4, sec. 5, T27S, R17E. Examined with S.A. Marcus.
- 3) Eudora Shale Member-Stoner Limestone Member contact exposed in ditch on south side of east-west road in N 1/2, NE 1/4, NW 1/4, NE 1/4, sec. 3, T27S, R17E, at ~1013' (hand level to topographic line). Eudora here is black, fissile in lower 2/3; at least 2' thick. Examined with S.A. Marcus.
- 4) Stanton-Vilas contact exposed at 1017' (hand level to topographic line) in north-south road near midpoint, west edge SW 1/4, sec. 8, T27S, R17E. Examined with S.A. Marcus.
- 5) Stanton-Vilas contact exposed at 1004' (hand level to topographic line) in north-south road near midpoint, west edge, NW 1/4, sec. 4, T27S, R17E. Examined with S.A. Marcus.
- 6) Stanton-Vilas contact very poorly exposed in northeast-flowing creek on east side of north-south road in the northwest corner of the SW 1/4, sec. 7, T27S, R17E, at ~1006' (hand level to spot elevation). Examined with S.A. Marcus.

Yates Center Quadrangle

Chris Maples

11-9-91

Map Sta:

- 1) Exposure along east side of north-south highway US75 on west edge SW 1/4, SW 1/4, SW 1/4, sec. 35, T23S, R15E. Yellow nodular zone at '1087'; Toronto at '1094' (both hand level from topographic line).
- 2) Toronto Limestone Member exposed on both sides of north-south highway US75 at '1096'; thin, very weathered, poorly exposed coaly streak at '1092'; thin, very weathered, poorly exposed coaly streak at '1092' (both hand level to topographic line). Exposure along west edge SW 1/4, NW 1/4, NW 1/4, sec. 2, T24S, R15E.
- 3) Toronto Limestone Member exposed on both sides of north-south highway US75 at '1100' (hand level from topographic line). Exposure along west edge NW 1/4, SW 1/4, SW 1/4, sec. 11, T24S, R15E.
- 4) Toronto Limestone Member poorly exposed on west side of north-south highway US75 at '1100' (hand level to topographic line). Exposure near midpoint, east edge, SE 1/4, NE 1/4, sec. 15, T24S, R15E.
- 5) Thin-bedded (<2"), fine- to medium-grained, ripple-marked, bioturbated sandstone exposed primarily on east side of north-south highway US75 along west edge SW 1/4, NW 1/4, SW 1/4, sec. 23, T24S, R15E. This is in the Lawrence Shale, below the Toronto.
- 6) Sandstone, fine- to medium-grained, very common soft-sediment deformational structures, exposed on both sides of north-south highway US75 near midpoint, west edge, SW 1/4, NW 1/4, sec. 35, T24S, R15E.

Yates Center Quadrangle

Chris Maples

11-7-92

Map Sta:

- 7) Toronto Limestone Member exposed in feed lot in northeast corner NW 1/4, sec. 2, T24S, R15E, at '1108' (hand level from spot elevation).
- 8) Sandstone and shale poorly exposed on east side of north-south road along west edge SW 1/4, SW 1/4, sec. 8, T23S, R16E.
- 9) Sandstone and shale exposed in and along east-west road along south edge sec. 13 and 14, T24S, R15E.
- 10) Sandstone very poorly exposed in east-west road along south edge sec. 18, T24S, R16E.
- 11) Sandstone and shale exposed along north-south road on west edge sec. 19, T24S, R16E.

Yates Center Quadrangle
Map Sta:

Chris Maples

11-8-92

- 12) Haskell Limestone Member exposed on both sides of northeast-southwest road near center NW 1/4, NW 1/4, sec. 1, T25S, R15E, at '1016' (hand level to topographic line).
- 13) Very poor exposures of sandstone and shale along east-west road on south edge sec. 20 and 21, T24S, R16E.
- 14) Good exposure of shale/siltstone on north side of east-west road along south edge SE 1/4, SW 1/4, SE 1/4, sec. 16, T24S, R16E.

Yates Center Quadrangle
Map Sta:

Chris Maples

11-29-92

- 15) Haskell Limestone Member exposed in ditch along east side of north-south road along west edge of NW 1/4, SW 1/4, SW 1/4, SW 1/4, sec. 25, T24S, R15E, at '1051' (hand level from spot elevation).
- 16) Sandstone/shale poorly exposed on south bank of and in North Owl Creek in NW 1/4, SW 1/4, SW 1/4, sec. 36, T24S, R15E.
- 17) Sandstone poorly exposed in and along north-south road on west edge NW 1/4, NW 1/4, SW 1/4, sec. 25, T24S, R15E.
- 18) Sandstone with molds of Aviculopecten and float blocks/slabs of sandy limestone exposed on west side of north-south road along east edge SE 1/4, NE 1/4, SE 1/4, sec. 14, T24S, R15E, at '1126' (hand level to spot elevation). This could be either thin, grubby Toronto or fairly typical Amazonia.
- 19) Toronto Limestone Member poorly exposed in and adjacent to north-south road near northwest corner SW 1/4, SW 1/4, sec. 1, T24S, R15E, at '1120' (hand level to spot elevation).
- 20) Sandstone and shale very poorly exposed along south edge sec. 36, T23S, R15E and south edge sec. 31, T23S, R14E.
- 21) Sandstone and shale very poorly exposed along south edge sec. 32, T23S, R14E.

Yates Center SE
Map Sta:

Chris Maples

7-20-93

- 1) Stanton-Vilas contact exposed in east-west road at 1002' (hand level to topographic line) in midpoint, south edge SE 1/4, SW 1/4, sec. 33, T25S, R17E. Examined with S.A. Marcus.
- 2) Weston-Stanton-Vilas contact exposed on east-facing hillside on north side of east-west road along south edge SW 1/4, SE 1/4, SW 1/4, sec. 34, T25S, R17E. Stanton-Vilas contact at 990'; Stanton-Weston contact at 1010' (both hand level to topographic line). Examined with S.A. Marcus.
- 3) Stanton-Vilas contact at 999' (hand level to topographic line). Exposure on north side of east-west road along south edge SW 1/4, SW 1/4, SE 1/4, sec. 3, T26S, R17E. Examined with S.A. Marcus.
- 4) Sandstone exposed in east-west road along south edge SW 1/4, SW 1/4, sec. 3, T26S, R17E. This is a surprise to me, especially given the Stanton elevation at MS3. Examined with S.A. Marcus.
- 5) Sandstone exposed along north-south road along east edge, N 2/3 sec. 9, T26S, R17E. Examined with S.A. Marcus.
- 6) Base of Stanton Limestone very poorly exposed in north-south road at 990' (estimated from topographic map). Exposure is near midpoint, west edge NW 1/4, SW 1/4, sec. 10, T26S, R17E. Good Stanton exposed in ditch on east side of road along west edge SW 1/4, SW 1/4, sec. 10, T26S, R17E. Examined with S.A. Marcus.
- 7) Stanton-Vilas contact at 1005' (hand level from spot elevation). Base of Stanton here is coated grain-small brachiopod pack-/grainstone (same as at MS3). Exposure on west side of north-south road approximately 400'-600' north of southeast corner sec. 16, T25S, R17E. Examined with S.A. Marcus.