# KANSAS GEOLOGICAL SURVEY
# OPEN-FILE REPORT 94-63

STRATIGRAPHIC SECTIONS --
GREENWOOD COUNTY, KANSAS

by

Christopher G. Maples

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Coyville Quadrangle Chris Maples 5-28-94
Map Sta:

1) Toronto Limestone Member exposed in southeast corner sec. 28, T26S, R13E, at ~956' (hand level to spot elevation). Examined with S.A. Marcus.

2) Sandstone exposed along east-west road on south edge sec. 27, T26S, R13E. Examined with S.A. Marcus.

3) Leavenworth-Plattsmouth Limestone Members exposed in east-west road along south edge SW 1/4, SE 1/4, sec. 28, T26S, R13E, at ~1015 and 1020, respectively. Examined with S.A. Marcus.

4) Sandstone in Snyderville Shale Member exposed near midpoint west edge NE 1/4, sec. 33, T26S, R13E. Examined with S.A. Marcus.

5) Toronto Limestone Member exposed in SE 1/4, SE 1/4, NE 1/4, sec. 33, T26S, R13E, at ~956' (hand level to spot elevation). Examined with S.A. Marcus.

Fall River Quadrangle | Chris Maples | 8-17-94
Map Sta:

1) Two thin (<6"), rubbly, crinoid-brachiopod wackestone beds separated by about 2' of mudstone exposed along north-south road near midpoint, west edge NW 1/4, NW 1/4, NE 1/4, sec. 20, T28S, R13E, at ~1002' (hand level to spot elevation). Below this all the way down to about 900' is mostly massive sandstone (Ireland?). The limestone either is Amazonia or very poorly developed Toronto. Examined with K.D. Newell.

Fall River Lake Quadrangle Chris Maples 6-3-94
Map Sta:

1) Leavenworth-Plattsmouth Limestone Members near picnic area on west side of access road, southwest side of dam, near midpoint, north edge NE 1/4, SE 1/4, NE 1/4, sec. 3, T28S, R12E, at ~949'; and 952', respectively (hand level from topographic line). The Plattsmouth here is quite thick again (relative to the Neal Quadrangle thickness), about 8'-10', and largely phylloidal. Examined with K.D. Newell (who found the Heebner and Leavenworth Members, thus proving that the well-exposed limestone is Plattsmouth, not Toronto as has been reported previously).

2) Kereford Limestone Member exposed on south side of Picnic Area access road in NW 1/4, NE 1/4, SE 1/4, NE 1/4, sec. 3, T28S, R12E, at ~1000'; top of Kereford/base of Kanwaka Shale at ~1014' (both hand level to topographic line). Examined with K.D. Newell.

3) Massive, cross-bedded sandstone (±10' thick) exposed in SW 1/4, SW 1/4, sec. 34, T27S, R12E. Examined with K.D. Newell.

4) Massive, cross-bedded sandstone (±10' thick) exposed a reservoir edge on point near center NW 1/4, sec. 33, T27S, R12E. Examined with K.D. Newell.

5) Kereford Limestone Member exposed on north side of east-west Kansas Highway 96 along south edge SW 1/4, NW 1/4, sec. 10, T28S, R12E, at ~966' (hand level from topographic line). Channel sandstone in overlying Kanwaka Shale cuts down to top of Kereford here. Kereford is about 2' thick. Examined with K.D. Newell.

6) Plattsmouth-lowermost Heumader beautifully exposed in active quarry in W 1/2, NW 1/4, NE 1/4, sec. 11, T28S, R12E. Leavenworth Limestone Member exposed under power line near midpoint, west edge NE 1/4, NW 1/4, NE 1/4, sec. 11, T28S, R12E, at ~931' (hand level to topographic line). Fusulinid-rich zone about 4" thick about 5-6' from base of Heumader. Examined with K.D. Newell.

GRIDLEY QUADRANGLE Chris Maples 3-25-94

1) Chert gravel in SE 1/4, SE 1/4, SE 1/4, sec. 22, T22S, R13E. Examined with S.A. Marcus.

2) Chert gravel exposed along east edge NE 1/4, sec. 27, T22S, R13E. Chert exposures abruptly end at about the half-section line. Examined with S.A. Marcus.

3) Chert gravel exposed along east edge NE 1/4, sec. 34, T22S, R13E. Examined with S.A. Marcus.

4) Curzon Limestone Member very poorly exposed in creek bank near midpoint, east edge SE 1/4, NE 1/4, sec. 10, T23S, R13E. Examined with S.A. Marcus.

5) Rock Bluff Limestone Member exposed in east-west road near midpoint south edge SE 1/4, sec. 22, T23S, R13E, at ~1189' (hand level from topographic line). Examined with S.A. Marcus.

6) Thin bedded (<3"), ripple-marked sandstone exposed in north-flowing drainage in W 1/2, SE 1/4, SW 1/4, sec. 22, T23S, R13E. Examined with S.A. Marcus.

7) Ozawkie Limestone Member exposed on hilltop in SW 1/4, SW 1/4, SW 1/4, sec. 22, T23S, R13E, at ~1170' (hand level to spot elevation). Examined with S.A. Marcus.

(Revisited - 11-18-94) This is an unnamed limestone in the Oskaloosa Shale Member. Examined with S.A. Marcus.

8) Rock Bluff Limestone Member exposed near center, SE 1/4, NW 1/4, NW 1/4, sec. 27, T23S, R13E, at ~1180' (estimated from topographic map). Examined with S.A. Marcus.

5-17-94

9) Sandstone exposed in wet-drainage gulley in SE 1/4, NE 1/4, SE 1/4, sec. 28, T22S, R13E. Sandstone seems to become better cemented and slightly fossiliferous near the top, but these slabs are only preserved as float. Thin (≤1') veneer of chert gravel to top of hill; chert thickens to south. This could be a very sandy version of Bachelor Creek Lst. Mbr.

(Revisited) Top of sandstone (base of Bachelor Creek) at ~1241' (hand level from topographic line).

10) Chert gravel overlying shale/mudstone/sandstone exposed along east edge sec. 33, T22S, R13E, to about 1/8 mile from south edge of section.

11) Topeka Limestone (Curzon-Du Bois Limestone Members?) exposed in south-flowing creek along east-west road in E 1/2, SE 1/4, SE 1/4, SW 1/4, sec. 33, T22S, R13E. Top of Curzon (fusulinid grainstone) exposed in creek bottom; Sheldon is about 4' thick of coated-grain and fossiliferous grainstone (some very fine grained) with shaley intervals; Du Bois is orange-weathering fossiliferous wacke-/packstone (very suggestive of Toronto Limestone Member) about 1' thick. Top of Topeka/base of Severy Shale at

~1159' (hand level to topographic line).

12) Chert gravel exposed in field in SE1/4, SE 1/4, sec. 32, T22S, R13E, at ~1170' (estimated from topographic map).

13) Church Limestone Member exposed in curve on east-west road in SE 1/4, SE 1/4, SE 1/4, sec. 29, T22S, R13E, at ~1219' (hand level to spot elevation).

14) Chert gravel at ~1250' (estimated from topographic map) along east-west road on south edge sec. 28, T22S, R13E.

15) Rock Bluff-Ervine Creek Limestone Members exposed along north-south road near midpoint, west edge NW 1/4, NW 1/4, sec. 10, T23S, R13E, at ~1139' and 1142', respectively (hand level to topographic line).

16) Chert gravel poorly exposed along south edge sec. 34, T22S, R13E.

17) Section exposed along north-south road on west edge NW 1/4, SW 1/4, sec. 15, T23S, R13E. Dark, single bed of limestone at ~1127'; Linoproductus-bearing limestone at ~1132'; yellow-weathering, slabby, wavy-bedded limestone at ~1138'; packstone at ~1141' (all ≤ 1-2' thick; all hand level to topographic line). Sandstone at ~1160'; limestone at ~1163' (hand level from topographic line). This is still Lecompton interval and, as far as member-level mapping goes, it continues to be difficult. For the moment, I'm assuming that the lowest limestone is Big Springs and the uppermost one is Ozawkie.

18) Rock Bluff Limestone Member exposed along north-south road about 150' north of southeast corner sec. 16, T23S, R13E, at ~1155' (hand level to spot elevation).

19) Hartford Limestone Member exposed along east-west road near midpoint, south edge SW 1/4, sec. 15, T23S, R13E, at ~1195' (hand level to spot elevation).

20) Same limestone underlain by sandstone as at top of section at MS17 (so far I'm calling this Ozawkie) exposed in north-south road near midpoint, west edge SW 1/4, SW 1/4, sec. 16, T23S, R13E, at ~1172' (hand level from spot elevation).

21) Limestone, dark, single bed with fusulinids and mollusks exposed in east-west road about 200' east of southwest corner sec. 16, T23S, R13E, at ~1133'. Another limestone bed is poorly exposed at ~1140' (both hand level to spot elevation). The upper limestone has a paleosol horizon at its top. For the moment, I'll assume that this limestone pair is the Avoca.

22) Ozawkie? and Rock Bluff Limestone Members exposed in east-west road near midpoint, south edge SE 1/4, sec. 16, T23S, R16E, at ~1144' and 1152', respectively (hand level to spot elevation).

23) Hartford Limestone Member exposed in north-south road near midpoint, west edge NW 1/4, sec. 22, T23S, R13E, at ~1191' (hand level from topographic line).

24) Rock Bluff Limestone Member exposed near midpoint, west edge sec. 22, T23S, R13E, at ~1149' (hand level from spot elevation).

25) Base of Big Springs-Beil interval(?) exposed in north-south road near west edge SW 1/4, sec. 22, T23S, R13E, at ~1114' (hand level to topographic line). Thin, yellow-weathering wackestone overlain by dense, white grainstone and underlain by about 1' of green shale and 2' of slabby, ripple-laminated sandstone.

(Revisited - 11-18-94) This is Ozawkie Limestone Member. Examined with S.A. Marcus.

5-18-94

26) Exposures in creek and along east-west road in NE 1/4, NE 1/4, NW 1/4, NE 1/4, sec. 28, T23S, R13E. Lowest unit exposed in creek cut-bank is gray calcareous mudstone with thin (<1 cm) layers of chonetid brachiopods at ~1103'. Sandstone/limestone combination like MS25 overlies this unit--base of limestone at ~1114' (both hand level to topographic line). I'm still assuming that this is the Big Springs/Beil interval.

(Revisited - 11-18-94) This is Ozawkie Limestone Member. Examined with S.A. Marcus.

27) Limestone, about 2'-3' thick, exposed in north-flowing drainage in SW 1/4, SE 1/4, SW 1/4, SW 1/4, sec. 21, T23S, R13E, at ~1079' (hand level to topographic line). This may be Clay Creek or, if I mis-estimated the base of the Big Springs/Beil interval, this may be lowermost Lecompton. Sandstone exposed in east-west road at ~1091' (hand level from topographic line).

(Revisited - 11-18-94) This is Ozawkie Limestone Member. Examined with S.A. Marcus.

28) Well, I am genuinely confused now. Limestone exposed in N 1/2, NE 1/4, SE 1/4, SE 1/4, sec. 20, T23S, R13E, in west-flowing creek. Excellent exposures with hundreds of feet$^2$ of bedding surfaces. Syringoporoids and large, <u>Caninia</u>-like rugose corals seen.

(Revisited - 11-18-94) This is Avoca. Examined with S.A. Marcus.

5-31-94

29) Spring Branch-Big Springs-Beil Limestone Members exposed up drainage gulley on east side of north-south road near midpoint, west edge SW 1/4, SW 1/4, NW 1/4, sec. 33, T23S, R13E, at ~1066', 1072', and 1082', respectively (hand level from topographic line). Yellow/orange petrocalcic horizon rests directly(?) on Beil. Examined with J.A. Baker.

9-23-94

30) Howard Limestone (Bachelor Creek-Utopia Members) exposed around farm pond in SW 1/4, NW 1/4, SW 1/4, sec. 21, T22S, R13E. Bachelor Creek at ~1182'; Church at ~1185' (both hand level to topographic line). Total thickness of Howard is about 15'. Chert gravel covers top of hills. Examined with S.A. Marcus.

31) Rock Bluff-Ervine Creek Limestone Members exposed along north-south road at ~1142' and 1145', respectively (hand level to spot elevation). Exposure along west edge, SW 1/4, SW 1/4, NW 1/4, SW 1/4, sec. 28, T23S, R13E. Examined with S.A. Marcus.

32) Rock Bluff Limestone Member exposed at top of hill along north-south road near midpoint, west edge NW 1/4, NW 1/4, sec. 28, T23S, R13E, at ~1143' (hand level from topographic line). Examined with S.A. Marcus.

GRIDLEY NW QUADRANGLE Chris Maples 3-23-94
Map Sta:

1) Church Limestone Member exposed on south side east-flowing creek near midpoint west edge SW 1/4, NW 1/4, sec. 3, T22S, R13E, at ~1170' (hand level to topographic line). Black shale (Shanghi Creek Shale Member) with Orbienloidea, Crurithyris, and Dunbarella underlies Church. Remnants of chalky-texture coated-grain wackestone about 2' below Church (maybe the Wauneta Limestone Member) and just below black shale. Examined with S.A. Marcus.

3-24-94

2) Utopia Limestone Member exposed in ditch on south side of east-west road at ~1188' (hand level to topographic line). Exposure near midpoint, north edge NE 1/4, NW 1/4, NE 1/4, sec. 9, T22S, R13E. Examined with S.A. Marcus.

3) Chert gravel capping hill in E 1/2, SE 1/4, sec. 8, T22S, R13E. No idea where lower contact is (not seen). Examined with S.A. Marcus.

(Revisited - 9-26-94) Happy Hollow Limestone exposed in drainage ditch in W 1/2, SE 1/4, SE 1/4, SE 1/4, sec. 8, T22S, R13E, at ~1268' (hand level to Bench Mark). Examined with S.A. Marcus. This is about the level of Tertiary gravels, which cut-out the Happy Hollow laterally.

4) Sandstone poorly exposed in ditch in northeast corner sec. 15, T22S, R13E. Examined with S.A. Marcus.

5) Howard Limestone exposed along east-west road on north edge NW 1/4, NE 1/4, NW 1/4, NE 1/4, sec. 21, T22S, R13E. Bachelor Creek Limestone Member at ~1207', Church Limestone Member at ~1213' (both hand level to topographic line), Utopia Limestone Member at ~1223' (hand level from topographic line). Thin coaly scout exposed in road between Bachelor Creek and Church. Waumeta Limestone Member about 2' below Church Limestone Member. Examined with S.A. Marcus.

6) Chert gravel exposed in hill along north-south road on east edge SW 1/4, sec. 14, T22S, R13E. Base of chert gravel (estimated from topographic map) at ~1230'. Examined with S.A. Marcus.

7) Bachelor Creek Limestone Member exposed on hill on north side of east-west road near midpoint, south edge SE 1/4, sec. 17, T22S, R13E, at ~1189' (hand level from topographic line). Examined with S.A. Marcus.

Hamilton Quadrangle Chris Maples 5-23-94
Map Sta:

1) Bachelor Creek-Church Limestone Members exposed along east-west road near midpoint, south edge SE 1/4, SE 1/4, SW 1/4, sec. 1, T24S, R11E, at ~1076' and 1085', respectively (both hand level to spot elevation).

2) Bachelor Creek-Church Limestone Members exposed along east-west road near midpoint, south edge SW 1/4, SE 1/4, SE 1/4, sec. 1, T24S, R11E, at ~1100' and 1108', respectively (both hand level from topographic line).

3) Hartford-Sheldon(?) Limestone Members exposed in draw and on south side of Willow Creek near center, NW 1/4, NW 1/4, sec. 7, T24S, R12E. Base(?) of Hartford at ~1069'; base of Curzon Limestone Member at ~1080'; base of Sheldon(?) Limestone Member (may be Du Bois) at ~1086' (all hand level to topographic line).

   Oops, after a second look, the base Hartford is not exposed here, and the basal Curzon is at 1072' (hand level to topographic line).

Lamont Quadrangle Chris Maples 5-17-94
Map Sta:

1) Du Bois Limestone Member poorly exposed along north-south road about 200' north and south of midpoint, west edge sec. 32, T22S, R13E, at ~1133' (hand level from spot elevation). Base of Severy Shale estimated at ~1135'.

2) Sheldon-Du Bois Limestone Members exposed on north side of creek in SW 1/4, SW 1/4, SE 1/4, SW 1/4, sec. 29, T22S, R13E. Base of Du Bois at ~1110' (hand level from topographic line). Base of Severy Shale estimated at ~1112'.

3) Bachelor Creek-Utopia Limestone Members at ~1204' and 1216', respectively (hand level to topographic line). Exposures along east-west road near midpoint, south edge SE 1/4, sec. 29, T22S, R13E. Sandstone, about 2' thick, chocolate-colored with darker blebs 2-3 mm in size, is directly below Bachelor Creek here. This may be the same situation at MS9 on the Gridley Quadrangle.

9-23-94

4) Uppermost Topeka Limestone exposed along Long Creek in SW 1/4, SW 1/4, SW 1/4, sec. 20, T22S, R13E. Sheldon Limestone Member at ~1095'; Du Bois Limestone Member at ~1100' (both hand level to spot elevation). Top of Topeka/base of Severy at ~1101'. Examined with S.A. Marcus.

5) Roadcut along east-west road (KS-57) in SW 1/4, SE 1/4, sec. 24 and N 1/2, NW 1/4, NE 1/4, sec. 25, T22S, R12E. Base of Church Limestone Member at ~1170', base of Utopia Limestone Member at ~1176' (both hand level from topographic line). Wauneta Limestone Member is about 3' below base of Church; Shanghai Creek Shale Member exposed about 1'-2' below Church. Outcrops of south side of road are about 7' lower than on north side (probably slumped). Examined with S.A. Marcus.

6) Hartford Limestone Member exposed along northwest side of southwest-flowing creek in northeast corner sec. 26, T22S, R12E, at ~1044' (hand level to topographic line). Examined with S.A. Marcus.

11-16-94

7) Hartford Limestone Member on south side of east-west road near midpoint, north edge NW 1/4, NE 1/4, sec. 31, T22S, R13E, at ~1076' (hand level from topographic line). Underlying Hartford here is about 3" of shale and 6" of fossiliferous and coated-grain packstone that probably is the unnamed limestone member in the Calhoun Shale. Quarries in the center, N 1/2, sec. 31, T22S, R13E, are in Topeka Limestone.

8) Hartford Limestone Member exposed along north-south road near center, sec. 6, T23S, R13E, at ~1088'. Unnamed limestone in Calhoun Shale exposed in creek bottom on west side of road in southeast corner, NW 1/4, sec. 6, T23S, R13E, at ~1078' (both hand level to topographic line).

9) Deer Creek-Topeka Limestones exposed on north and east side of northwest-southeast part of east-west road in SE 1/4, SE 1/4, SE 1/4, sec. 7, T23S, R13E. Base of Deer Creek very poorly exposed at ~1062' (Rock Bluff Limestone Member); Ervine Creek

Limestone Member at ~1066'; base of Calhoun Shale at ~1080'; base of Topeka Limestone (Hartford Limestone Member) at ~1110' (all hand level to topographic line). The Calhoun is very sandy here and has some thin, sandy, limestone beds with bits of charcoal in places.

10) ?Ozawkie Limestone Member exposed in north cut-bank of southwest-flowing creek in SW 1/4, SW 1/4, SE 1/4, sec. 7, T23S, R13E, at ~1026' (hand level from spot elevation). The ?Ozawkie here is about 3' thick and weathers into 3-4 beds of about 8"-1' each.

11) Rock Bluff Limestone Member exposed on east side of north-south road near midpoint, west edge SW 1/4, SW 1/4, sec. 7, T23S, R13E, at ~1040' (hand level from spot elevation).

11-17-94

12) Hartford/Curzon Limestone Members exposed in quarry in SE 1/4, NW 1/4, sec. 7, T23S, R13E, at ~1091' (hand level from topographic line). The Hartford and Curzon show a lot of "rolls" here that probably result form internal scouring during deposition. The basal sponge-oncolite bed here is very dark and sponge rich. The upper Calhoun Shale here is very dark. Examined with S.A. Marcus.

13) Topeka Limestone with phylloidal facies but without oncolitic sponge horizon (sponges are preset in places in the phylloidal facies) exposed on east-west road west of Hilltop, Kansas, at ~1047' (hand level from topographic line). Chert gravel veneer covers hilltop area at ~1100' (estimated from topographic map). Examined with S.A. Marcus.

14) Rock Bluff/Ervine Creek exposed on west side of north-south road near center, NE 1/4, sec. 13, T23S, R12E, at ~1029' (hand level to topographic line). Topeka Limestone exposed uphill to north at ~1064' (hand level from topographic line). Examined with S.A. Marcus.

15) Rock Bluff/Ervine Creek (about 15' thick) exposed along east-west road in southeast corner SW 1/4, sec. 36, T22S, R12E, at ~1035' (hand level to topographic line). Examined with S.A. Marcus.

16) Upper Calhoun/Lower Topeka exposed in spillway drainage for small pond in SE 1/4, sec. 1, T23S, R12E. Unnamed limestone in Calhoun at ~1045' (hand level to spot elevation). Base of Topeka at ~1056' (hand level from spot elevation). Topeka-Calhoun contact sharp and undulatory over 10' $\pm$ scale. Examined with S.A. Marcus.

17) Thin (~1") coal, overlain by about 1' of fossiliferous shale, overlain by about 1'-2' of packstone/wackestone with productids (?Ozawkie). Base of ?Ozawkie at ~999' (hand level to spot elevation). Examined with S.A. Marcus. Exposure in drainage on west side of north-south road in NW 1/4, NE 1/4, NE 1/4, SE 1/4, sec. 13, T23S, R12E.

18) Avoca-Ozawkie Limestone Members exposed in low-water crossing (Avoca) and cutbank (Ozawkie) of Verdegris River at ~977' and 1008', respectively (both hand level to topographic line). Tecumseh Shale here is 26' thick and contains bioturbated sandstones with mud-draped ripple marks. The Avoca here is about 5' thick as 2 or 3

beds with very thin (<1') shale partings, is dense, micritic, and contains large fusulinids and syringporoids (near the top). The Ozawkie is about 3' thick, rubbly, and contains small fusulinids near its base and productids/chonetids throughout. Exposure on Verdegris River in NE 1/4, NW 1/4, SE 1/4, sec. 24, T23S, R12E. Examined with S.A. Marcus.

19) Avoca Limestone Member exposed at road intersection on northeast side of curve (south of east-west road) near center sec. 19, T23S, R13E, at ~1003'. Yellow paleosol in King Hill Shale at ~995' (both hand level from spot elevation). The King Hill here below the Avoca has numerous myalinids. The Avoca here is overlain by about 5' of sandstone. Syringoporoids and large fusulinids seen in Avoca, which is about 3' thick here. Examined with S.A. Marcus.

20) Topeka Limestone (Hartford Limestone Member) poorly exposed on west side of north-south road in ditch at ~1076' (hand level from spot elevation). Exposure is in SW 1/4, SE 1/4, SW 1/4, SE 1/4, sec. 36, T22S, R12E. Examined with S.A. Marcus.

21) Unnamed limestone in Calhoun, overlain by sandstone, then shale and earthy, yellow bed with fossils, then Hartford Limestone Member, exposed along east-west road along north edge NE 1/4, NW 1/4, SW 1/4, sec. 20, T23S, R13E. Unnamed limestone at ~1144', base of Hartford at ~1154' (both hand level to topographic line). Examined with S.A. Marcus.

22) Avoca-Ervine Creek Limestone Members exposed along east-west road along north edge, NW 1/4, SE 1/4, sec. 19 and NW 1/4, NW 1/4, SW 1/4, sec. 20, T23S, R13E. Avoca at ~1020' (hand level to topographic line); Ozawkie Limestone Member (with thin zone of abundant chonetids) is about 2'-3' thick and at ~1049'; thin (<4"), sandy molluscan limestone in Oskaloosa Shale Member at ~1060'; Rock Bluff Limestone Member at ~1103'; Ervine Creek Limestone Member at ~1106' (all hand level from topographic line). Examined with S.A. Marcus.

11-18-94

23) Avoca Limestone Member exposed along east-west and northeast-southwest, triangle-forming roads along south edge SW 1/4, NE 1/4, SW 1/4, sec. 32, T23S, R13E, at ~1060' (hand level from topographic line). Examined with S.A. Marcus.

Madison Quadrangle Chris Maples 9-23-94
Map Sta:

1) Roadcut along east-west road in N 1/2, SW 1/4, NE 1/4, sec. 13, T22S, R11E. Rulo, Burlingame, and Wakarusa Limestones exposed at 1131', 1165', and 1169', respectively (all hand level to topographic line). Examined with S.A. Marcus.

2) East-west road outcrops along Lincoln St. in Madison, 200'-600' west of midpoint, east edge sec. 13, T22S, R11E. Rulo Limestone at ~1130'; Burlingame Limestone at ~1167' (both hand level to topographic line). Examined with S.A. Marcus.

9-24-94

3) Exposures in Madison on S. 2nd St., E 1/2, E 1/2, NW 1/4, SW 1/4, sec. 18, T22S, R12E. Happy Hollow Limestone exposed at ~1113' (hand level to topographic line). Elmo Coal at ~1130'; Rulo Limestone at ~1137'; Burlingame Limestone (with underlying yellowish paleosol/calcrete) at ~1176' (all hand level from topographic line). Happy Hollow weathers orangish with large, white fusulinids. Examined with S.A. Marcus.

4) Exposures on east and west sides of north-south road along west edge SW 1/4, SW 1/4, sec. 12, T22S, R11E. Happy Hollow Limestone (about 4' thick) at ~1088'; ?Rulo Limestone (very poorly exposed on west side of road) at ~1108'; Burlingame/Wakarusa Limestones at ~1152' (all hand level to topographic line). Examined with S.A. Marcus.

5) Limestone in creek bed and ~15' of shale exposure in creek cut bank with thin limestone in north-south road above shale in creek cut bank. Lower limestone is thin (<2'), nodular, orange-weathering and molluscan in part; dense, creamy colored in part. Upper limestone is thin and slightly nodular. Lower limestone at ~1086' (hand level to spot elevation). Upper limestone at ~1114' (hand level from spot elevation). Based on shale thickness, this probably is Happy Hollow-Rulo. Examined with S.A. Marcus.

6) Burlingame-Wakarusa Limestones exposed in north-south road about 100' north of southwest corner sec. 6, T22S, R12E, at ~1156' (hand level from spot elevation). Examined with S.A. Marcus.

9-25-94

7) Happy Hollow Limestone exposed in east-west road near mid-point, south edge NE 1/4, SW 1/4, NE 1/4, sec. 7, T22S, R12E, at ~1099' (hand level to topographic line). Examined with S.A. Marcus.

9-26-94

8) Burlingame-Wakarusa Limestones exposed on north-south road (KS249) in Madison at ~1162' (hand level to topographic line). Exposure near midpoint, east edge SE 1/4, SE 1/4, sec. 13, T22S, R11E. Examined with S.A. Marcus. Total thickness of Burlingame-Wakarusa interval is about 12'.

1-27-95

9) Reading Limestone Member exposed on hilltop in center, S 1/2, NW 1/4, sec. 13, T22S, R11E, at ~1214' (hand level from spot elevation). Examined with S.A. Marcus. Auburn Shale exposed below Reading contains thin calcareous zone with Linoproductus,

echinoderm debris, bellerophontid gastropods, myalinids, etc.

10) Reading Limestone Member exposed in ditch on east side of Kansas 99 near midpoint, east edge SE 1/4, NE 1/4, sec. 2, T22S, R11E, at ~1163' (hand level to topographic line). Examined with S.A. Marcus. I think the uppermost bed exposed here (biomicritic with fat fusulinids) may be the Elmont, which would make the Reading-Elmont interval about 6' thick.

11) Rulo Limestone Member exposed on north side of east-west road (east side of North Branch, Verdigris River) at ~1092' (hand level from spot elevation). Elmo Coal about 2' below Rulo. Examined with S.A. Marcus. Exposure near midpoint, north edge NE 1/4, NE 1/4, NW 1/4, sec. 11, T22S, R11E.

12) Burlingame/Wakarusa Limestone Members (with underlying boxwork bed) exposed on west side of north-south road near midpoint, east edge SW 1/4, sec. 2, T22S, R11E, at ~1120' (hand level to topographic line). Examined with S.A. Marcus.

13) Elmont Limestone Member (limestone pebble conglomerate overlain by dense, fusulinid packstone-wackestone with very small fusulinids) exposed near head of gulley in the southeast corner NE 1/4, NW 1/4, sec. 2, T22S, R11E, at ~1155' (hand level to topographic line). Examined with S.A. Marcus.

MADISON NE QUADRANGLE Chris Maples 3-23-94
Map Sta:

1) Howard Limestone exposed on east-west road along south edge SW 1/4, SW 1/4, SW 1/4, sec. 17, T22S, R13E. Bachelor Creek Limestone Member at ~1166', Church Limestone Member at ~1179', Utopia Limestone Member at ~1188' (all hand level to spot elevation). Bachelor Creek is very poorly exposed here. Examined with S.A. Marcus.

3-24-94

2) Howard Limestone exposed along east-west road near south edge sec. 17, T22S, R13E. Bachelor Creek Limestone at ~1185'; Church Limestone Member at ~1193' (both hand level to spot elevation); Utopia Limestone Member at ~1202' (hand level from spot elevation). Examined with S.A. Marcus.

3) Church Limestone Member exposed in east-west road at low-water crossing near midpoint, north edge sec. 19, T22S, R13E, at ~1170' (hand level to topographic line). Examined with S.A. Marcus.

4) Howard Limestone exposed on hill in southwest corner sec. 18, T22S, R13E. Bachelor Creek Limestone Member at ~1177'; Church Limestone Member at ~1186'; Utopia Limestone Member at ~1193' (all hand level from spot elevation). Examined with S.A. Marcus.

5) Bachelor Creek Limestone Member exposed in northwest-southeast road at ~1154'; Church Limestone Member exposed at ~1160' (both hand level to topographic line). Thin Wauneta Limestone Member and coal soot within 2' of overlying Church. Exposure in SW 1/4, SW 1/4, SW 1/4, sec. 13, T22S, R12E. Examined with S.A. Marcus.

6) Howard Limestone exposed in east-west road approximately 200'-400' west of center sec. 14, T22S, R12E. Bachelor Creek Limestone Member at ~1123'; Utopia Limestone Member at ~1135' (all hand level from topographic line). Examined with S.A. Marcus.

7) Howard Limestone exposed in northeast-southwest kink in east-west road near center W 1/2, sec. 15, T22S, R12E. Bachelor Creek Limestone Member at ~1089'; Church Limestone Member at ~1097'; Utopia Limestone Member at ~1106' (all hand level to topographic line). Examined with S.A. Marcus. Bachelor Creek here is two beds with a total thickness of about 2'.

8) Howard Limestone exposed in southeast corner NE 1/4, sec. 16, T22S, R12E. Bachelor Creek Limestone Member is very thin here (<6") and at ~1081'; Church Limestone Member is at ~1085'; Utopia Limestone Member is at ~1093' (all hand level from spot elevation). Examined with S.A. Marcus.

9) Church Limestone Member exposed along Kansas Highway 57, near midpoint, south edge SE 1/4, SW 1/4, SE 1/4, sec. 16, T22S, R12E, at ~1074' (hand level to topographic line). Examined with S.A. Marcus.

10) Church and Utopia Limestone Members exposed in creek and roadway in southeast corner NE 1/4, sec. 17, T22S, R12E. Church Limestone Member is at ~1048'; Utopia Limestone Member is at ~1060' (both hand level to topographic line). Examined with S.A. Marcus.

9-25-94

11) Burlingame-Wakarusa Limestones exposed in north-south roadway near midpoint, west edge NW 1/4, SW 1/4, SW 1/4, sec. 4, T22S, R12E, at ~1198' (hand level to topographic line). Examined with S.A. Marcus.

12) Burlingame-Wakarusa Limestones well exposed in oil field in S 1/2, S 1/2, NW 1/4, NE 1/4, sec. 5, T22S, R12E, at ~1194' (hand level to topographic line). Examined with S.A. Marcus.

13) Reading Limestone (conglomeratic in lowermost part) exposed on hilltop in SW 1/4, NW 1/4, NW 1/4, NW 1/4, sec. 4, T22S, R12E, at ~1247' (hand level to topographic line). Examined with S.A. Marcus.

14) Burlingame-Wakarusa Limestones exposed in oil field near center, NE 1/4, SE 1/4, NW 1/4, sec. 4, T22S, R12E, at ~1207' (hand level from topographic line). Examined with S.A. Marcus.

15) Burlingame-Wakarusa and Reading Limestones exposed along east edge NE 1/4, NE 1/4, NE 1/4, sec. 6, T22S, R12E, at ~1177' (hand level to topographic line) and at 1227' (hand level from topographic line). Examined with S.A. Marcus. Burlingame-Wakarusa interval is about 13'-15' thick. The Auburn Shale here has a thin (<2") Linoproductus-rich limestone in the upper third.

16) Burlingame-Wakarusa Limestones exposed in north-south road about 100' south of northwest corner sec. 8, T22S, R12E, at ~1164' (hand level from spot elevation). Examined with S.A. Marcus.

17) Burlingame-Wakarusa Limestones exposed in north-south road about 200' north of southwest corner NW 1/4, sec. 5, T22S, R12E, at ~1168' (hand level to spot elevation). Examined with S.A. Marcus.

18) Reading Limestone exposed on hilltop in NE 1/4, SE 1/4, sec. 6, T22S, R12E, at ~1209' (hand level from topographic line). Examined with S.A. Marcus.

19) Rulo Limestone exposed in north-south roadway 100' north of southwest corner sec. 4, T22S, R12E, at ~1158' (hand level from spot elevation). Examined with S.A. Marcus.

20) Auburn Shale, with thin Linoproductus-rich limestone, exposed along north edge, NW 1/4, sec. 4, T22S, R12E. Examined with S.A. Marcus.

21) Burlingame-Wakarusa Limestones exposed along north-south road about 250' south of northeast corner sec. 4, T22S, R12E, at ~1209' (hand level from spot elevation). Examined with S.A. Marcus.

22) Burlingame-Wakarusa Limestones exposed along north-south road about 250' north of southwest corner NW 1/4, sec. 3, T22S, R12E, at ~1217' (hand level from spot elevation). Examined with S.A. Marcus.

23) Burlingame-Wakarusa Limestones exposed in north-south road near mid-point, west edge SW 1/4, sec. 3, T22S, R12E, at ~1224' (hand level to topographic line). Examined with S.A. Marcus.

(Revisited -- 9-27-94) Rulo Limestone very poorly exposed in ditch on east side of north-south road at ~1193' (hand level from topographic line). Examined with S.A. Marcus.

24) Rulo Limestone exposed in north-south road about 100' south of northwest corner SW 1/4, sec. 10, T22S, R12E, at ~1155' (hand level to spot elevation). Examined with S.A. Marcus.

(Revisited -- 9-27-94) Oops... this is Happy Hollow Limestone, not Rulo Limestone. Examined with S.A. Marcus.

25) Bachelor Creek-Church-Utopia Limestone Members exposed in northwest-southeast road in NW 1/4, NW 1/4, SW 1/4, sec. 11, T22S, R12E. Base of Bachelor Creek at ~1108'; base of Church at ~1113'; base of Utopia at ~1124' (all hand level to topographic line). Top of Utopia at ~1128'. Examined with S.A. Marcus.

9-26-94

26) Exposures of Happy Hollow-Rulo Limestones in east-west road on north edge NW 1/4, NW 1/4, NW 1/4, sec. 3, T22S, R12E, at ~1150' and 1174', respectively (both hand level to spot elevation). Elmo Coal about 6" under base of Rulo Limestone. Examined with S.A. Marcus.

27) Exposure of top of Utopia (~base of White Cloud) in creek bed of south-flowing creek in NW 1/4, NW 1/4, NE 1/4, NW 1/4, sec. 2, T22S, R12E, at ~1112' (hand level to topographic line). Examined with S.A. Marcus.

28) Happy Hollow Limestone exposed in east-west road about 200' east of northwest corner NE 1/4, sec. 1, T22S, R12E, at ~1221' (hand level from spot elevation). Good section of Cedar Vale Shale on north side of road above Happy Hollow; Rulo Limestone in float in soil at hilltop at ~1240' (estimated from topographic map). Cedar Vale has a 3'-thick sandstone near the top. Examined with S.A. Marcus.

29) Happy Hollow Limestone capping hill on east-west road near midpoint, north edge NE 1/4, NE 1/4, sec. 1, T22S, R12E, at ~1225' (hand level from spot elevation). Examined with S.A. Marcus.

30) Happy Hollow Limestone exposed in east-west road near midpoint, north edge NE 1/4, NW 1/4, sec. 8, T22S, R13E, at ~1246' (hand level to spot elevation). Chert gravel seems to cap hill here at ~1270' or so (estimated from topographic map). Examined with S.A. Marcus.

31) Top of Utopia (~ base of White Cloud) exposed in west-flowing creek near midpoint, west edge SW 1/4, NW 1/4, sec. 6, T22S, R13E, at ~1170' (hand level to spot elevation). Examined with S.A. Marcus.

32) Rulo Limestone exposed in north-south road near midpoint, west edge NW 1/4, sec. 5, T22S, R13E, at ~1256' (hand level from topographic line). Examined with S.A. Marcus.

33) Happy Hollow Limestone exposed in north-south road near midpoint, west edge SW 1/4, sec. 5, T22S, R13E, at ~1231' (hand level from topographic line). Examined with S.A. Marcus.

34) Bachelor Creek Limestone Member exposed along north-south road in roadcut through hill near midpoint, west edge, SW 1/4, sec. 7, T22S, R13E, at ~1189' (hand level from topographic line). Examined with S.A. Marcus.

35) Church and Utopia Limestone Members poorly exposed in east-west roadway near midpoint, north edge, SE 1/4, sec. 12, T22S, R12E, at ~1175' and 1185', respectively (hand level to topographic line). Examined with S.A. Marcus.

36) Bachelor Creek Limestone Member very poorly exposed in southwest corner of sec. 12, T22S, R12E, at ~1147' (hand level from spot elevation). Examined with S.A. Marcus.

37) Church Limestone Member poorly exposed in east-west road about 300' west of midpoint, south edge, sec. 12, T22S, R12E, at ~1158' (hand level from spot elevation). Examined with S.A. Marcus.

38) Bachelor Creek and Church Limestone Members exposed on hilltop in east-west road near midpoint, south edge, SW 1/4, SE 1/4, sec. 7, T22S, R13E, at ~1197' and 1204', respectively (both hand level from topographic line). Examined with S.A. Marcus.

39) Happy Hollow(?) Limestone poorly exposed along east-west road near midpoint, north edge sec. 17, T22S, R13E, at ~1240' (hand level to spot elevation). Examined with S.A. Marcus. The top of this hill is capped by Tertiary gravels, which randomly have scoured out the Happy Hollow.

40) Bachelor Creek-Church-Utopia Limestone Members exposed along north-south road on west edge SW 1/4, SW 1/4, NW 1/4, sec. 17, T22S, R13E, at ~1165', 1170', and 1181', respectively (all hand level to spot elevation). Examined with S.A. Marcus.

41) Top of Utopia (~base of White Cloud) exposed in northwest corner sec. 7, T22S, R13E, at ~1190' (hand level from spot elevation). Examined with S.A. Marcus.

9-27-94

42) Bachelor Creek-Church-Utopia Limestone Members exposed on east and west sides of south-flowing creek along east-west road on south edge SW 1/4, NE 1/4, sec. 10, T22S, R12E. Section containing Bachelor Creek on east side of stream valley has slump, which results in 2 Bachelor Creek Limestones, one about 15' below the other. Bachelor Creek at ~1100'; Church at ~1106'; Utopia at ~1114' (all hand level from topographic line). Section taken from unslumped west side of creek valley. Examined with S.A. Marcus.

Madison SW Quadrangle Chris Maples 1-27-95
Map Sta:

1) Burlingame/Wakarusa Limestone Members exposed near midpoint, north edge NE 1/4, NE 1/4, sec. 25, T22S, R11E, at ~1165' (hand level to spot elevation). Exposure along east-west road at top of hill. Examined with S.A. Marcus.

2) Reading Limestone Member exposed on hilltop near midpoint, north edge, sec. 25, T22S, R11E, at ~1200' (hand level from spot elevation). Examined with S.A. Marcus.

3) Reading Limestone Member exposed near midpoint, north edge, NW 1/4, sec. 25, T22S, R11E, along east-west road, at ~1192' (hand level from topographic line). Examined with S.A. Marcus.

4) Burlingame/Wakarusa Limestone Members exposed along lake edge near center, NW 1/4, SE 1/4, sec. 25, T22S, R11E, at ~1152' (hand level to topographic line). Examined with S.A. Marcus.

5) Reading Limestone Member exposed on hilltop near midpoint, north edge NE 1/4, sec. 36, T22S, R11E, at ~1207' (hand level from spot elevation). Thin (<2") Linoproductus limestone exposed in Auburn Shale at ~1201' (hand level from spot elevation) in northeast corner sec. 36, T22S, R11E. Examined with S.A. Marcus.

6) Reading Limestone Member exposed on hilltop in SW 1/4, SW 1/4, sec. 30, T22S, R12E, at ~1211' (hand level from spot elevation). Examined with S.A. Marcus.

NEAL QUADRANGLE Chris Maples 3-26-94
Map Sta:

1) Shale with sandstone channel (NNE-SSW orientation) exposed on both sides of east-west US Hwy. 54, along north edge NW 1/4, NW 1/4, sec. 32, T25S, R13E. Examined with S.A. Marcus.

2) Mostly shale and covered with thin (<1 cm) sandstone laminae; massive sandstone float at top of hill. Exposure of fossiliferous sandstone with abundant bioturbation at base, fossils increasing in abundance/diversity upward through about 3' of exposure. Fossils include Derbyia, Jurasania, crinoid debris, myalinids, pectens, bryozoans, and gastropods. This whole section looks very Kanawaka-like to me. Small-scale structure seen at west end of roadcut with reversal of bedding (strike N, dip 5 degrees E) seen on both sides of road. Elevation of fossiliferous sandstone/sandy limestone is 989'-986' (hand level from spot elevation). Examined with S.A. Marcus. Exposure on both sides of east-west US Hwy. 54 along north edge NE 1/4, NW 1/4, NE 1/4, sec. 36, T25S, R12E.

3) Limestone, argillaceous, fossiliferous, about 1' thick overlying platy, fossiliferous limestone/shale with abundant Derbyia, Juresania, chonetid, myalinids, Neospirifer, echinoderm debris, etc. Very Stull-Big Springs/Beil in appearance. Overlies sandstone and shale. Exposure along east-west US Hwy. 54 on north edge NW 1/4, sec. 36, T25S, R12E, at ~1025' (hand level to spot elevation). Examined with S.A. Marcus.

4) Chonetid-rich shale with thin, fossiliferous packstone (about 1' thick) at ~999' (hand level from spot elevation). This is the same sequence as exposed at Round Mound, about 2 miles south and 1 mile east. Excellent clam collecting here in dark shale. Exposure along east-west US Hwy. 54, along south edge SW 1/4, SW 1/4, sec. 26 and SE 1/4, SE 1/4, sec. 27, T25S, R12E. Examined with S.A. Marcus. The limestone either is Spring Brach or Clay Creek--my preference is the former.

5) Same shale as below limestone at MS4. Exposure along east-west US Hwy. 54 near midpoint, south edge sec. 27, T25S, R12. Examined with S.A. Marcus.

6) Exposure along US Hwy. 54 and parallel side road to south in S 1/2, S 1/2, SE 1/4, sec. 29, T25S, R12E. Approximately 16' of ripple-bedded and cross-bedded sandstone is exposed on the north side of the parallel road. Thin (~1') single bed of massive, very hard, fusulinid-bearing limestone at ~987'. A thin (<2") sandstone underlies the limestone (separated from it by 1"-2" of shale). The sandstone contains some brachiopods and is piped downward into the underlying gray shale, which contains some chonetids, where it weathers out as trace fossils (mostly Zoophycos, Rhizocorallium, and Palaeophycus). Black shale rests on the limestone. Another limestone, mostly a fossiliferous wackestone/packstone (becoming a fusulinid packstone upward), about 1' thick, occurs at ~990' (both hand level from topographic line). The section is projected about 1/4 mile west along US Hwy. 54. Above the fusulinid packstone is a yellow, unfossiliferous, "rotten" limestone at ~995'. Gray shale with myalinids, Derbyia, and some chonetids (but not a large number of most) is exposed on the north side of US Hwy. 54 and is overlain by fusulinid/fossiliferous packstone in the grass line at ~1010' (last 2 elevations hand level from projected base of limestone above black shale).

So, what is this section? Right now, based on projected elevation differences, I think the sandstone is in the Stull, the black shale is the Queen Hill, the yellow limestone is the paleosol in the King Hill, and the uppermost limestone is the Avoca.

3-27-94

7) Thin (<1'), earthy, yellow-weathering limestone; sparsely fossiliferous (gastropods, productids, bryozoans) at ~1026'. Thin, dense, fossiliferous recrystallized grainstone/packstone at ~1028' (both hand level from topographic line). Examined with S.A. Marcus. I think this is the Ozawkie Limestone Member. Exposure near midpoint, south edge sec. 29, T25S, R12E.

8) ?Rock Bluff Limestone Member exposed on hilltops along south edge SW 1/4, SW 1/4, sec. 29, T25S, R12E, at ~1042' (hand level to spot elevation). Examined with S.A. Marcus. Slabby, sandy fossiliferous limestone exposed in field in northwest corner sec. 31, T25S, R12E, at ~1048' (hand level to spot elevation).

5-28-94

9) Kereford Limestone Member exposed in east-west road in S 1/2, SE 1/4, SE 1/4, SW 1/4, sec. 17, T25S, R13E, at ~968' (hand level to topographic line). Very fossiliferous shale with typical Heumader fauna of sponges, Crurythyris chonetids, Rhipidomella, crinoid debris, bryozoans, orthocane cephalopods, and encrusting forams exposed in ditch on south side of northwest-southeast road near center, north edge NW 1/4, NE 1/4, sec. 20, T25S, R13E. Examined with S.A. Marcus.

10) Very fine grained, grainstone, becomes very sandy upward (total thickness about 5'). Exposures on north side of east-west road along south edge SE 1/4, SE 1/4, SW 1/4, sec. 8, T26S, R13E, at ~913' (hand level to spot elevation). Examined with S.A. Marcus. This probably is a limestone in the Snyderville Shale Member.

11) Leavenworth, Plattsmouth, Heumader, and Kereford Members exposed along northeast-southwest road in NW 1/4, NW 1/4, NW 1/4, sec. 17, T26S, R13E, at ~959', 963', 965', and 1000', respectively (hand level to spot elevation). The Kereford here is about 16' thick. Examined with S.A. Marcus. The Plattsmouth here is about 2' thick, nodular, oncolitic, yellow weathering, and generally nonresistant.

12) Kereford Limestone Member exposed along curvy east-west road along south edge SE 1/4, SW 1/4, SW 1/4, SE 1/4, sec. 7, T26S, R13E, at ~974' (hand level from spot elevation). Kereford here is about 19' thick and overlain by mostly covered interval with thin (<3') sandstone beds, some of which contain molds of mollusks. Examined with S.A. Marcus.

5-29-94

13) Kereford Limestone Member exposed in east-west road near midpoint, north edge NW 1/4, NW 1/4, sec. 18, T26S, R13E, at ~966' (hand level to topographic line). Top of Kereford at ~979' (hand level from topographic line). Examined with S.A. Marcus. Sandstone and shale to top of hill in NE 1/4, NE 1/4, sec. 13, T26S, R12E.

14) Sandstone and shale in Kanwaka Shale exposed on east side of Fancy Creek, south of east-west road, in NW 1/4, NW 1/4, NW 1/4, NE 1/4, NW 1/4 sec. 13, T26S, R12E. Examined with S.A. Marcus.

15) Limestone and sandstone/shale exposed in east-west road near midpoint, north edge sec. 14, T26S, R12E. Two limestone beds are present, the lower one at 1014' (hand level to spot elevation) and the upper one at 1029' (hand level from spot elevation). Below the lower limestone bed is a fossiliferous shale containing chonetids and some myalinids. The shale between the two limestones contains chonetids in the lower third. The upper limestone is a coated-grain packstone about 2' thick. The lower limestone is an argillaceous fossiliferous packstone/wackestone about 2' thick. I am not sure, but for now I'll call this the Clay Creek interval. Examined with S.A. Marcus. Overlain by sandstone.

16) Fusulinid packstone/wackestone as about 1' thick dense bed exposed in east-west road along north edge NE 1/4, NW 1/4, NW 1/4, sec. 14, T26S, R12E, at ~1059' (hand level to topographic line). This may be the Spring Branch/Big Springs interval. Examined with S.A. Marcus.

5-30-94

17) Exposures of Big Springs/Beil-Avoca Limestone Members in east-west road on south edge SE 1/4, SW 1/4, SE 1/4 and SW 1/4, SE 1/4, SE 1/4, sec. 9, T26S, R12E. Big Springs Limestone Member at ~1025' (hand level to topographic line); Beil Limestone Member at ~1035', overlain by thin (<3") shale and yellow, boxwork paleosol horizon in King Hill at ~1037'; Avoca Limestone Member (dense, fusulinid-rich, sponge bearing wackestone/biomicrite) at ~1045' (all hand level from topographic line). Examined with S.A. Marcus. Interval overlain by sandstones and shales to top of small hill near center, south edge sec. 9, T26S, R12E. Mollusk mold-rich sandstone at ~1051' (hand level from topographic line).

18) Ozawkie Limestone Member (thin, <2', coarse fossiliferous grainstone with very bioturbated upper surface) at ~1073'; red clay-rich zone with water seep at ~1083'; Rock Bluff, Larsh-Burroak, and Ervine Creek Members at ~1109', ~1110', ~1111', respectively. Top of Ervine Creek Limestone Member at ~1119'. Limestone in Calhoun Shale at ~1134'; Hartford Limestone Member at ~1135' (all hand level to topographic line). Exposures along east-west road near midpoint, south edge sec. 9, T26S, R12E. Examined with S.A. Marcus.

19) Exposures of Big Springs - Ervine Creek Members along east-west and northwest-southeast trending farm road in S 1/2, SW 1/4, sec. 10, T26S, R12E. Big Springs at ~1024'; Beil at ~1035'; Avoca at ~1054' (overlain by greenish, fossiliferous shale); Ozawkie at ~1090'; Rock Bluff at ~1129'; Ervine Creek at ~1131' (all hand level to topographic line).

6-3-94

20) Sandstone exposed along northeast-flowing creek near midpoint, west edge SW 1/4, sec. 12, T26S, R12E. Examined with K.D. Newell.

21) Excellent exposure of Leavenworth-Plattsmouth Members at Rocky Ford near center, W 1/2, SW 1/4, NW 1/4, sec. 1, T26S, R12E, at ~914' and 917', respectively (hand level to topographic line). Examined with K.D. Newell.

22) Leavenworth-Clay Creek Members exposed in creek on west side of railroad and hill of railroad cut in N 1/2, SE 1/4, sec. 1, T26S, R12E. Leavenworth at ~928'; Plattsmouth at ~930'; Kereford at ~948'; Clay Creek at ~969' (all hand level to topographic line). What this means is that the Kanwaka Shale is very thick here (>70') and that it contains a couple of limestones in addition to the Clay Creek (at ~963' and 986'; both hand level to topographic line). Abundant myalinids in upper Jackson Park Shale Member about 1' above unnamed limestone at ~963'. Abundant, very well preserved clam and snail fauna in sideritic ironstone concretions above Clay Creek Limestone Member. Examined with K.D. Newell.

23) Leavenworth-Plattsmouth Limestone Members exposed on both sides of hill near midpoint, south edge sec. 6, T26S, R13E, at ~967' and 969', respectively, on east side of hill, and at 958' and 960', respectively, on west side of hill (all hand level to spot elevation). Examined with K.D. Newell.

24) Sandstone exposed near midpoint, west edge SW 1/4, sec. 1, T26S, R12E. Examined with K.D. Newell.

8-17-94

25) Sandstone exposed along west edge NW 1/4, SW 1/4 and SW 1/4, NW 1/4 of the SW 1/4, sec. 13, T26S, R12E. Examined with K.D. Newell.

26) Kereford Limestone Member exposed near top of hill on north-south road near mid-point, east edge SE 1/4, sec. 18, T26S, R13E, at ~997' (hand level to topographic line). The Kereford here is 2 limestone beds separated by 1'-2' of greenish-gray shale. The lower limestone has thin (<2") nodular fusulinid layers and thin (<3") micritic limestone layers with Linoproductus. The upper bed is about 1' thick of skeletal wackestone/packstone with burrows weathering out on the upper surface in the overlying mudstone. Entire Kereford is about 7' thick. Examined with K.D. Newell.

27) Kereford Limestone Member exposed in east-west road near mid-point, south edge sec. 18, T26S, R13E, at ~985' (hand level to topographic line). Upper Kereford bed weathers dark reddish here and at MS26. Examined with K.D. Newell.

28) Sandstone and shale in Jackson Park Shale Member exposed along north-south road on west edge, S 3/4, sec. 19, T26S, R13E. Examined with K.D. Newell.

29) ?Clay Creek Limestone Member exposed about 200' west of midpoint, south edge sec. 24, T26S, R12E, at ~1065'. The ?Clay Creek is rubbly, fossiliferous, with abundant Crurythyris zone at base; Clay Creek interval is about 2' thick here. ?Spring Branch Limestone Member (pinkish, dolomitic, crinoidal wackestone/packstone) exposed along same east-west road near midpoint, south edge SW 1/4, sec. 24, T26S, R12E, at ~1084' (both hand level to topographic line). Examined with K.D. Newell.

30) ?Spring Branch Limestone Member exposed along north-south road near midpoint, east edge SW 1/4, sec. 24, T26S, R12E, at ~1078'. Big Springs Limestone Member exposed farther uphill at ~1107' (both hand level from spot elevation). Several fine grained, light-colored sandstones in Doniphan Shale Member. Examined with K.D. Newell.

TONOVAY QUADRANGLE Chris Maples 3-27-94
Map Sta:

1) ?Hartford Limestone Member exposed along east-west US Hwy. 54 along midpoint, south edge SE 1/4, sec. 30, T25S, R12E, at ~1060' (hand level to topographic line). Examined with S.A. Marcus. Fossil collection TON-1.1 from here. Lower part of section is crinoid-rich limestone, which may be the unnamed limestone in the Calhoun Shale directly beneath the ?Hartford. I am calling this ?Hartford because it does have numerous Amblysiphonella, but it is slabby and argillaceous.

2) Hartford-?Curzon Limestone Members exposed in SW 1/4, SW 1/4, sec. 30 and NW 1/4, NW 1/4, sec. 31, T25S, R12E, along east-west US Hwy. 54. Hartford at ~1040' (hand level to spot elevation). Excellent fauna--same as at MS1, including a Derbyia zone directly above Hartford Limestone Member. Fossil collection TON-2.1 from here. Ervine Creek Limestone Member exposed in creek near midpoint, north edge NW 1/4, sec. 31, at ~1020' (hand level to spot elevation). Ervine Creek here is about 5' thick. Examined with S.A. Marcus.

3) Complete exposure of Calhoun Shale in gulley in N 1/2, NE 1/4, NW 1/4, NE 1/4, sec. 36, T25S, R11E. Base of Calhoun at 1013'; Hartford Limestone Member at 1028' (both hand level to topographic line). No limestone seen in Calhoun Shale. Examined with S.A. Marcus. Thin crinoidal limestone at base of Hartford may be in Calhoun.

4) Topeka Limestone exposed in roadcut along east-west US Hwy 54 on north edge NW 1/4, NW 1/4, sec. 36, T25S, R11E. The main limestone bed here is about 2' thick, fossiliferous wackestone that weathers into thin (<2") wavy beds with a yellow color. This may be the Sheldon Limestone Member, base at ~1037' (hand level to topographic line). Examined with S.A. Marcus.

5) Topeka Limestone exposed in roadcut on north side of east-west US Hwy 54 along south edge SE 1/4, SE 1/4, SW 1/4, sec. 26, T26S, R11E. Examined with S.A. Marcus.

6) ?Bachelor Creek Limestone Member--?Church Limestone Member exposed near center SW 1/4, NE 1/4, NW 1/4, sec. 34, T25S, R11E, at ~1021' (hand level to spot elevation). This could be Church-Utopia, but if that is the case then the Winzeler Shale Member has a coal about 2" thick here. Examined with S.A. Marcus.

TORONTO QUADRANGLE Chris Maples 3-26-94

Map Sta:

1) Snyderville-Heebner members exposed on hill on south side of east-west US Hwy. 54 on north edge of NW 1/4, NW 1/4, NW 1/4, sec. 33, T25S, R13E. Snyderville has abundant chonetids in upper part (about 1 1/2'). Below that, red and green paleosoil development is well exposed with a thin (about 2'), clean sandstone at road level. Leavenworth Limestone Member at ~969' (hand level from spot elevation). Examined with S.A. Marcus.

5-24-94

2) Toronto Limestone Member exposed in north-south road about 400' north of midpoint, west edge sec. 34, T25S, R13E, at ~931' (hand level to spot elevation). Examined with K.D. Newell.

3) Toronto Limestone Member exposed on southwest side of curve in north-south road near midpoint, south edge SW 1/4, SW 1/4, SW 1/4, sec. 34, T25S, R13E, at ~938' (hand level from topographic line). Base of Toronto very poorly exposed here. Examined with K.D. Newell.

4) Toronto Limestone Member (about 10' thick) exposed along north-south road near midpoint, west edge SW 1/4, NW 1/4, sec. 10, T26S, R13E, at ~920' (hand level to topographic line). Examined with K.D. Newell.

5) Leavenworth Limestone Member exposed at tops of roadcuts in north-south road about 300' north of southeast corner sec. 4, T26S, R13E, at ~1006' (hand level from spot elevation). This means that the Snyderville Shale Member is about 75' thick at this locality. Two sandstone beds (each less than 2' thick) are exposed between here and MS4 to the south, below 980'. Examined with K.D. Newell.

6) Amazonia-Toronto Limestone Members exposed in east-west road along north edge NW 1/4, NE 1/4, NE 1/4, NW 1/4, sec. 15, T26S, R13E. Amazonia at ~925'; Williamsburg Coal Bed at ~944'; base of Toronto at ~947' (all hand level to topographic line). Examined with K.D. Newell.

7) Williamsburg-Toronto exposed on north side of east-west road on south edge SW 1/4, SW 1/4, SE 1/4, sec. 9, T26S, R13E, at ~935' and 937', respectively (hand level to spot elevation). Examined with K.D. Newell. Williamsburg is ~6" thick.

8) Toronto Limestone Member exposed on southeastern side of curve in east-west road in S 1/2, SE 1/4, SW 1/4, SW 1/4, sec. 9 T26S, R13E, at ~933' (hand level to spot elevation). Sandstone (Ireland) exposed near water level on east side of Walnut Creek in N 1/2, NE 1/4, NW 1/4, NW 1/4, sec. 16, T26S, R13E. Examined with K.D. Newell.

9) Sandstone (1'-2') in Snyderville Shale Member exposed along railroad cut about 250' south and 50' west of northeast corner, sec. 8, T26S, R13E. Examined with K.D. Newell.

10) Toronto Limestone Member exposed on southwest side of curve in northwest-southeast road in SW 1/4, NW 1/4, NE 1/4, SW 1/4, sec. 16, T26S, R13E, at ~943' (hand level from spot elevation). Examined with K.D. Newell.

11) Toronto and Amazonia Limestone Members exposed along north-south road in W 1/2, NE 1/4, NE 1/4, NW 1/4, sec. 22, T26S, R13E, at ~983' and 955', respectively (both hand level to spot elevation). Examined with K.D. Newell.

12) Toronto Limestone Member exposed along northwest-southeast road in S 1/2, SW 1/4, SE 1/4, sec. 16, T26S, R13E, at ~948' (hand level to spot elevation). This is the minimum number for a base of the Toronto in this area (it may be 5' or so lower). Examined with K.D. Newell.

13) Toronto Limestone Member exposed in east-west road near midpoint, north edge SW 1/4, NW 1/4, NW 1/4, sec. 22, T26S, R13E, at ~976' (hand level to topographic line). The Toronto here is about 8' thick, with a 6" thick green, fossiliferous shale near the top (overlain by 1"-2" of limestone). Examined with K.D. Newell. Good exposures of Ireland Sandstone in north-flowing creek in NW 1/4, NW 1/4, sec. 22, T26S, R13E.

14) Toronto-Williamsburg poorly exposed in east-west road near midpoint, south edge SW 1/4, SE 1/4, SW 1/4, SE 1/4, sec. 22, T26S, R13E, at ~997' and 995', respectively (hand level from spot elevation). Examined with K.D. Newell.

5-28-94

15) Leavenworth Limestone Member exposed northeast-flowing drainage in NW 1/4, SW 1/4, SW 1/4, NW 1/4, sec. 21, T25S, R13E, at ~932' (hand level to spot elevation). Examined with S.A. Marcus.

16) Kereford Limestone Member poorly exposed in east-west road near center NE 1/4, sec. 20, T25S, R13E, at ~978' (hand level from topographic line). Examined with S.A. Marcus. Sandstone exposed in road about 75' east contains abundant clam molds.

Virgil Quadrangle Chris Maples 11-18-94
Map Sta:

1) Big Springs-Beil Limestone Members exposed in roadcut on east-west road near midpoint, north edge NW 1/4, NE 1/4, sec. 8, T24S, R13E, at ~1049' and 1054', respectively (hand level from topographic line). Examined with S.A. Marcus.

2) Exposure of sandstone-shale-limestone (bottom to top) along east edge of north-south road north of Virgil in SW 1/4, NE 1/4, NW 1/4, SW 1/4, sec. 5, T24S, R13E. Most of the cut is dark shale with a sideritic fauna of mollusks similar to that found near Neal, Kansas. Two limestone beds occur at the top of the cut at ~1030' and 1036', respectively (hand level from topographic line). The lower limestone has a bed of Linoproductus at the base (with large burrows penetrating downward into it). There are 3 options for this section: 1) the lower limestone is Kereford and the upper is Clay Creek; 2) the lower limestone is an unnamed limestone in the Jackson Park Shale; 3) both limestones together comprise the Clay Creek Limestone Member. Sara and I prefer option 3 at the moment. Examined with S.A. Marcus.

   (Revisited) This may be the Big Springs/Beil instead of Clay Creek. Examined with S.A. Marcus.

3) Sandstone in Jackson Park Shale(?) exposed in northeast corner, sec. 6, T24S, R13E; contains clam and some brachiopod molds. Examined with S.A. Marcus.

4) Okay, we've gone up-section much farther than I expected here. Yellow paleosol in King Hill at ~1048, ?lower Avoca at ~1051'; (upper?) Avoca (with syringoporoids) at ~1056' (all hand level from spot elevation). Myalinids in shale below Avoca. "Lower" Avoca here may be out-of-place slabs. Examined with S.A. Marcus. Exposure along north-south about 200' north of southeast corner, SW 1/4, SW 1/4, sec. 32, T23S, R13E.

11-19-94

5) Snyderville Shale Member-Plattsmouth Limestone Members exposed on west side of north-south road on east edge NE 1/4, SE 1/4, NE 1/4, NE 1/4, sec. 12, T24S, R12E. Leavenworth at ~1020', Plattsmouth at ~1023' (both hand level from topographic line). Examined with S.A. marcus.

   (Revisited) This may be Big Springs/Beil instead of Plattsmouth/Leavenworth. Examined with S.A. Marcus.

6) Leavenworth Limestone Member exposed on hilltop, near midpoint, east edge NE 1/4, sec. 13, T24S, R12E, at ~1068' (hand level from topographic line). Thin (<6") limestone at ~1051' in underlying Snyderville Shale (hand level to topographic line). Examined with S.A. Marcus. Bits of myalinids and Derbyia in top of Snyderville.

   (Revisited) This may be Big Springs/Beil instead of Leavenworth. Examined with S.A. Marcus.