

FIELD GEOLOGY MAPS

BOURBON COUNTY, KANSAS

Preliminary Field Geology Maps for

**Blue Mound
Mapleton
Bronson
Xenia
Moran SE
Porterville**

1:24,000-scale quadrangles

Ronald R. West and Robert S. Sawin

**Kansas Geological Survey
Open-file Report 99-13**

BOURBON COUNTY, KANSAS

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PR Photorevised

Field maps for the Hammond, Richards, Marmaton, Fort Scott, Deerfield, Hiattville, Cato, and Garland quadrangles (West and Sawin, 1997) and Mantey, Prescott, Hume, Devon, and Uniontown quadrangles (West and Sawin, 1998) are open-filed with the Kansas Geological Survey in Lawrence, Kansas.

IT IS IMPORTANT TO POINT OUT AT THE OUTSET THAT THESE MAPS INDICATE LITHOSTRATIGRAPHIC UNITS ONLY, NO TEMPORAL, GENETIC, OR RELATED DEPOSITIONAL ASPECTS ARE MEANT OR IMPLIED. STRATIGRAPHIC NAMES USED ARE THOSE AS PUBLISHED IN ZELLER, 1968, The Stratigraphic Succession of Kansas. We have tried, in so far as was practical, to use the changes and additions suggested by Heckel and Watney (in press) for the sequence between the formations Lenapah and Swope. Solids indicate confident contacts, dashed lines indicated inferred contacts

The following lithostratigraphic contacts, from lowest to highest, were mapped in the Bourbon County quadrangles of this report:

Base of Altamont Limestone/ top of Bandera Shale = AL* (yellow)

Top of Altamont Limestone/base of Nowata Shale = N* (red)

Lenapah Limestone (base of Norfleet limestone) = No* (light blue) Xenia Quad. only

Exline limestone = E* (violet) - Xenia Quad. only

Base of Critzer limestone = C* (yellow green)

Top of Hertha Interval (Sniabar limestone) = S (light brown)

Top of Ladora Shale/ base of Swope Limestone (Middle Creek limestone) = M (red orange)

Top of Swope Limestone (Bethany Falls limestone) = B (orange)

Base of Dennis Limestone (Canville limestone) = Ca (dark green)

Top of Dennis Limestone (Winterset limestone) = W (dark blue)

Alluvium was determined using the soil maps of Bourbon County prepared by the Bell & Fortner, 1981 of the U. S. Soil Conservation Service = Qa

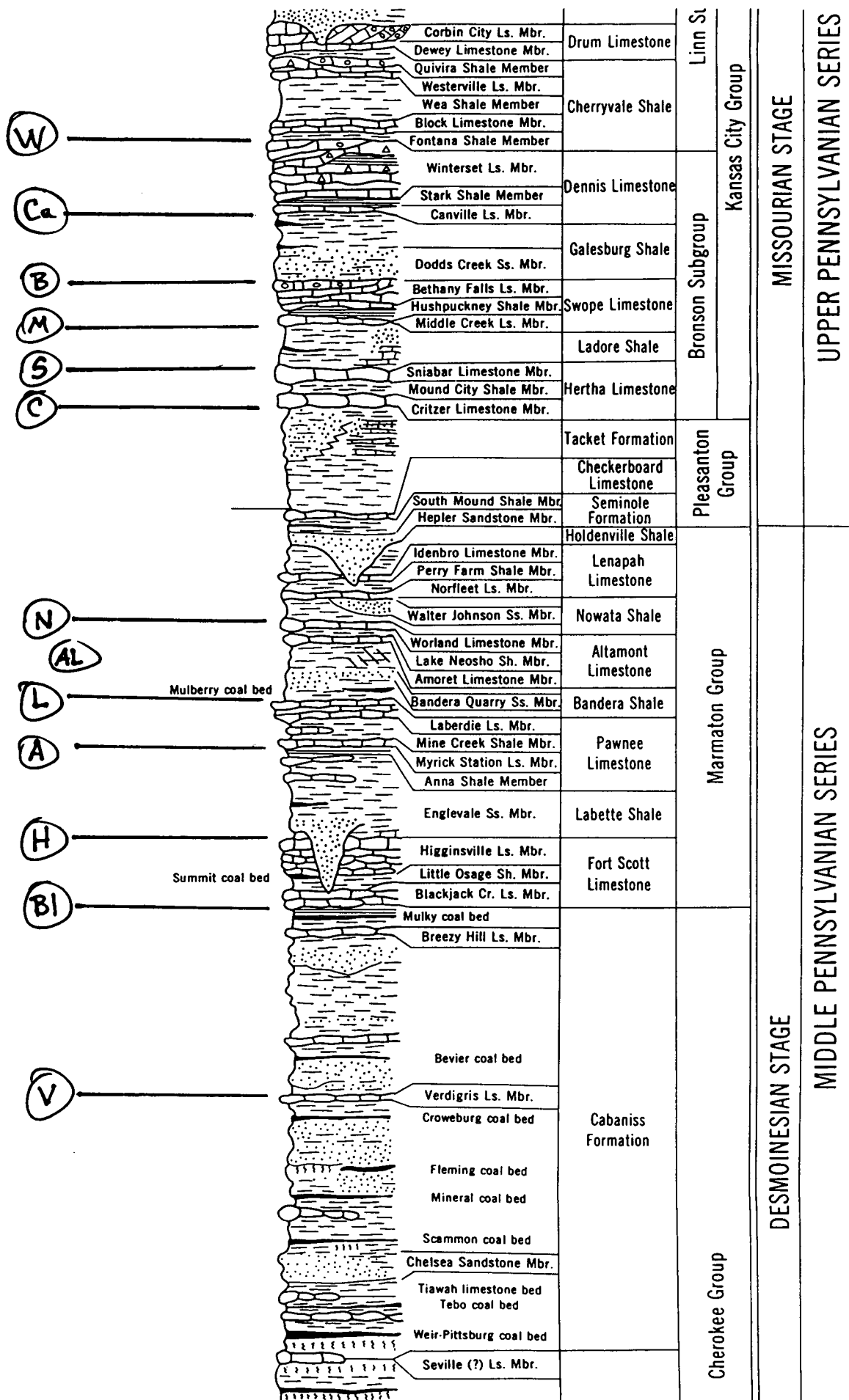
Pt = quarries, strip pits, and/or reclaimed areas.

* In the quadrangles mapped the Altamont Limestone still presents some problems as noted by Jewett, 1945. First it is commonly thin, less than 5.0' (2m). Second, the lower member, the Amoret is poorly developed, commonly a nodular limestone interval, if present. What is mappable in the six quadrangles covered by this report is the upper limestone member, the Worland; below the Worland a yellowish brown to light grayish mudrock interval with dark phosphatic nodules is present, the Lake Neosho Shale Member. This years efforts have increased our understanding of the interval between the top of the Altamont and the top of the Hertha interval (Sniabar limestone). We have been able to recognize the Norfleet Limestone Member of the Lenapah Limestone and the Exline Limestone Member in the Xenia Quadrangle. The Exline and overlying interval, through the Hertha have been recognized using the information from an in press manuscript by Heckel and Watney. With this new understanding we will be able to trace some of these units into the previously mapped quadrangles, i. e. Uniontown, Mantey, and

Devon and tie them into Heilen's (1998) map of the Hepler Quad. In spite of these advances, we have found no lithostratigraphic basis for separating the Desmoinesian from the Missourian in the areas mapped.

REFERENCES:

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- Heinlen, W. D., Jr., 1998, Expression of Regional Structural Trends in Surface Features and Geology of the Hepler and Western Hiattville Quadrangles, Southeast Kansas. Unpublished Master of Science Thesis, Kansas State University, 63p.
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- Jungmann, W. L., 1966, Geology and Ground-Water Resources of Neosho County, Kansas. Kansas Geological Survey Bulletin 183, 46p.
- Miller, D. E., 1969, Geology and Ground-Water Resources of Allen, County, Kansas. Kansas Geological Survey Bulletin 195, 50p.
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- West R. R., and Sawin, R. S., 1994, Stratigraphic Sections - Bourbon County, Kansas, 1993-94 Field Season. Kansas Geological Survey, Open-File Report 94-37, 51p.
- Zeller, D. N., 1968, The Stratigraphic Succession of Kansas. Kansas Geological Survey Bulletin 189, 81p.



BLUE MOUND QUADRANGLE

EXPLANATION - CONTROL POINTS FOR THE BOURBON COUNTY MAP ARE IDENTIFIED AS FOLLOWS:

(1) NUMBERS PRECEDED BY THE LETTER **B** REFER TO MEASURED SECTIONS IN THE BOURBON COUNTY, KANSAS BOOKS IN THE FILES OF THE KANSAS GEOLOGICAL SURVEY, NUMBERING BEGAN AT FIRST SECTION IN THE BOOK AND PRECEDED SEQUENTIALLY TO THE LAST SECTION;

(2) NUMBERS PRECEDED BY THE LETTER **L** REFER TO SITES FROM WHICH I HAVE COLLECTED GEOLOGICAL SPECIMENS; AND

(3) NUMBERS PRECEDED BY THE LETTERS **BB** ARE SITES EXAMINED AND EVALUATED SPECIFICALLY FOR THIS MAPPING PROJECT.

OBVIOUSLY, ANY GIVEN SITE MAY BE IDENTIFIED BY ANY ONE, TWO, OR ALL THREE OF THESE DESIGNATIONS.

B-180 = Hertha to Swope, same area as **BB-934** and **BB-935**; roadcut at SE corner of Sec. 20, T.23S., R.22E., Bourbon Co., Kansas.

B-181 = Hertha to Swope, same area as **BB-934** and **BB-935**; Northwest of Xenia, Kansas; near Center of South line of Sec. 20, T.23S., R.22E., Bourbon Co., Kansas.

B-182 = Hertha to Swope, same area as **BB-934** and **BB-935**; near Center of East line of Sec. 20, T.23S., R.22E., Bourbon Co., Kansas.

B-183 = Same as **B-180**.

B-184 = Hertha to Swope, same area as **BB-934** and **BB-935**; along South line of Sec. 20, T.23S., R.22E., Bourbon Co., Kansas, **B-181** is within this area.

BB-932 = **BM-1** = Exposure in creek and road cut on East side of road; thicknesses: Bethany Falls 15' (oolitic, cross-bedded), Galesburg 6', Canville 3', Stark 5', Winterset 20'+; top of Swope (Bethany Falls) Limestone @ 960', base of Dennis (Canville) Limestone @ 966'; about 200' North of Center of West line, NW1/4, Sec. 31, T.23S., R.22E., Bourbon Co., Kansas.

BB-933 = **BM-2** = Bluff and road cut on north side of Little Osage River at iron bridge, sequence and thicknesses as **BM-1**; top of Swope (Bethany Falls) Limestone @ 950', base of Dennis (Canville) Limestone @ 955'; about 200' North of Center of West line, NW1/4, NW1/4, Sec. 31, T.23S., R.22E., Bourbon Co., Kansas.

BB-934 = **BM-3** = Excellent road cut from mudrock below thick, molluscan bearing Critzer limestone to the Winterset limestone; base of Critzer limestone at @ 920'; thicknesses: Critzer limestone = 12.0', mudrock = 6.0', Sniabar limestone = 5.0', mudrock = 5.0', Middle Creek limestone = 4.0', Hushpuckney shale = 3.0', Bethany Falls = 27.0' (17.0' of lower beds and 10.0' of oolitic beds separated by a sharp contact), Galesburg Shale = 5.0', with 1 to 2 feet of Canville limestone, Stark shale covered, and only a few feet of lower Winterset limestone exposed; top of Hertha (Sniabar) Limestone at @ 943', base of Swope (Middle Creek) Limestone at @ 948', top of Swope (Bethany Falls) Limestone at @ 982', and base of Dennis (Canville) Limestone at @ 987'; Stop 4A of 1989 Guidebook titled "Late

Pennsylvanian and Early Permian Cyclic sedimentation,
Paleogeography, Paleocology, and Biostratigraphy in Kansas and
Nebraska"; about 200' North of Center of East line, NE1/4, NE1/4, Sec. 20,
T.23S., R.22E., Bourbon Co., Kansas.

BB-935 = BM-4 = Same sequence as at BB-934 (BM-3), but poorly exposed; base of
Swope (Middle Creek) Limestone @ 955'(good elev.); about 100' North of
Center of East line, NE1/4, SE1/4, Sec. 20, T.23S., R22E., Bourbon Co.,
Kansas.

BB-947 = Old quarry in Winterset limestone on East side of Kansas Highway 3;
NW corner, Sec. 36, T.23S., R.21E., Bourbon Co., Kansas.

BB-948 = Top of Dennis (Winterset) Limestone, oolitic, on both sides of Kansas
Highway 3 at @ 1000'; near Center of West line SW1/4, SW1/4, NW1/4,
Sec. 36, T.23S., R.21E., Bourbon Co., Kansas.

BB-949 = Base of Dennis (Canville) Limestone at @ 950' on both sides of Kansas
Highway 3; good exposure of Dennis Limestone on both sides of road
from the top of the Swope (Bethany Falls) Limestone, oolitic phase to the
top of the Dennis (Winterset) Limestone, oolitic phase, with 30 to 40 feet
of Bethany falls exposed under bridge over the Little Osage River;
Galesburg Shale = 6.0' (covered), Canville limestone = 3.0', Stark shale =
5.0', Winterset limestone = 30.0'; top of Swope (Bethany Falls) Limestone
at @ 944' and top of Dennis (Winterset) Limestone at @ 988'; about 100'
South of Center of West line, SW1/4, SW1/4, Sec. 25, T.23S., R.21E.,
Bourbon Co., Kansas.

BB-950 = Exposure of Dennis Limestone along Kansas Highway 3 on North side
of Little Osage River, from Canville limestone, Stark shale, and lower
beds of Winterset limestone with the base of the Dennis (Canville)
Limestone at @ 950'; about 100'; North of Center of West line, SW1/4, Sec.
25, T.23S., R.21E., Bourbon Co., Kansas.

BB-951 = Top of Dennis (Winterset) Limestone, oolitic phase, at @ 990'; Center of
West line, SW1/4, SW1/4, Sec. 24, T.23S., R.21E., Bourbon Co., Kansas.

BB-952 = Top of Dennis (Winterset) Limestone, oolitic phase at @ 990'; near
Center of West line, SW1/4, Sec. 24, T.23S., R.21E., Bourbon Co., Kansas.

BB-953 = Upper beds of Winterset limestone exposed in road ditch on North side
of road at 970', estimated top of Dennis (Winterset) Limestone at 980'
based on regional dip; near Center of South line, NW1/4, Sec. 23, T.23S.,
R21E., Bourbon Co., Kansas.

BB-954 = Top of Dennis (Winterset) Limestone, oolitic phase, in field South of
road at @ 995'; near Center of South line, SE1/4, NW1/4, Sec. 24, T.23S.,
R.21E., Bourbon Co., Kansas.

BB-955 = Top of Dennis (Winterset) Limestone, oolitic? phase, in field South of
road at @ 1000'; about 300' East of Center of South line, SE1/4, NE1/4,
Sec.24, T.23S., R.21E., Bourbon Co., Kansas.

BB-956 = Weathered, cherty, oolitic top of Dennis (Winterset) Limestone on North side of road at @ 1010' with algal limestone beds of the middle and lower Winterset limestone in road ditch on the South side of road; near Center of South line SW1/4, SE1/4, NE1/4, Sec. 19, T.23S., R.23E., Bourbon Co., Kansas.

BB-957 = Top of Dennis (Winterset) Limestone, oolitic phase, in road somewhere between 1010' and 1020'; about 200' North of Center of East line NE1/4, NE1/4, Sec. 20, T.23S., R.23E., Bourbon Co., Kansas.

BRONSON QUADRANGLE

EXPLANATION - CONTROL POINTS FOR THE BOURBON COUNTY MAP ARE IDENTIFIED AS FOLLOWS:

(1) NUMBERS PRECEDED BY THE LETTER B REFER TO MEASURED SECTIONS IN THE BOURBON COUNTY, KANSAS BOOKS IN THE FILES OF THE KANSAS GEOLOGICAL SURVEY, NUMBERING BEGAN AT FIRST SECTION IN THE BOOK AND PRECEDED SEQUENTIALLY TO THE LAST SECTION;

(2) NUMBERS PRECEDED BY THE LETTER L REFER TO SITES FROM WHICH I HAVE COLLECTED GEOLOGICAL SPECIMENS; AND

(3) NUMBERS PRECEDED BY THE LETTERS BB ARE SITES EXAMINED AND EVALUATED SPECIFICALLY FOR THIS MAPPING PROJECT.

OBVIOUSLY, ANY GIVEN SITE MAY BE IDENTIFIED BY ANY ONE, TWO, OR ALL THREE OF THESE DESIGNATIONS.

B-5 = Dennis, not Swope, same area as BB-929; near Center of North line of Sec. 30, T.24S., R.22E., Bourbon Co., Kansas.

B-62 = Winterset; new quarry (1952) on new Highway 54, now nearly full of water; near Center of NW1/4, Sec. 7, T.25S., R.22E., Bourbon Co., Kansas.

B-63 = Winterset; new quarry (1952) on new U. S. Highway 54, same area as BB-924; near Center of Sec. 7, T.25S., R.22E., Bourbon Co., Kansas.

B-64 = Upper part of Swope (Bethany Falls) Limestone to Dennis (Winterset) Limestone, same area as BB-920 and BB-937; Center of South line of Sec. 5, T.25S., R.22E., Bourbon Co., Kansas.

BB-869 = Algal limestone in road with top at @ 1000' and base near 970'; near Northwest corner of Sec. 11, T.24S., R.21E., Bourbon Co., Kansas.

BB-870 = Old quarry in Bethany Falls limestone with massive, oolitic upper beds and middle and lower beds like those exposed at BB-817; Middle Creek limestone exposed in oil field road below level of quarry but above the floodplain; Canville limestone exposed in quarry wall above Bethany Falls above approx. 6.0' of Galesburg Shale; probable Stark shale above Canville based on black soil and basal parts of Winterset at the tops of the hills; base of Swope (Middle Creek Limestone at approx. 925', top of Swope (Bethany Falls) Limestone at approx. 979', and base of Dennis (Canville) Limestone at approx. 985'; SW1/4, NW1/4, SW1/4, Sec. 4, T.24S., R.22E., Bourbon Co., Kansas.

BB-918 = BR-1 = Hunt Midwest Quarry; thicknesses hand leveled, top of Hertha (Sniabar) Limestone @ 985' in creek north of quarry in Opossum Hollow, base of Swope (Middle Creek) Limestone @ 998' in road/drainage north from quarry, top of Swope (Bethany Falls, upper 8' cross-bedded oolites, lower 17 mottled gray limestone) Limestone @ 1030 below pond above quarry; thicknesses: Sniabar 2'+(covered below), Ladore 13', Middle Creek 3', Hushpuckney 3', Bethany Falls 26', Galesburg 6'+ (covered); base of sequence about 200' South of Center of West 1/2, Sec. 9, T.25S., R.22E., Bourbon Co., Kansas with top about 700' Southwest of base in Sec. 9, T.25S., R.22E., Bourbon Co., Kansas.

- BB-919 = BR-2 = Base of Dennis (Canville) Limestone @1040' in road; about 200' South of Center of West line, NW1/4, Sec. 9, T.25S., R.22E., Bourbon Co., Kansas,
- BB-920 = BR-3 = Top of Swope (Bethany Falls) Limestone @1006' in creek below bridge and south of road; Stark and Winterset exposed in pit silo just SE of bridge, floor of silo is probably Canville; base of Dennis (Canville) Limestone @1018; Galesburg and Canville exposed in pond spillway about 100 yards south of bridge; thicknesses: Galesburg 12', Canville 1.5'; near Center of North line, NE1/4, NW1/4, Sec. 8, T.25S., R.22E., Bourbon Co., Kansas.
- BB-921 = BR-4 = Quarry in Winterset limestone (Don Pemberton, Bandera Quarry owner); thick section of upper and lower Winterset, upper 10-15'+ crossbedded, oolitic; lower 20-30' + algal, wavy-bedded; no contacts; limestone to at least 1055' toward top of hill; near Center of SW1/4, SE1/4, SE1/4, Sec. 6, T.25S., R.22E., Bourbon Co., Kansas.
- BB-922 = BR-5 = Road cut on north side of U. S. Hwy 54, east of creek; top of Swope (Bethany Falls) Limestone @ 1002', base of Dennis (Canville) Limestone @ 1015'; thicknesses: Galesburg 13', Canville 1.5', Stark 4'; near Center of SW1/4, SW1/4, NW1/4, Sec. 8, T.25S., R.22E., Bourbon Co., Kansas.
- BB-923 = BR-6 = Road cut on north side of U. S. Hwy 54, west of creek; Stark shale and base of Winterset limestone in ditch; base of Dennis (Canville) Limestone @1000'; near Center of SE1/4, NE1/4, Sec. 7, T.25S., R.22E., Bourbon Co., Kansas.
- BB-924 = BR-7 = Top of Swope (Bethany Falls) Limestone @ 998' below spillway at south end of dam at Bronson Reservoir; base of Dennis (Canville) Limestone estimated @ 1000'; about 200' North of Center of South line, SW1/4, NE1/4, Sec. 7, T.25S., R.22E., Bourbon Co., Kansas.
- BB-925 = BR-8 = Base of Dennis (Canville) Limestone @ 1042' in road ditches just west of BB-918 (BR-1); about 200' South of Center of West line, NE1/4, SE1/4, Sec. 8, T.25S., R.22E., Bourbon Co., Kansas.
- BB-926 = BR-9 = Base of Dennis (Canville) Limestone @ 1000' just South of fence on South side of road; about 300' South of Center of North line, NE1/4, NE1/4, Sec. 7, T.25S., R.22E., Bourbon Co., Kansas.
- BB-927 = BR-10 = Base of Dennis (Canville) Limestone @ 1000' with Stark shale in road ditch South of road; about 300' West and about 100' South of NE corner, Sec. 7, T.25S., R.22E., Bourbon Co., Kansas.
- BB-928 = BR-11 = Base of Dennis (Canville) Limestone @ 1000' with Stark shale in road ditch South of road; Center of North line of NE1/4, Sec. 7, T.25S., R.22E., Bourbon Co., Kansas.
- BB-929 = BR-12 = Stark shale and basal Winterset limestone exposed in creek bank South of bridge; Stark shale 6' (upper 2' yellow gray shale, lower 4' black, platy) thick; Canville limestone not exposed (below water level);

about 200' West of Center of North line, NE1/4, NW1/4, Sec. 30, T.24S., R.22E., Bourbon Co., Kansas.

BB-929A = Top of Dennis (Winterset) Limestone, oolitic, at @ 1030' in road and drainage South of road; near Center of South line, SE1/4, SW1/4, SE1/4, Sec. 19, T.24S., R.22E., Bourbon Co., Kansas.

BB-929B = Top of Canville limestone at @ 968' in stream bed in field, base of Dennis (Canville) Limestone estimated at @ 965'; near Center of SW1/4, NW1/4, Sec. 19, T.24S., R.22E., Bourbon Co., Kansas.

BB-929C = Top of Dennis (Winterset) Limestone at @ 1020' in road; near Center of West line, NW1/4, NW1/4, SW1/4, Sec. 19, T.24S., R.22E., Bourbon Co., Kansas.

BB-930 = BR-13 = Top of Dennis (Winterset) Limestone @1018' in road ditch on East side of road; oolitic limestone with shale and sandstone above in road ditch on East side; limestones in Cherryvale ? above; near Center of West line, SW1/4, NW1/4, SW1/4, Sec. 18, T.24S., R.22E., Bourbon Co., Kansas.

BB-931 = BR-14 = Top of Dennis (Winterset) Limestone @ 1015' in pasture West of road; Center of West line NW1/4, NW1/4, Sec. 18, T.24S., R.22E., Bourbon Co., Kansas.

BB-936 = Old quarry full of water, upper beds of algal limestone of Winterset limestone, no oolitic phase observed, possibly top of Dennis (Winterset) Limestone estimated at @ 1055'; polaroid photo of underside of algal limestone showing branching algal thalli, also 35 mm photos by Sawin; Center of West 1/2, NW1/4, NE1/4, NE1/4, Sec. 12, T.25S., R.21E., Bourbon Co., Kansas.

BB-937 = Top of Dennis (Winterset) Limestone, not oolitic, near 1060' in the road; near Center of North line, NW1/4, NW1/4, NE1/4, Sec. 8, T.25S., R.22E., Bourbon Co., Kansas.

BB-938 = Top of Dennis (Winterset) Limestone, not oolitic, in road near 1050'; poor exposure because of relative flat topography; near Center of South line SE1/4, SE1/4, Sec. 36, T.24S., R.21E., Bourbon Co., Kansas.

BB-939 = Top of Dennis (Winterset) Limestone, not oolitic, in road and field North of road near 1050'; about 200' East of Center of South line, Sec. 36, T.24S., R.21E., Bourbon Co., Kansas.

BB-940 = Top of Dennis (Winterset) Limestone, not oolitic, near 1040' in the road; about 100' West of Center of South line, SE1/4, SW1/4, Sec. 36, T.24S., R.21E., Bourbon Co., Kansas.

BB-941 = Top of Dennis (Winterset) Limestone, not oolitic, near 1030' in the field East of road; about 200' North of Center of West line, NW1/4, Sec. 36, T.24S., R.21E., Bourbon Co., Kansas.

BB-942 = Top of Dennis (Winterset) Limestone, not oolitic, in the road at Section corner at 1033'; limestone well exposed along South side of drainage on

the east side of road slightly North of the Section corner; NW corner, Sec.36, T.24S., R.21E., Bourbon Co., Kansas.

BB-943 = Good exposure of cross-bedded oolitic upper beds of Winterset limestone in field East of road with top of Dennis (Winterset) Limestone at @ 1055'; SW corner, Sec. 24, T.24S., R.21E., Bourbon Co., Kansas.

BB-944 = Same as at BB-943 with top of Dennis (Winterset) Limestone, including oolitic phase, but not as good as at BB-943; near Center of South line, Sec. 24, T.24S., R.21E., Bourbon Co., Kansas.

BB-945 = Top of Dennis (Winterset) Limestone at @ 1040' in field West of road; just North of Center of West line, SW1/4, SW1/4, NW1/4, Sec. 13, T.24S., R.21E., Bourbon Co., Kansas.

BB-946 = Reddish brown sandstone of Cherryvale/Chanute interval in road ditch on West side of road; Center of West line, SW1/4, SW1/4, Sec. 1, T.24S., R.21E., Bourbon Co., Kansas.

MAPLETON QUADRANGLE

EXPLANATION - CONTROL POINTS FOR THE BOURBON COUNTY MAP ARE IDENTIFIED AS FOLLOWS:

(1) NUMBERS PRECEDED BY THE LETTER **B** REFER TO MEASURED SECTIONS IN THE BOURBON COUNTY, KANSAS BOOKS IN THE FILES OF THE KANSAS GEOLOGICAL SURVEY, NUMBERING BEGAN AT FIRST SECTION IN THE BOOK AND PRECEDED SEQUENTIALLY TO THE LAST SECTION;

(2) NUMBERS PRECEDED BY THE LETTER **L** REFER TO SITES FROM WHICH I HAVE COLLECTED GEOLOGICAL SPECIMENS; AND

(3) NUMBERS PRECEDED BY THE LETTERS **BB** ARE SITES EXAMINED AND EVALUATED SPECIFICALLY FOR THIS MAPPING PROJECT.

OBVIOUSLY, ANY GIVEN SITE MAY BE IDENTIFIED BY ANY ONE, TWO, OR ALL THREE OF THESE DESIGNATIONS.

B-173 = Hertha to Middle Creek, same area as BB-958; Sec. 34, T.23S., R.22E., Bourbon Co., Kansas.

B-174 = Pleasanton to Bethany Falls; base of Critzer limestone at @ 963', top of Hertha (Sniabar) Limestone at @ 973', base of Swope (Middle Creek) Limestone at @ 978', and Bethany Falls (NO TOP) at 993'; 1 mile North of Xenia, Kansas; SE corner of Sec. 28, T.23S., R.22E., Bourbon Co., Kansas.

B-175 = Pleasanton (Bourbon Flags?), area of Hidden Valley Lake spillway, same area as BB-961; near Center of North line of NE1/4, Sec. 26, T.23S., R.22E., Bourbon Co., Kansas.

B-176 = Pleasanton to Middle Creek, area of Hidden Valley Lake spillway, same area as BB-961; just South of Center of North line of NE1/4, Sec. 26, T.23S., R.22E., Bourbon Co., Kansas.

B-177 = Hertha to Middle Creek; unfinished roadcut and fill Northeast of Xenia, Kansas 1 July 1936; base of Critzer limestone at @ 950', top of Hertha (Sniabar) Limestone at @ 974', and base of Swope (Middle Creek) Limestone at @ 986'; Stop 4B of 1989 Guidebook titled "Late Pennsylvanian and Early Permian Cyclic sedimentation, Paleogeography, Paleoecology, and Biostratigraphy in Kansas and Nebraska"; NW corner of NE1/4, to Center of West line of NE1/4, T.23S., R.22E., Bourbon Co., Kansas.

B-178 = Middle Creek to Canville, same area as BB- 963; SW corner of Sec. 24, T.23S., R.22E., Bourbon Co., Kansas.

B-179 =Base Hertha to Dennis?, not seen, inaccessible; just SE of Center of North line of Sec. 21. T.23S., R.22E., Bourbon Co., Kansas.

B-185 = Pleasanton to Bethany Falls, same area as BB-974; near NW corner of Sec. 29, T.23S., R.23E., Bourbon Co., Kansas.

B-187 = Pleasanton (Bourbon Flags) to Bethany Falls, same area as BB-974; along South side of road Sec. 20, T.23S., R.23E., Bourbon Co., Kansas.

B-188 = Hertha to Bethany Falls, same area as BB-974; along highway North and West of Mapleton, Kansas; Sec. 20, T.23S., R.23E., Bourbon Co., Kansas.

- B-189 = Pleasanton (Bourbon Flags) to Bethany Falls, same area as BB-974; roadcut of highway Northwest of Mapleton, Kansas; SW corner of Sec. 20, T.23S., R.23E., Bourbon Co., Kansas; **EAST DIP!**
- B-191 = Bandera and lower Altamont, section in floodplain, inaccessible; Sec. 33, T.23S., R.24E., Bourbon Co., Kansas.
- BB-958 = Base of Swope (Middle Creek) Limestone at @ 1020'? with top of Hertha (Sniabar) Limestone at @ 1010'?, area of B-173; near Center of Sec. 32, T.23S., R.22E., Bourbon Co., Kansas.
- BB-959 = Typical "Bourbon Flags" exposed along road on West side of stream; about 100' North of Center of West line, SW1/4, NW1/4, Sec. 36, T.23S., R.22E., Bourbon Co., Kansas.
- BB-960 = Same as BB-959; near Center of West line, SW1/4, Sec. 25, T.23S., R.22E., Bourbon Co., Kansas.
- BB-961 = Excellent exposure of typical "Bourbon Flags" and Critzer limestone like at B-177; base of Critzer limestone at @ 940' suggesting an East dip of about 5' per quarter mile!; area of site B-176; about 100' North of South line, SE1/4, Sec. 23, T.23S., R.22E., Bourbon Co., Kansas.
- BB-962 = Top of Swope (Bethany Falls) Limestone, oolitic phase, at @ 1000'; about 500' East of SW corner, Sec. 24, T.23S., R.22E., Bourbon Co., Kansas.
- BB-963 = Quarry exposing Bethany Falls through lower Winterset limestone; top of Swope (Bethany Falls) Limestone like at BB-962 at @ 1000' with 5.0' of Galesburg Shale, 3.0' of Canville limestone, 5.0' of Stark shale, and 8 to 10 feet of lower part of Winterset limestone; base of Dennis (Canville) Limestone at @ 1005'; near Center of S1/2, SW1/4, Sec. 24, T.23S., R.22E., Bourbon Co., Kansas.
- BB-964 = Base of Swope (Middle Creek) Limestone in drainage North of road at 2 975'; about 200' West of Center of South line, SE1/4, SW1/4, Sec. 24, T.23S., R.22E., Bourbon Co., Kansas.
- BB-965 = Exposure along North-South road from below Critzer limestone into the Bethany Falls limestone; base of Critzer limestone at @ 961', top of Hertha (Sniabar) Limestone at @ 983', and base of Swope (Middle Creek) Limestone at @ 988'; about 300' North of Center of West line, SW1/4, Sec. 23, T.23S., R.22E., Bourbon Co., Kansas.
- BB-966 = Top of Swope (Bethany Falls, non-oolitic) Limestone at @ 1020' in road and field East of road; base of Dennis (Canville) Limestone estimated at @ 1025' in road just North (200') of BB-966; near Center of West line, Sec. 23, T.23S., R.22E., Bourbon Co., Kansas.
- BB-967 = Exposure along road from light brownish grey silty, blocky, mudrock in stream upto limestone beds in the Winterset limestone at the middle of the section at an elevation of 1031'; base of Critzer limestone at @ 955', top of Hertha (Sniabar) Limestone at @ 970', base of Swope (Middle Creek) Limestone at @ 990', top of Swope (Bethany Falls) Limestone at @

1020', and base of Dennis (Canville) Limestone at @ 1025'; about 300' South of Center of East line, SE1/4, Sec. 14, T.23S., R.22E., Linn Co., Kansas.

BB-968 = Base of Dennis (Canville) Limestone at 1020' in road with black, platy, fissile shale (Stark) above and lower beds of Winterset limestone above toward section corner to the West; about 100' West of Center of North line, NW1/4, NW1/4, Sec. 19, T.23S., R.23E., Bourbon Co., Kansas.

BB-969 = Base of Dennis (Canville) Limestone in North-South road at @ 1030' near section corner; top of Swope (Bethany Falls) Limestone in creek North of East-West road at @ 1025'; NE corner, Sec. 25, T.23S., R.22E., Bourbon Co., Kansas.

BB-970 = Old quarry in the Bethany Falls limestone; Center SW1/4, SE1/4, NE1/4, Sec. 25, T.23S., R.22E., Bourbon Co., Kansas.

BB-971 = Top of Swope (Bethany Falls) Limestone in road and field West of road at @ 1025'; based of Dennis (Canville) Limestone at @ 1030' in road ditch on East side of road, good exposure of Canville limestone with black, fissile shale above and lower beds of the Winterset limestone in the road to the South; Center East line, SE1/4, NE1/4, Sec. 25, T.23S., R.22E., Bourbon Co., Kansas.

BB-972 = Base of Dennis (Canville) Limestone at @ 1025' and top of Swope (Bethany Falls) Limestone at @ 1010', both in the road; near Center of East line NE1/4, NE1/4, NE1/4, Sec. 36, T.23S., R.22E., Bourbon Co., Kansas.

BB-973 = Base of Critzer limestone at @ 960', top of Hertha (Sniabar) Limestone at @ 993', and base of Swope (Middle Creek) Limestone at @ 998', all three contacts were observed in the road; near Center of North line NW1/4, NE1/4, Sec. 31, T.23S., R.23E., Bourbon Co., Kansas.

BB-974 = Base of Critzer limestone in road at @ 965' and at section corner and along the South side of road; area of sites B-185, 187, 188, and 189 as well as Stop 4C of 1989 Guidebook titled "Late Pennsylvanian and Early Permian Cyclic Sedimentation, Paleogeography, Paleoecology, and Biostratigraphy in Kansas and Nebraska"; SE corner, Sec. 19, T.23S., R.23E., Bourbon Co., Kansas.

BB-975 = Top of Swope (Bethany Falls) Limestone at 1025' in road and roadcut on South side of road; using the measured sections at sites B-185, 187, 188, and 189 the following tops are as follows: top of Hertha (Sniabar) Limestone at 1000 to 1005 feet, base of Swope (Middle Creek) Limestone estimated (not seen) at 1010', and base of Dennis (Canville) Limestone estimated (not seen) at 1030'; near Center of South line SE1/4, SW1/4, Sec. 19, T.23S., R.23E., Bourbon Co., Kansas.

BB-976 = Top of Hertha (Sniabar) Limestone at @ 1000 to 1005 feet in road and in roadcut on South side of road, base of Swope (Middle Creek) Limestone at @ 1010', top of Swope (Bethany Falls) Limestone at @ 1030' and base of Dennis (Canville) Limestone at @ 1035'; near Center North line, NE1/4, NW1/4, NE1/4, Sec. 20, T.23S., R.23E., Bourbon Co., Kansas.

BB-977 = Base of Critzer limestone at @ 965', top of Hertha (Sniabar) Limestone at @ 1000', and base of Swope (Middle Creek) Limestone at @ 1005', all three observed in road; near Center of North line, NW1/4, NE1/4, NE1/4, Sec. 19, T.23S., R.23E., Bourbon Co., Kansas.

BB-978 = Thin bedded, hard, dense, light grey bluish, algal limestone with *Composita* in low water bridge at @ 945' (Exline/Checkerboard equivalent??); near Center of North line, NE1/4, NW1/4, NE1/4, Sec. 19, T.23S., R.23E., Bourbon Co., Kansas.

BB-979 = Exposure along East-west road from limestone at BB-978 through Critzer, Sniabar, Middle Creek, Hushpuckney (exposed in road ditch on South side of road), and Bethany Falls with intervening mudrocks; base of Critzer limestone at @ 960', top of Hertha (Sniabar) Limestone at @ 980', base of Swope (Middle Creek) Limestone at @ 985', and top of Swope (Bethany Falls) Limestone at @ 1010'; about 200' West of Center of North line NW1/4, NE1/4, Sec. 19, T.23S., R.23E., Bourbon Co., Kansas.

BB-980 = Sequence exposed along East-West road from Winterset limestone down to flaggy beds below Critzer limestone, base of Dennis (Canville) Limestone at @ 1020' and base of Critzer limestone at @ 930', other contacts covered; about 200' East of Center of South line, SW1/4, SE1/4, Sec. 25, T.23S., R.22E., Bourbon Co., Kansas.

MORAN QUADRANGLE

EXPLANATION - CONTROL POINTS FOR THE BOURBON COUNTY MAP ARE IDENTIFIED AS FOLLOWS:

(1) NUMBERS PRECEDED BY THE LETTER **B** REFER TO MEASURED SECTIONS IN THE BOURBON COUNTY, KANSAS BOOKS IN THE FILES OF THE KANSAS GEOLOGICAL SURVEY, NUMBERING BEGAN AT FIRST SECTION IN THE BOOK AND PRECEDED SEQUENTIALLY TO THE LAST SECTION;

(2) NUMBERS PRECEDED BY THE LETTER **L** REFER TO SITES FROM WHICH I HAVE COLLECTED GEOLOGICAL SPECIMENS; AND

(3) NUMBERS PRECEDED BY THE LETTERS **BB** ARE SITES EXAMINED AND EVALUATED SPECIFICALLY FOR THIS MAPPING PROJECT.

OBVIOUSLY, ANY GIVEN SITE MAY BE IDENTIFIED BY ANY ONE, TWO, OR ALL THREE OF THESE DESIGNATIONS.

B-46 = Bethany Falls; old quarry on South side of road; just South of Center of North line of NE1/4, NE1/4, Sec. 24, T.25S., R.21E., Bourbon Co., Kansas.

B-47 = Same as B-46.

B-48 = Hertha to Dennis?; old quarry on South side of road; near NE corner of Sec. 24, T.25S., R.21E., Bourbon Co., Kansas.

B-49 = Same as B-48.

B-50 = Bethany Falls to Winterset; near Center of West line of SE1/4, NW1/4, Sec. 24, T.25S., R.21E., Bourbon Co., Kansas.

B-51 = Hertha to Bethany Falls; West of railroad on US Highway 54 (Type locality of Schubert Creek (Sniabar) in NE, Sec. 24, T.25S., R.21E., Bourbon Co., Kansas); near Center of South line of SE1/4, Sec. 13, T.25S., R.21E., Bourbon Co., Kansas.

B-56 = Middle Creek to Stark; Center of North line of NW1/4, NW1/4, Sec. 19, T.25S., R.22E., Bourbon Co., Kansas..

B-57 = Hertha (very top of Schubert Creek); just East of railroad on North side of Highway; SW corner of Sec. 18, T.25S., R.22E., Bourbon Co., Kansas.

NOTE: For area of sites above denoted as B-46 through B-57 the following comments apply: top of lower massive limestone, see B-48, is at an elevation of @ 960' (this limestone has been called Sniabar by Heckel, Jewett called it Critzer); the top of the massive, cross-bedded oolitic limestone is at @ 1010' (Jewett called it Bethany Falls, but Heckel suggested it might be Winterset). It appears that Heckel is correct which means that the top of the Hertha (Sniabar) Limestone is at @ 960', the interval between the top of Snibar and base of Bethany Falls is only 2.0' thick!!, the top of the Swope (Bethany Falls) Limestone is at @ 968'; base of Dennis (Canville) Limestone is at @ 977', and the top of the Denis (Winterset) Limestone is at 1010' (Dennis Limestone is 33 feet thick, not unreasonable

- B-58 = Hertha (Schubert Creek) to Bethany Falls with base of Middle Creek Limestone Member of Swope Limestone at 990', top of Hertha Limestone based on thicknesses from measured section = 979', Swope Limestone is 27' thick based on measured section and ends in the oolitic cross bedded facies of the Bethany Falls limestone; along U. S. Highway 54; near Center of North line of NE1/4, Sec. 19, T.25S., R.22E., Bourbon Co., Kansas.
- B-59 = Schubert Creek and limestone below, not seen, inaccessible; Sec. 18, T.25S., R.22E., Bourbon Co., Kansas.
- B-71 = Top of Hertha (Sniabar) Limestone at 1000' in road and fields on both sides of road, a good section; Sniabar (Schubert Creek) limestone and beds below; just East of Center of North line of NE1/4, Sec. 31, T.25S., R.22E., Bourbon Co., Kansas; base of Swope (Middle Creek) Limestone in road at @ 1010' with black shale (Hushpuckney) above, just West of B-71, thus the intervening mudrock (Ladore/Elm Branch) is 10 feet thick.
- B-108 = upper Hertha through Galesburg, not seen, inaccessible; possibly similar to B-116; East side of Sec. 25, T.26S., R.21E., Bourbon Co., Kansas.
- B-109 = Swope (thick Bethany Falls), looks okay; slightly Northwest of Center of SW1/4, SE1/4, Sec. 13, T.26S., R.21E., Bourbon Co., Kansas.
- B-110 = Bethany Falls to Winterset, looks okay; near SE corner of Sec. 13, T.26S., R.21E., Bourbon Co., Kansas.
- B-111 = Hertha to Bethany Falls, same as B-112; Center of West line of Sec. 12, T.26S., R.21E., Bourbon Co., Kansas.
- B-112 = Bourbon Formation, same locality as B-111, same area as BB-856 and BB-857; in ditch near Center of West line of Sec. 12, T.26S., R.21E., Bourbon Co., Kansas
- B-113 = Bethany Falls to Canville, Winterset, oolitic limestone, in place at Section corner in road and in field North and South of road, weathered top; just East of Center of West line of Sec. 11, T.26S., R.21E., Bourbon Co., Kansas.
- B-115 = Pleasanton to Middle Creek; on non-passable North-South road (July 1935); walked out the sequence as described in 1935 and it looks okay including mudrock sequences, calcareous siltstone/sandstone and limestone at the top; top of Sniabar limestone at @ 1040'; 27 February 1999; Center of West line of Sec. 28, T.26S., R.22E., Bourbon Co., Kansas.
- B-116 = Bethany Falls limestone, not Winterset as indicated on measured section; new quarry July 1955; just East of Center of South line of SW1/4, Sec. 19, T.26S., R.22E., Bourbon Co., Kansas.
- B-117 = Pleasanton to Hertha, same area as BB-832; just East of Center of North line of NW1/4, Sec. 16, T.26S., R.22E., Bourbon Co., Kansas.
- B-122 = Hertha to Bethany Falls, old quarry, mostly within the Bethany Falls; just East of Center of North line of Sec. 7, T.26S., R.22E., Bourbon Co.,

Kansas. QUARRY BETWEEN B-123 AND B-124, PROBABLY THIS SITE, B-122, IS IN THE LOWER BETHANY FALLS LIMESTONE.

B-123 = Hertha to Bethany Falls, mostly Bethany Falls, no contacts observed; roadcut in Township South of Uniontown; Center of Sec. 7, T.26S., R.22E., Bourbon Co., Kansas.

B-124 = Hertha to Bethany Falls, top of Hertha (Sniabar) Limestone at @ 955' and base of Swope (Middle Creek) Limestone at @ 975'; near Center of NW1/4, NE1/4, Sec. 7, T.26S., R.22E., Bourbon Co., Kansas.

B-125 = Pleasanton (Bourbon Flags) to Hertha (Schubert Creek), same area as BB-840; just East of NW corner of Sec. 7, T.26S., R.22E., Bourbon Co., Kansas.

BB-800 = Dennis? limestone exposed in road, probably top in field West of road; near Center of West line of NE1/4, Sec. 23, T. 25S., R.21E., Bourbon Co., Kansas.

BB-801 = Swope? limestone exposed in drainage West of road, probably top; near Center of West line of SE1/4, NE1/4, Sec. 23, T. 25S., R. 21E., Bourbon Co., Kansas.

BB-802 = Dennis? limestone exposed in road and field West of road; near Center of West line of SE1/4, SE1/4, NE1/4, Sec. 23, T. 25S., R.21E., Bourbon Co., Kansas.

BB-803 = Dennis? limestone like at BB-800 and BB-802 exposed in road and in drainage East of road; about 500 feet South of NW corner of Sec. 25, T. 25S., R.21E., Bourbon Co., Kansas.

BB-804 = Small, old limestone quarry and large blocks in field North of road; near Center of South line of SE1/4, SE1/4, Sec. 23, T. 25S., R.21E., Bourbon Co., Kansas.

BB-805 = Chert gravels in fields on both sides of road, probably indicative of Dennis limestone; near Center of West line of SW1/4, Sec. 14, T. 25S., R.21E., Bourbon Co., Kansas.

BB-806 = Top of Dennis? limestone and large boulders in drainage West of road near an elevation of 1060'; about 100 feet North of Center of East line of Sec. 27, T. 25S., R.21E., Bourbon Co., Kansas.

BB-807 = Limestone (Drum?) in the Cherryvale Shale exposed in road; about 600 feet South of NE corner of Sec. 34, T. 25S., R.21E., Bourbon Co., Kansas.

BB-808 = Limestone (Winterset) in drainage on both sides of road, stratigraphically below limestone exposed at BB-807; near Center of East line of SE1/4, NE1/4, Sec. 34, T. 25S., R.21E., Bourbon Co., Kansas.

BB-809 = Top of limestone (bed in the Winterset) exposed at BB-808? at an elevation of 1037'; near Center of East line of Sec. 34, T. 25S., R.21E., Bourbon Co., Kansas.

BB-810 = Limestones (Swope) in fields on both sides of road and in the road at the corner, approximately 80' of carbonate, probably the three lower carbonate formations of the traditional Missourian; Southeast corner of Sec. 34, T. 25S., R.21E., Bourbon Co., Kansas.

BB-811 = Limestone (lower Swope, Middle Creek?) exposed in stream bed is at 970', limestones continue back up the hill in both directions; about 500 (feet West of SE corner of Sec. 34, T. 25S., R.21E., Bourbon Co., Kansas.

BB-812 = Chert gravels and limestone cobbles at corner; possibly the same limestone as at BB-807; near Center of South line of SE1/4, SW1/4, SE1/4, Sec. 34, T. 25S., R.21E., Bourbon Co., Kansas.

BB-813 = Limestone bench(Winterset) in road at an elevation of 1030"; near Center of West line of SE1/4, NE1/4, NE1/4, Sec. 3, T. 26S., R.21E., Bourbon Co., Kansas.

BB-814 = Good limestone bench, top of Swope (Bethany Falls) Limestone at an elevation of 1000'; near Center of West line of NE1/4, SE1/4, NE1/4, Sec. 3, T. 26S., R. 21E., Bourbon Co., Kansas.

BB-815 = Limestone bench in road, lowest limestone unit, Hertha, in sequence; near Center of West line of SE1/4, SE1/4, SE1/4, Sec. 3, T. R.26S., 21E., Bourbon Co., Kansas.

BB-816 = Bluff along drainage where there appear to be three limestone units separated by thinner mudrock intervals, probably Hertha, Swope, and Dennis; possibly owner of land for access to BB-816 is Dennis West; near Center of West line of NE1/4, NE1/4, Sec. 10, T. 26S., R.21E., Bourbon Co., Kansas.

BB-817 = Swope Limestone (Bethany Falls exposed in roadcut on North side of road, Hushpuckney and Middle Creek exposed in the West bank of Wolfpen Creek); base of Swope (Middle Creek) Limestone inferred at 978', Bethany Falls is a massive bed of mottled, rubbly carbonate mudstone with crinoid ossicles, articulated brachiopods (*Cleiothyridina*), and fenestrate bryozoans (some are nearly vertical fronds, others are more or less parallel to bedding), GOOD EXPOSURE, MEASURE (from here to BB-817A, 6 Jan.'99); about 600 feet West of SE corner of Sec. 15, T. 26S., R.21E., Allen Co., Kansas.

BB-817A = Same limestone as exposed at BB-818A, top of Swope Limestone at 1015'total thickness of Swope from here to BB-818 approx. 35', 6 Jan.'99; about 150 feet North of Center of West line of NW1/4, NW1/4, Sec. 23, T.26S., R.21E., Allen Co., Kansas.

BB-818 = Limestone as at BB-848 (6 Jan.'99) along drainage in field on West side of road, base of Dennis Limestone at 1030'; along Northwest to Southeast diagonal across NE1/4, SE1/4, SE1/4, Sec. 22, T. 26S., R.21E., Bourbon Co., Kansas.

BB-818A = Top of Swope Limestone and base of Galesburg Shale exposed in drainage West of road, coal smut in lower Galesburg, upper Bethany

Falls is a cross-bedded oolitic carbonate grainstone (6 Jan.'99); about 150 feet NW of Center of E1/2, SE1/4, Sec. 22, T.26S., R.21E., Allen Co., Kansas.

BB-819 = Dennis (oolitic) limestone in road at an elevation of 1055'; SW corner of Sec. 23, T. 26S., R.21E., Bourbon Co., Kansas.

BB-820 = Base of Canville? limestone in road at an elevation of @1068'; about 200 feet East of Center of South line of SE1/4, SE1/4, Sec. 23, T. 26S., R.21E., Bourbon Co., Kansas.

BB-821 = Swope? limestone in road and in fields on both sides of road; near Center of East line of NE1/4, NE1/4, SE1/4, Sec. 23, T. 26S., R.21E., Bourbon Co., Kansas.

BB-822 = Swope (Bethany Falls) Limestone in road and in field Southeast of road, thick limestone exposed in drainage Northwest of road; near Center of N1/2, NW1/4, T. 26S., R.21E., Bourbon Co., Kansas.

BB-822A = Top of Swope (Bethany Falls) Limestone in road at @1050';

BB-823 = Exposure like that at BB-822, top of Swope (Bethany Falls) Limestone at @ 1050+'; near Center of South line of SE1/4, SE1/4, SW1/4, Sec. 13, T. 26S., R.21E., Bourbon Co., Kansas.

BB-824 = Cross-bedded, oolitic limestone, Swope (Bethany Falls) in road, also forms a small waterfall in field South of road; about 150 feet South of Center of North line of Sec. 24, T. 26S., R.21E., Bourbon Co., Kansas.

BB-825 = Galesburg Shale 10' thick with top of Swope (Bethany Falls) Limestone at 1065' and base of Dennis (Canville) Limestone at 1075' with Dennis (Winterset) Limestone in drainage on North side of road at an elevation of 1080'; SW corner of Sec. 18, T. 26S., R.22E., Bourbon Co., Kansas.

BB-826 = Galesburg Shale in drainage on West side of road with base of Dennis (Canville) Limestone at @ 1085'; near Center of S1/2 of Sec. 18, T. 26S., R.22E., Bourbon Co., Kansas.

BB-827 = Top of Swope (Bethany Falls) Limestone, oolitic, at @ 1075' in field on West side of road; near Center of Sec. 18, T. 26S., R.22E., Bourbon Co., Kansas.

BB-828 = Base of Swope (Middle Creek) Limestone at @ 960' in roadcut below house and in road ditch on West side of road here road turns East; about 300 feet East of Center of Sec. 8, T. 26S., R.22E., Bourbon Co., Kansas.

BB-829 = Swope (Bethany Falls) limestone exposed in old quarry with typical mottled limestone below and cross-bedded oolite above; near Center of NW1/4, NE1/4, SE1/4, Sec. 8, T. 26S., R.22E., Bourbon Co., Kansas.

BB-830 = Swope (upper part of Bethany Falls) Limestone caps this hill; near Center of S1/2 of SE1/4, Sec. 8, T. 26S., R.22E., Bourbon Co., Kansas.

BB-831 = Sniabar type limestone in road; SW corner of Sec. 9, T. 26S., R.22E., Bourbon Co., Kansas.

- BB-831A = At @ 1000' in road Sniabar Limestone and flaggy limestone beds of upper Mound City Shale exposed in road, not contacts; near Center of West line, NE1/4, NE1/4, Sec. 17, T.26S., R.22E., Bourbon Co., Kansas.
- BB-831B = Critzer Limestone of Heckel & Watney manuscript at 980' on both sides of hill flaggy beds of upper Mound City Shale above at top of hill; near Center of South line, SE1/4, SE1/4, Sec. 17, T.26S., R.22E., Bourbon Co., Kansas.
- BB-832 = Flaggy beds like in the upper Mound City Shale of the Heckel & Watney manuscript exposed along both sides of road; near Center of North line of NE1/4, NW1/4, NW1/4, Sec. 16, T. 26S., R.22E., Bourbon Co., Kansas.
- BB-833 = Thin limestone like that at BB-831B, Critzer of Heckel & Watney manuscript, at an elevation of @980'; mudrock above and below; just North of Center of South line of Sec. 9, T. 26S., R.22E., Bourbon Co., Kansas.
- BB-834 = Yellowish brown mudrock in stream bank on South side of road, upper part of Mound City shale as identified in Heckel & Watney manuscript; just South of Center of North line of NW1/4, Sec. 29, T. 26S., R.22E., Bourbon Co., Kansas.
- BB-834A = Bourbon Flag type beds of upper part of Mound City shale as identified in Heckel & Watney manuscript; Mason Cemetery; near Center of N 1/2, NW1/4, SE1/4, Sec. 20, T.26S., R.22E., Bourbon Co., Kansas.
- BB-835 = Limestone in road at 997', Bourbon Flag type beds of upper part of Mound City shale as identified in Heckel & Watney manuscript; SW corner of Sec. 20, T. 26S., R.22E., Bourbon Co., Kansas.
- BB-836 = Good exposure of limestone, Sniabar with based at @ 1000' and top at @ 1020' in road; near Center of South line of SE1/4, Sec. 19, T. 26S., R.22E., Bourbon Co., Kansas.
- BB-837 = Limestone as in quarry at B-116 in road, Bethany Falls; Center of South line of Sec. 19, T. 26S., R.22E., Bourbon Co., Kansas.
- BB-838 = Limestone in road, stratigraphically lower than the limestone at BB-837, a distinctive rimrock of this limestone occurs in a North-South drainage on both sides of road, Sniabar, with top at @ 1000'; about 500 feet West of Center of South line of Sec. 19, T. 26S., R.22E., Bourbon Co., Kansas.
- BB-838A = Base of Swope (Middle Creek) Limestone at @ 1010' with Hushpuckney shale above in road ditch on South side of road; just East of Center of South line, SW1/4, Sec. 19, T.26S., R.22E., Bourbon Co., Kansas.
- BB-838B = Top of Swope (Bethany Falls) Limestone at @ 1060'; about 100 feet East of SW corner, Sec. 19, T.26S., R.22E., Bourbon Co., Kansas.

- BB-839 = Base of Swope Limestone (Middle Creek) at 980' in road ditch and exposure on East side of road with a black platy mudrock in the Ladore in the road ditch along the East side of the road where the road curves to the East; near Center of West line of NW1/4, Sec. 7, T. 26S., R.22E., Bourbon Co., Kansas.
- BB-839A = Upper part, possibly the top of the Swope (Bethany Falls) Limestone at 1000' on East side of road; approx. 200' South of Center of West line of NW1/4, Sec. 7, T.26S., R.22E., Bourbon Co., Kansas.
- BB-840 = Top of Hertha (Sniabar) Limestone 32 feet below base of Swope (Middle Creek) Limestone at 948' in bluff on East side of road; near Center of West line of NW1/4, NW1/4, Sec. 7, T. 26S., R.22E., Bourbon Co., Kansas.
- BB-841 = Sniabar-like limestone, no top or base, exposed in curve of road at an elevation of about 955'; like limestone at BB-840?; about 500 feet West and 100 feet South of Center of Sec. 1, T. 26S., R.21E., Bourbon Co., Kansas.
- BB-842 = Bethany Falls limestone, no top or base, in road at an elevation of 990'; near Center of Sec. 1, T. 26S., R.21E., Bourbon Co., Kansas.
- BB-843 = Critzer limestone in road ditch on North side of road at approx. 920' with a mudrock interval (Guthrie Mountain and Mound City shales of Heckel & Watney manuscript) above overlain by a series of flaggy limestone beds like at BB-876 with lower beds of the Sniabar limestone above; the thinner limestone at roads level probably correlates with bed 5 at BB-876; polaroid taken 31 January 1999; just North of Center of NW1/4, SW1/4, Sec. 5, T. 26S., R.22E., Bourbon Co., Kansas.
- BB-844 = Critzer Limestone Member at 968' on North side of road with base of flaggy limestone beds of upper Mound City Shale at 980'; Eastward along road from this site are beds like those numbered 3, 4, and 5 at BB-876, same lithologies and similar thicknesses; near Center of West line of NW1/4, NW1/4, Sec. 32, T. 25S., R.22E., Bourbon Co., Kansas.
- BB-845 = Top of Swope? limestone at 1030', good point; near Center of North line of NE1/4, NW1/4, NW1/4, Sec. 31, T. 25S., R.22E., Bourbon Co., Kansas.
- BB-845A = Base of Dennis (Canville) Limestone in road at 1045'; approx. 400' West of Center of North line of Sec. 31, T.25S., R.22E., Bourbon Co., Kansas.
- BB-846 = Limestone in field South of road like that at BB-845 (Swope?), top is at 1020', good point; good example of low, western regional dip between BB-845 and this site; near Center of North line of NW1/4, NE1/4, Sec. 36, T. 25S., R.21E., Bourbon Co., Kansas.
- BB-846A = Base of Dennis (Canville, approx. one foot of hard, dense, grey limestone) Limestone in road ditch on North side of road at 1035' with black, fissile shale (Stark) fragments in recently graded road ditch on North side of road; approx. 200 feet East of BB-846 (see above).

- BB-847 = Base of Dennis (Canville) Limestone at 1035' in field South of road and in road with Stark shale above in road ditch; near Center of North line of Sec. 36, T. 25S., R.21E., Bourbon Co., Kansas.
- BB-848 = Algal limestone with some coated grains, Winterset, in road and the way along road to BB-819; near Center of west line of Sec. 26, T.26S., R.21E., Bourbon Co., Kansas.
- BB-848A = Base of Dennis (Canville) Limestone at 1045', 0.1 mile East of Section corner; approx. 500 feet East of Center of West line of Sec. 11, T.26S., R.21E., Bourbon Co., Kansas.
- BB-849 = Top of Swope (Bethany Falls) Limestone (oolitic) at 1030' in drainage North of road; near Center of South line of SE1/4, SW1/4, NW1/4, Sec. 11, T.26S., R.21E., Bourbon Co., Kansas.
- BB-850 = Sandy mudrock and clayey sandstone (Galesburg Shale) in road; approx. 200 feet East of Center of South line of SE1/4, SW1/4, NW1/4, Sec. 11, T.26S., R.21E., Bourbon Co., Kansas.
- BB-851 = Limestone as at BB-848A, base of Dennis (Canville) Limestone at 1045' in road ditch on South side of road; near Center of South line of SW1/4, SE1/4, NW1/4, Sec. 11, T.26S., R.21E., Bourbon Co., Kansas.
- BB-852 = Limestone as at BB-851 in road, but base slightly higher at 1055'; Center of Sec. 11, T.26S., R.21E., Bourbon Co., Kansas.
- BB-853 = Top of Swope (Bethany Falls) Limestone (oolitic) at 1040'; approx. 200 feet East of Center of South line of SW1/4, NE1/4, Sec. 11, T.26S., R.21E., Bourbon Co., Kansas.
- BB-854 = Base of Swope (Middle Creek) Limestone inferred at 1010' on South side of road (questionable contact); Center of North line of SE1/4, Sec. 11, T.26S., R.21E., Bourbon Co., Kansas.
- BB-855 = Exposure in spillway of Bourbon County State Park Lake, begins in the the Mound City Shale (of Heckel & Watney manuscript), approx 25' below the base of the Sniabar limestone with the entire Sniabar Limestone Member well exposed as an algal limestone, is 14' thick); above the Sniabar is 22 feet of Ladore Shale with the Middle Creek, Hushpuckney interval (covered) and basal beds of Bethany Falls limestone at the top of the hillside; base of the Sniabar limestone is at lake level with the top at 950' and base of Swope (Middle Creek) Limestone at 972'; several poor polaroid photos and numerous 35 mm photos (Sawin); EXCELLENT SECTION, MEASURE AND DESCRIBE; SE1/4, SW1/4, SE1/4, NW1/4, Sec. 12, T.26S., R.21E., Bourbon Co., Kansas.
- BB-856 = Top of Hertha (Sniabar) Limestone in road and ditch on North side of road at 950' with the base of Hertha (Critzler) Limestone 20' below at 930'; area of B-111 and B-112; approx 300 feet South of Center of SW1/4, NW1/4, Sec. 12, T.26S., R.21E., Bourbon Co., Kansas.
- BB-857 = Base of Swope (Middle Creek) Limestone 18' (Ladore Shale) above top of Hertha (Sniabar) Limestone at 970'; area of B-111 and B-112;

approx. 100 feet West and 200 feet North of Center of South line of SW1/4, NW1/4, Sec. 12, T.26S., R.21E., Bourbon Co., Kansas.

BB-858 = Top of Hertha (Sniabar) Limestone at 950' in road with old quarry in the Swope (Bethany Falls limestone) Northwest of road; near Center of North line of SW1/4, NE1/4, NE1/4, Sec. 14, T.26S., R.21E., Bourbon Co., Kansas.

BB-859 = Spillway of pond Northwest of quarry noted at BB-858, top of Hertha (Sniabar) Limestone at 950', 12 feet of Ladore Shale to base of Swope (Middle Creek, a single bed 1.5' thick) Limestone, thus base of Swope Limestone is at 962', including the 1.5 foot thick bed of Middle Creek there is 12 feet of section to the base of the Bethany Falls limestone, thus the Hushpuckney here is 10.5' thick, there is 8+' of Bethany Falls limestone in the hillside above spillway; approx. 100 feet West and 400 feet South of Center of North line of NE1/4, Sec. 14, T.26S., R.21E., Bourbon Co., Kansas.

BB-860 = Complete exposure of Sniabar Limestone Member because of very low lake level, base of Sniabar is 6' above lake level here, a total of 8.5' of Sniabar is exposed here in a vertical face; 35 mm photos by Sawin (7 Jan.'99); **NOTE: based on these data and those at BB-855 there is a dip of approx. 6 feet per mile in a NNE direction or the Sniabar Limestone Member is 6' thinner here at BB-860;** near Center of SW1/4, NW1/4, SE1/4, NE1/4, Sec. 14, T.26S., R.21E., Bourbon Co., Kansas.

BB-860A = Base of Swope (Middle Creek) Limestone at @ 975' in road, large blocks of black, platy, fissile shale (Hushpuckney) in stream Northwest of road; about 300' East of Center of South line SE1/4, NE1/4, Sec. 14, T.26S., R.21E., Bourbon Co., Kansas.

BB-861 = Bethany Falls limestone in road ditch of North side of road; near Center of North line of NW1/4, NE1/4, Sec. 14, T.26S., R.21E., Bourbon Co., Kansas.

BB-862 = Oolitic Bethany Falls limestone at 1020' in road and in field South of road (not the top); near Center of North line of Sec. 14, T.26S., R.21E., Bourbon Co., Kansas.

BB-863 = Top of Swope (Bethany Falls) Limestone at 1030' in field North of road; just North of Center of South line of SW1/4, Sec. 11, T.26S., R.21E., Bourbon Co., Kansas.

BB-864 = Base of Dennis (Canville) Limestone at 1050' in road with 20' of Galesburg Shale between BB-863 and BB-864; approx. 200 feet East of Center of North line of NW1/4, NW1/4, Sec. 14, T.26S., R.21E., Bourbon Co., Kansas.

BB-865 = Winterset limestone in road at Section corner at 1076'; NW corner of Sec. 14, T.26S., R.21E., Bourbon Co., Kansas.

- BB-866 = Base of Dennis (Canville) Limestone/ top of Galesburg Shale at 1045' in road; approx. 200 feet South of Center of West line of NW1/4, Sec. 14, T.26S., R.21E., Bourbon Co., Kansas.
- BB-867 = Sandy soil suggests Galesburg Shale; approx. 100 feet South of Center of West line of SW1/4, NW1/4, Sec. 14, T.26S., R.21E., Bourbon Co., Kansas.
- BB-868 = Top of Swope (Bethany Falls) Limestone at 1025' in road; approx. 250 feet North of Center of West line of Sec. 14, T.26S., R.21E., Bourbon Co., Kansas.
- BB-876 = Sequence from about 60 feet below the base Critzer Limestone at 950' in Moran Quad to the upper part of the Hertha (Sniabar) Limestone at 1012' in Uniontown Quad, with 15 to 20 interbeds of hard, dense, grey limestone and grey mudrock in the upper Mound City Shale of Heckel & Watney manuscript; along North side of road beginning in the Moran Quad near Center of South line of SW1/4, SE1/4, SW1/4, Sec. 33 and ending in the Uniontown Quad near Center of South line of SE1/4, SW1/4, Sec. 33, T.25S., R.22E., Bourbon Co., Kansas; sequence measured and briefly described (according to Heckel & Watney manuscript unit 1 = Critzer, units 2 & 3 = Guthrie Mountain Shale, units 4 through 8 = Mound City Shale, and units 10 through 12 = Snibar; 1 January 1999.
- BB-877 = Flaggy limestone beds of upper Mound City Shale as seen at BB-876 and BB-843; in road ditch on North side of road at 935, no top or base, approx. 200 feet East of Center of South line of NW1/4, Sec. 6, T.26S., R.22E., Bourbon Co., Kansas.
- BB-878 = Base of flaggy limestone beds in upper Mound City Shale of Heckel & Watney manuscript at 970' with mudrock sequence Mound City and Guthrie Mountain below similar to sequence at BB-876, in hillside on East side of road; looks very much like sequence at BB-844; near Center of West line of NW1/4, NE1/4, SW1/4, Sec. 20, T.25S., R.22E., Bourbon Co., Kansas.

PORTERVILLE QUADRANGLE

EXPLANATION - CONTROL POINTS FOR THE BOURBON COUNTY MAP ARE IDENTIFIED AS FOLLOWS:

(1) NUMBERS PRECEDED BY THE LETTER **B** REFER TO MEASURED SECTIONS IN THE BOURBON COUNTY, KANSAS BOOKS IN THE FILES OF THE KANSAS GEOLOGICAL SURVEY, NUMBERING BEGAN AT FIRST SECTION IN THE BOOK AND PRECEDED SEQUENTIALLY TO THE LAST SECTION;

(2) NUMBERS PRECEDED BY THE LETTER **L** REFER TO SITES FROM WHICH I HAVE COLLECTED GEOLOGICAL SPECIMENS; AND

(3) NUMBERS PRECEDED BY THE LETTERS **BB** ARE SITES EXAMINED AND EVALUATED SPECIFICALLY FOR THIS MAPPING PROJECT.

OBVIOUSLY, ANY GIVEN SITE MAY BE IDENTIFIED BY ANY ONE, TWO, OR ALL THREE OF THESE DESIGNATIONS.

B-114 = upper Pleasanton through Hertha, what Jewett called Critzer we think are the "Bourbon Flags" , either the Bourbon Flag facies of the Critzer as recognized in Heckel & Watney manuscript or similar beds in the upper Mound City shale, also of the Heckel & Watney manuscript; Northwest corner of Sec. 33, T.26S., R.22E., Bourbon Co., Kansas.

B-170 = Sniabar, NOT Bethany Falls limestone exposed in old quarry faces on both sides of North-South road, top of Hertha (Sniabar) Limestone inferred at an elevation of about 1005'; Northeast corner of Sec. 11, T.27S., R.21E., Bourbon Co., Kansas.

B-209 = Cherty limestone (Sniabar) overlying foss. mudrock; base of Critzer? limestone at 1077' in road with Sniabar, not the top, at top of hill;SW corner of Sec. 17, T.27S., R.22E., Bourbon Co., Kansas.

B-210 = Sequence similar to that at B-209 (see site BB-796), cherty limestone identified as Schubert Creek (Sniabar); West of NE corner of Sec. 17, T.27S., R.22E., Bourbon Co., Kansas.

B-211 = Pleasanton to Hertha (cherty limestone); sandstone in road and road ditch on West side of road ("Hepler type") see measured section just South of the Center of East line of Sec. 24, T.27S., R.21E., Bourbon Co., Kansas.

BB-748 = Swope Limestone in road; near Center of West line of NW1/4, SW1/4, SW1/4, Sec. 2, T.27S., R.21E., Bourbon Co., Kansas.

BB-749 = Dennis Limestone (oolitic) in road just below elevation 1080'; near Center of West line of NW1/4, NW1/4, Sec. 2, T.27S., R.21E., Bourbon Co., Kansas.

BB-750 = Hard, dense, oolitic limestone exposed in road ditch on West side of road, upper surface smooth with circular depressions up to a decimeter or two in diameter some of which are stained very dark reddish black, top of Dennis (Winterset) Limestone inferred at 1080', Cherryvale - Chanute interval above; near Center of East line of SE1/4, NE1/4, Sec. 34, T.26S., R.21E., Bourbon Co., Kansas.

- BB-751 = Dennis Limestone in road, looks similar to that seen at BB-750; near Center of North line of NW1/4, NE1/4, Sec. 35, T.26S., R.21E., Bourbon Co., Kansas.
- BB-752 = Limestone in road, stratigraphically, at least topographically, higher than limestones at BB-750 and BB-751, limestone (Drum?) in Cherryvale Shale; near Center of North line of NW1/4, NE1/4, NE1/4, Sec. 35, T.26S., R.21E., Bourbon Co., Kansas.
- BB-753 = Dennis Limestone in road and in pond bank of West side of road, appears similar to limestone at BB-750; near Center of East line of SE1/4, NE1/4, Sec. 35, T.26S., R.21E., Bourbon Co., Kansas.
- BB-754 = Swope Limestone in field on West side of road, looks similar to limestone at BB-750, but possibly lower stratigraphically; just South of the Center of East line of NE1/4, SE1/4, Sec. 35, T.26S., R.21E., Bourbon Co., Kansas.
- BB-755 = Swope Limestone in road like that seen at BB-754; near Center of East line of NE1/4, NE1/4, Sec. 2, T.27S., R.21E., Bourbon Co., Kansas.
- BB-756 = Swope Limestone like that at BB-755 in road and field West of road; near Center of East line of Sec. 2, T.27S., R. 21E., Bourbon Co., Kansas.
- BB-757 = Hertha (Sniabar) Limestone in road at grade change and in drainage East and South of road; near Center of East line of SE1/4, Sec. 14, T.27S., R.21E., Bourbon Co., Kansas.
- BB-758 = Near top of Hertha (Sniabar) Limestone in road at an elevation of about 1022'; near Center of East line of SE1/4, SE1/4, SE1/4, Sec. 14, T.27S., R.21E., Bourbon Co., Kansas.
- BB-759 = Black, cherty soil in road ditch on East side of road; near Center of West line of NW1/4, NW1/4, Sec. 24, T.27S., R.21E., Bourbon Co., Kansas.
- BB-760 = Limestone in road and piles of chert cobbles along edges of field on North side of road; near weathered top of limestone, probably Swope at approx. 1035'; near Center of South line of Sec. 23, T.27S., R.21E., Bourbon Co., Kansas.
- BB-761 = Hertha (Sniabar) Limestone in road, cherty soil on West side of road, possibly near the top of the limestone unit; near Center of East line of SE1/4, SE1/4, SE1/4, Sec. 22, T.27S., R.21E., Bourbon Co., Kansas.
- BB-762 = Large blocks of light coloured, algal limestone on West side of road, not unlike the Sniabar limestone at the roadcut near Uniontown on Kansas Highway 3, top of two feet of Sniabar type limestone at approx. 998'; about 200 feet South of Center of East line of SE1/4, Sec. 22, T.27S., R.21E., Bourbon Co., Kansas.
- BB-763 = Possible top of Hertha (Sniabar) Limestone in road and in road ditch on the East side of road, extending back South from this site a few hundred feet; upper part of Sniabar limestone between 1000' and 1010';

about 200 feet North of Center of West line of NW1/4, SW1/4, Sec. 23, T.27S., R.21E., Bourbon Co., Kansas.

BB-764 = Same part of limestone (upper part of Sniabar) as exposed at BB-763; about 300 feet North of Center of West line of SW1/4, NW1/4, Sec. 23, T.27S., R.21E., Bourbon Co., Kansas.

BB-765 = Limestone exposed on West side of road just South of low water bridge, Hertha Limestone (lower Sniabar and upper Mound City of Heckel & Watney manuscript) at approx. 975'; slightly South of Center of East line of SE1/4, NE1/4, NE1/4, Sec. 22, T.27S., R.21E., Bourbon Co., Kansas.

BB-765A = Hertha (base of flaggy beds of upper Mound City Shale Member of Heckel & Watney manuscript Limestone at approx. 975' in road); about 200 feet North of Center of west line, NW1/4, NW1/4, Sec. 23, T.27S., R.21E., Bourbon Co., Kansas.

BB-766 = Hertha (Sniabar) Limestone in road; about 300 feet South of NW corner, Sec. 23, T.27S., R.21E., Bourbon Co., Kansas.

BB-766A = Sniabar limestone in placed on West side of road; near Center of West line of SW1/4, SW1/4, SW1/4, Sec. 14, T.27S., R.21E., Bourbon Co., Kansas.

BB-767 = Hertha (Sniabar) Limestone rubble in fields on both sides of road; Center of North line of NE1/4, NW1/4, Sec. 23, T.27S., R.21E., Bourbon Co., Kansas.

BB-768 = Hertha (Sniabar) Limestone in drainage on both sides of road; Center of North line of Sec. 23, T.27S., R.21E., Bourbon Co., Kansas.

BB-768A = Contact of limestone at BB-769A and underlying mudrock (Mound City shale of Heckel & Watney manuscript) at approx. 978' in stream cut on South side of road; about 100 feet East and 250 feet South of Center of North line of Sec. 23, T.27S., R.21E., Bourbon Co., Kansas.

BB-769 = Ledge of Hertha (Sniabar/upper Mound City shale) Limestone along drainage on North side of road; Center of South line of SW1/4, SE1/4, Sec. 14, T.27S., R.21E., Bourbon Co., Kansas.

BB-769A = Thin, regularly bedded, hard, dense, medium grey, fossiliferous (linoproductids conspicuous) limestone (upper Mound City Shale Member of Heckel & Watney manuscript), 10 to 15 feet thick in pond spillway on North side of road; about 100 feet West and 250 feet North of Center of South line of Sec. 14, T.27S., R.21E., Bourbon Co., Kansas.

BB-770 = Hertha (Sniabar) Limestone in road; Center of South line of SW1/4, SE1/4, SE1/4, Sec.14, T.27S., R.21E., Bourbon Co., Kansas.

BB-771 = Chert gravels in road and in field Northwest of Section corner; SE corner of Sec. 14, T.27S., R.21E., Bourbon Co., Kansas.

BB-772 = Large blocks of Sniabar-like limestone like those at BB-762 in drainage; Center of West line of SW1/4, SW1/4, Sec. 14, T.27S., R.21E., Bourbon Co., Kansas.

- BB-773 = Hertha (Sniabar) Limestone exposed in Rock Creek on West side of road; about 250 feet South of Center of West line of SW1/4, Sec. 11, T.27S., R.21E., Bourbon Co., Kansas.
- BB-773A = Old quarry on West side of road in Sniabar limestone, massive to thin, wavy bedded, fine to medium crystalline, light grey limestone with a diverse productid brachiopod assemblage, blady algal fragments, syringoporoid and solitary corals, inferred based of Sniabar limestone at approx. 965'; about 250 feet West of Center of East line of SE1/4, Sec. 10, T.27S., R.21E., Neosho Co., Kansas.
- BB-774 = Thin to medium bedded limestone (Sniabar) exposed in road and in creek bank West of road, possibly the same limestone as at B-170; near Center of East line of SE1/4, Sec. 10, T.27S., R.21E., Bourbon Co., Kansas.
- BB-774A = Inferred top of Hertha (Sniabar) Limestone at approx. 990' in road; near Center of West line of NW1/4, NW1/4, SW1/4, Sec. 21, T.27S., R.21E., Bourbon Co., Kansas.
- BB-775 = Inferred top of Swope (Bethany Falls) Limestone at approx. 1030' in road; near Center of West line of SW1/4, NW1/4, NW1/4, Sec. 11, T.27S., R.21E., Bourbon Co., Kansas.
- BB-775A = Oolitic limestone in road ditch on East side of road, top of Swope (Bethany Falls) Limestone inferred at 1030'; near Center of West line of SW1/4, SW1/4, Sec. 2, T.27S., R.21E., Bourbon Co., Kansas.
- BB-776 = Limestone float in stream on both sides of Kansas Highway 39, stair step topography, suggestive of limestones, Sniabar at this elevation, top of hertha Limestone inferred at @ 1000'; near Center of North line of NW1/4, NE1/4, Sec. 11, T.27S., R.21E., Bourbon Co., Kansas.
- BB-777 = Limestone, Hertha (Sniabar), in drainage on both sides of Kansas Highway 39; about 200 feet West of Center of North line of Sec. 12, T.27S., R.21E., Bourbon Co., Kansas.
- BB-778 = Limestone (Swope, Bethany Falls) cobbles in fields on both sides of road; NW corner of Sec. 18, T.27S., R.22E., Bourbon Co., Kansas.
- BB-779 = Hertha (mostly Sniabar like) Limestone and possible Swope (Middle Creek) in road at grade change, similar to that seen at site B-211; near Center of West line of Sec. 19, T.27S., R.22E., Bourbon Co., Kansas.
- BB-780 = Hertha (Sniabar) Limestone at another grade change in road, top inferred near 1085'; near Center of West line of NW1/4, NW1/4, SW1/4, Sec. 19, T.27S., R.22E., Bourbon Co., Kansas.
- BB-781 = Sandstone ("Hepler") caps this hill; near Center of South line of SW1/4, Sec. 20, T.27S., R.22E., Bourbon Co., Kansas.
- BB-782 = Near top of Hertha (Sniabar) Limestone in road and in road ditches on both sides of road at 1060'; near Center of West line of NW1/4, NW1/4, NW1/4, Sec. 8, T.27S., R.22E., Bourbon Co., Kansas.

- BB-783 = Limestone, Swope, Bethany Falls, rubble in field East of road; NW corner of Sec. 5, T.27S., R.22E., Bourbon Co., Kansas.
- BB-784 = Large blocks of limestone like that at BB-783 (Bethany Falls) in road and road ditch South of road; near Center of North line of NW1/4, NE1/4, Sec. 5, T.27S., R.22E., Bourbon Co., Kansas.
- BB-785 = Limestone, Swope, Bethany Falls in field North of road; about 300 feet East of Center of North line of NW1/4, NE1/4, Sec. 5, T.27S., R.22E., Bourbon Co., Kansas.
- BB-786 = Limestone, Swope, Bethany Falls in field West of road; about 100 feet North of Center of East line of SE1/4, SE1/4, Sec. 32, T.26S., R.22E., Bourbon Co., Kansas.
- BB-787 = Limestone, Hertha, Sniabar, in field West of road; about 150 feet North of Center of East line of NE1/4, SE1/4, Sec. 32, T.26S., R.22E., Bourbon Co., Kansas.
- BB-788 = Base of Critzer limestone at 1030' in drainage West of road; near Center of East line of SE1/4, NE1/4, Sec. 32, T.26S., R.22E., Bourbon Co., Kansas.
- BB-789 = Hertha (Sniabar) Limestone in drainage West of road; about 200 feet North of Center of East line of NE1/4, Sec. 32, T.26S., R.22E., Bourbon Co., Kansas.
- BB-790 = Base of Swope (Middle Creek) Limestone exposed on both sides of drainage at an elevation of about 1050'; near Center of SE1/4, NW1/4, NE1/4, Sec. 32, T.26S., R.22E., Bourbon Co., Kansas.
- BB-791 = Near, or part of that described for, site B-114; Critzer limestone "Bourbon Flag" (Hertha according to B-114); near Center of North line of NE1/4, NE1/4, NW1/4, Sec. 33, T.26S., R.22E., Bourbon Co., Kansas.
- BB-792 = Near, or part of that described for, site B-114; mostly limestone from here back to BB-791, top of Hertha (Sniabar) Limestone at @ 1060' and base of Critzer limestone at 1030'; near Center of North line of NE1/4, NW1/4, Sec. 33, T.26S., R.22E., Bourbon Co., Kansas.
- BB-793 = Limestone, interpreted as beds of upper Swope (Bethany Falls) Limestone in; about 500 feet South of Center of West line of Sec. 4, T.27S., R.22E., Bourbon Co., Kansas.
- BB-794 = Swope (Bethany Falls) Limestone in field East of road; near Center of West line of NW1/4, NW1/4, NW1/4, Sec. 9, T.27S., R.22E., Bourbon Co., Kansas.
- BB-795 = Hertha (Sniabar) Limestone exposed in West facing gully on East side of road, top of limestone at approx. 1075', base near 1060', thus approx. 15 thick; see Heckel & Watney manuscript, Figure 3, base of Swope (Middle Creek) Limestone inferred at @ 1085'; near Center of West line of SW1/4, NW1/4, SW1/4, Sec. 9, T.27S., R.22E., Bourbon Co., Kansas.

- BB-796 = Top of Hertha (Sniabar) Limestone at @ 1075', with medium to dark gray, highly fossiliferous mudrock below in road ditch on South side of road; Sniabar limestone in road and road ditches on both sides of road to the top of hill; about 150 feet West of NE corner, Sec. 17, T.27S., R.22E., Bourbon Co., Kansas.
- BB-797 = Base of two very thin limestone beds separated by very thin mudrock limestone at 1072' in drainage on Southeast side of road with top of Hertha (Sniabar) Limestone in road at @ 1080'; about 500 feet North and 300 feet East of Center of South line of SE1/4, Sec. 18, T.27S., R.22E., Bourbon Co., Kansas.
- BB-798 = Sandstone (?) in road; near Center of North line of Sec. 24, T.27S., R.21E., Bourbon Co., Kansas.
- BB-799 = Sandstone (?) in road and sandy type soil from BB-798 East to Section corner in stream bank; about 500 feet West of Center of North line of Sec. 24, T.27S., R.21E., Bourbon Co., Kansas.
- BB-874 = Black, fissile shale in road ditch on North side of road at approx. 1035' = basal bed of Mound City Shale Member of Heckel & Watney manuscript (Figure 3); 0.2 mile East of SW corner, Sec. 9, T.27S., R.22E., Bourbon Co., Kansas.

XENIA QUADRANGLE

EXPLANATION - CONTROL POINTS FOR THE BOURBON COUNTY MAP ARE IDENTIFIED AS FOLLOWS:

(1) NUMBERS PRECEDED BY THE LETTER **B** REFER TO MEASURED SECTIONS IN THE BOURBON COUNTY, KANSAS BOOKS IN THE FILES OF THE KANSAS GEOLOGICAL SURVEY, NUMBERING BEGAN AT FIRST SECTION IN THE BOOK AND PRECEDED SEQUENTIALLY TO THE LAST SECTION;

(2) NUMBERS PRECEDED BY THE LETTER **L** REFER TO SITES FROM WHICH I HAVE COLLECTED GEOLOGICAL SPECIMENS; AND

(3) NUMBERS PRECEDED BY THE LETTERS **BB** ARE SITES EXAMINED AND EVALUATED SPECIFICALLY FOR THIS MAPPING PROJECT.

OBVIOUSLY, ANY GIVEN SITE MAY BE IDENTIFIED BY ANY ONE, TWO, OR ALL THREE OF THESE DESIGNATIONS.

B-1 = Pleasanton and Hertha, area of BB-982; Center of North 1/2 of Sec. 35, T.24S., R.22E., Bourbon Co., Kansas.

B-2 = Hertha; quarry West of road, area of BB-982; near Center of NW1/4, NW1/4, Sec.35, T.24S., R.22E., Bourbon Co., Kansas.

B-3 = Pleasanton and lower Hertha, area of BB-982; Sec. 35., T.24S., R.22E., Bourbon Co., Kansas.

B-4 = SAME AS B-2.

B-7 = Pleasanton to Swope; base of Swope (Middle Creek) Limestone at @ 1013'; top of Hertha (Sniabar) Limestone? at @ 1000' or base of Critzer limestone at @ 990'; Center of North line of Sec. 14, T.24S., R.22E., Bourbon Co., Kansas.

B-8 = Pleasanton to Swope; base of Swope (Middle Creek) Limestone estimated at @ 1020'; top of Hertha (Sniabar) Limestone at @ 1010';; base of Critzer limestone at @ 993'; near SE corner, Sec. 14, T.24S., R.22E., Bourbon Co., Kansas.

B-9 = Pleasanton (probably Hertha) to Swope, area of BB-891 below; near SE corner, Sec. 13, T.24S., R.22E., Bourbon Co., Kansas.

B-10 = Hertha to Swope, very old and grown over, but based on what is exposed at B-7 this site is probably correct and accurate; Center of South line of Sec. 11, T.24S., R.22E., Bourbon Co., Kansas.

B-11 = Upper Hertha to lower Dennis, area of BB-912, BB-913, and BB-914; Center of Sec. 3., T.24S., R.22E., Bourbon Co., Kansas.

B-12 = Upper Hertha to middle Swope, top of Swope (Bethany Falls) Limestone at @ 1020+'; Center of Sec. 9, T.24S., R.22E., Bourbon Co., Kansas.

B-13 = Pleasanton to middle Swope, same area as BB-916 and BB-917; SW corner, Sec. 3, T.24S., R.22E., Bourbon Co., Kansas.

- B-14 = Pleasanton to Swope, same area as BB-916 and BB-917; long road cut South of Xenia, Kansas; SW corner, Sec. 3, T.24S., R.22E., Bourbon Co., Kansas.
- B-15 = Bethany Falls to Winterset with a thin (2'') Galesburg Shale between, base of Dennis (Canville) Limestone at @ 1010' in road; fourth of a mile South of Xenia, Kansas; near Center of West line of NW1/4, Sec. 3, T.24S., R.22E., Bourbon Co., Kansas.
- B-16 = Pleasanton (Bourbon Flags) and lower Hertha, not seen, inaccessible; Sec. 1, T.24S., R.22E., Bourbon Co., Kansas.
- B-17 = Altamont, area of BB-906; 0.1 mile North of SW corner of Sec. 34, T.24S., R.23E., Bourbon Co., Kansas.
- B-18 = Pleasanton to middle Swope; "Billy Goat Quarry", same area as BB-884 and BB-885; just West of Center of North line of NE1/4; Sec. 31, T.24S., R.23E., Bourbon Co., Kansas.
- B-19 = Same as B-18.
- B-20 = Same as B-18.
- B-21 = Same as B-18.
- B-22 = Pleasanton (Bourbon Flags ??), same area as BB-884 and BB-885; Center of North line, NW1/4, NE1/4, Sec. 31, T.24S., R.23E., Bourbon Co., Kansas.
- B-23 = Bethany Falls; old quarry, same area as BB-900 and BB-901; near Center of East line, SE1/4, NE1/4, Sec. 21, T.24S., R.23E., Bourbon Co., Kansas.
- B-24 = Upper Pleasanton to Swope, same area as BB-900 and BB-901; center of East line, Sec. 21, T.24S., R.23E., Bourbon Co., Kansas.
- B-25 = Base of Swope (Middle Creek) Limestone in road at @ 1050' with black, fissile shale float above in road ditch and Bethany Falls type limestone above in road, top of Swope (Bethany Falls) Limestone as high as the top of hill to the West at 1090+' ; North of Berlin School; just South of Center of West line, Sec. 21, T.24S., R.23E., Bourbon Co., Kansas.
- B-26 = Bethany Falls; quarry; same locality as B-24.
- B-27 = Dennis Limestone (Canville, Stark, and lower beds of Winterset) exposed in road ditch on East side of road and in an old trench silo; base of Dennis (Canville) Limestone at @ 1072'; Center of West line of Sec. 19, T.24S., R.23E., Bourbon Co., Kansas.
- B-28 = Ladora/Elm Branch to Dennis (probably Hertha (Snibar) to Swope, Bethany Falls), not seen, inaccessible, compare with B-9 and BB-891; Sec. 18, T.24S., R.23E., Bourbon Co., Kansas.
- B-30 = Pleasanton to Hertha, same area as BB-894; 3 miles South of Mapleton; Center of West line of Sec. 10, T.24S., R.23E., Bourbon Co., Kansas.

- B-31 = Roadcut on scarp; Same as B-30.
- B-32 = Same as B-30.
- B-34 = Pleasanton to lower Swope, same area as BB-888; high bluff South of Mapleton, Kansas; near Center of NW1/4, Sec. 8, T.24S., R.23E., Bourbon Co., Kansas.
- B-35 = Pleasanton (Bourbon Flags ?), not seen, inaccessible; Near Center of North line of NW1/4, NW1/4, Sec. 8, T.24S., R.23E., Bourbon Co., Kansas.
- B-36 = Swope and below, same area as BB-890; near the Center of SW1/4, NE1/4, Sec. 8, T.24S., R.23W., Bourbon Co., Kansas.
- B-61 = Swope to Dennis, not seen, inaccessible; Sec. 9, T.25S., R.22E., Bourbon Co., Kansas.
- B-65 = Winterset, same area as BB-987; near Center of Sec., 4, T.25S., R.22E., Bourbon Co., Kansas.
- B-66 = Hertha, same area as BB-983 and BB-984; just South of Center of SE1/4, Sec. 3, T.25S., R.22E., Bourbon Co., Kansas.
- B-67 = Hertha, not seen, inaccessible; SE corner, Sec. 3, T.25S., R.22E., Bourbon Co., Kansas.
- B-68 = Pleasanton through Hertha, not seen, inaccessible; 8 miles East and 1 mile North of Bronson; 4 miles North and 2 miles East of Uniontown; NW corner of Sec. 1, T.25S., R.22E., Bourbon Co., Kansas.
- B-90 = Dennis, not seen, inaccessible; just South of Center of SW1/4, Sec. 5, T.25S., R.23E., Bourbon Co., Kansas.
- B-91 = Lenapah to "Hepler" sandstone, same area as BB-902; SE corner of Sec. 7, T.25S., R.23E., Bourbon Co., Kansas.
- BB-499 = Top of Altamont (Worland) Limestone at approximately 895' in road West of low water bridge; near Center of North line of NW1/4, NW1/4, NE1/4, Sec. 17, T.25S., R.23E., Bourbon Co., Kansas.
- BB-500 = Approximately 1.0' of thin bedded, dense, crystalline limestone with iron oxide claystone clasts and crinoid debris, similar to limestone exposed at BB-478, (see Jewett's 1938 description of the Idenbro), top of limestone at approximately 900', base at @ 899' probably Lenapah Limestone, most likely the Norfleet; approximately 7.0' of blocky, olive gray green mudrock below limestone, well exposed in drainage ditch at the middle of the section on North side of road; Altamont Limestone exposed below mudrock; near Center of North line of Sec. 17, T.25S., R.23E., Bourbon Co., Kansas.
- BB-501 = Sandstone in road, possibly Hepler, but more probably sandstone in Perry Farm shale; near Center of North line of NE1/4, NW1/4, Sec. 17, T.25S., R.23E., Bourbon Co., Kansas.

- BB-502 = Limestone as at BB-500 with well developed joint sets, one strikes NW-SE and the other NE-SW, possibly a slight East dip, upper surface of limestone well exposed at 889', assuming a thickness of 1.0' the base is at @ 888', most likely the Norfleet limestone; 7 to 8 feet of mudrock exposed above limestone; near measured section B-91; approximately 100' East of NW cor. of Sec. 17, T.25S., R.23E., Bourbon Co., Kansas.
- BB-871 = Limestone, thin, platy bedded, argillaceous, crinoidal approx. one foot thick, overlain by approx. 2 feet of mudrock which is overlain by approx 0.5 foot of a thin, dense, grey to reddish brown weathered limestone with *Crurithyris*, marginiferids, lophophyllid corals, *Worthenia* and *Glabrocingulum* in road ditch on North side of road, lower limestone at 950' = Exline of Heckel & Watney manuscript (Figures 9 & 10); upper limestone = Critzer of Heckel & Watney manuscript (Figures 9 & 10), thus base of Critzer is at 953 feet; just West of Center of NW1/4, NW1/4, NW1/4, Sec. 12, T.25S., R.22E., Bourbon Co., Kansas.
- BB-872 = Black fissile shale with phosphate nodules in lower part and modules of dense, grey limestone in upper part, base at approx. 985', total thickness approx. 2.5 feet = basal bed of Mound City Shale Member of Heckel & Watney manuscript (Figures 9 & 10); same bed occurs approx. 28.5 feet above top of limestone identified as Exline by Heckel & Watney (manuscript) at the sequence south of Uniontown along Kansas Highway 3 (see Site BB-578); approx. 0.1 mile East of BB-871 in the North 1/2, NW1/4, NW1/4, Sec. 12, T.25S., R.22E., Bourbon Co., Kansas.
- BB-873 = Whitish, crystalline, algal thin to medium bedded limestone, base at approx. 1020' in field on North side of road = base of Snibar Limestone Member according to Heckel & Watney manuscript (Figures 9 & 10); near Center of North line of NW1/4, Sec. 12, T.25S., R.22E., Bourbon Co., Kansas.
- BB-879 = Exline limestone and Critzer limestone in road ditch on North side of road like these units at BB-871, with Exline limestone at @ 975' and Critzer limestone at @ 978'; near Center of South line, SE1/4, SW1/4, Sec. 6, T.25S., R.23E., Bourbon Co., Kansas.
- BB-880 = Black, platy to fissile shale exposed on North side of road at @ 1000' with dense, nodular, grey limestone @ 1.0' thick above, basal part of Mound City shale as defined in Heckel & Watney manuscript; about 150 feet East and 100 feet South of Center of North line, Sec. 7, T.25S., R.23E., Bourbon Co., Kansas.
- BB-881 = Limestone, Norfleet?, in stream bed on both sides of road, top at 905', assuming a thickness of 1.0' as at BB-500, the base is at 904'; near Center of West line, SW1/4, Sec. 9, T.25S., R.23E., Bourbon Co., Kansas.
- BB-882 = Top of limestone (Snibar) at @1070' with mudrock and flaggy beds of upper Mound City shale as defined by Heckel & Watney exposed below along west side of road Southward from this point, Critzer and Exline were not found although they probably occur here farther South along road; chert gravels in field on East side of road North of this point between 1080' and 1090' probably reflect presence of Swope (Bethany Falls) Limestone, suggested base of Swope (Middle Creek) Limestone at @

1085'; about 200 feet South of Center of East line, SE1/4, SE1/4, Sec. 36, T.24S., R.23E., Bourbon Co., Kansas.

BB-883 = Large blocks of lower (mottled) Bethany Falls limestone in field East of road, probably outcrops in road; about 300 feet South of Center of West line, Sec. 31, T.24S., R.23E., Bourbon Co., Kansas.

BB-884 = Quarry in Swope (Bethany Falls) Limestone with top at @ 1080'; near Center of South line, SW1/4, Sec. 30, T.24S., R.23E., Bourbon Co., Kansas.

BB-885 = Base of Swope (Middle Creek) Limestone at @1040' in pond bank and along stream with the top of Snibar limestone at @ 1020' along North side of stream; base of Swope near Center of SE1/4, SW1/4, Sec. 30, T.24S., R.23E., Bourbon Co., Kansas; top of Snibar near Center of NE1/4, SE1/4, SW1/4, Sec. 30, T.24S., R.23E., Bourbon Co., Kansas.

BB-886 = Base of Swope (Middle Creek) Limestone at @ 1040' in road, many float blocks of this unit occur in field on South side of road; top of Snibar limestone in old quarry (full of water) at @ 1020' on South side of road and also exposed in road and road ditches on both sides of road; near Center of South line, SW1/4, SE1/4, Sec. 30 T.24S., R.23E., Bourbon Co., Kansas.

BB-887 = Black, platy, fissile shale in drainage on South side of road at @ 990' with beds of flaggy limestone above and below, basal part of Mound City shale as defined in Heckel & Watney manuscript; near Center of South line, SE1/4, Sec. 30, T.24S., R.23E., Bourbon Co., Kansas.

BB-888 = Top of Bourbon Flags facies of Critzer limestone at 890' of Heckel & Watney manuscript, fig. 12, type section of Guthrie Mountain Shale Member; Exline Limestone Member approx 10 feet below Critzer at 880'; Exline near Center of South line, SW1/4, NW1/4, NW1/4, Sec. 8, T.24S., R.23E., Bourbon Co., Kansas; Critzer about 200 feet East and about 100 feet South of Center of South line, SW1/4, NW1/4, NW1/4, Sec. 8, T.24S., R.23E., Bourbon Co., Kansas.

BB-889 = Base of Snibar Limestone Member at 1000' of Heckel & Watney manuscript, fig. 12; type section of Guthrie Mountain Shale Member; probably Snibar limestone to top of hill at 1030'; about 200 feet South of Center of North line, SE1/4, NW1/4, Sec. 8, T.24S., R.23E., Bourbon Co., Kansas.

BB-890 = Base of Snibar limestone at @ 1000' with basal bed exposed in road and road ditch on South side of road; black, platy of fissile black shale with dense, nodular limestone bed below, the basal beds of the Mound City shale, exposed along the South side of road at an elevation of 950' as shown in Heckel & Watney manuscript; see also B-36; near Center of NW1/4, SW1/4, Sec. 8, T.24S., R.23E., Bourbon Co., Kansas.

BB-891 = Probably position of Critzer limestone at 890' as at BB-888; near Center of South line, NE1/4, NE1/4, Sec. 8, T.24S., R.23E., Bourbon Co., Kansas.

BB-892 = Thin, platy, bedded, crystalline, fossiliferous, 2.0' thick, dark reddish to maroon limestone in drainage on both sides of road; appears

- pedogenetic, upper surface very irregular, top of limestone at 880', probably Exline; about 200 feet West of Center of East line, NE1/4, Sec. 8, T.24S., R.23E., Bourbon Co., Kansas.
- BB-893 = Sandstone and silty mudrock in drainage on both sides of road, probably Hepler Fm.; near Center of SW1/4, NW1/4, SE1/4, Sec. 4, T.24S., R.23E., Bourbon Co., Kansas.
- BB-894 = Excellent exposure of interval from the lower part of the Guthrie Mountain shale to the lower beds of the Bethany Falls limestone along West side of road; five overlapping polaroids taken of interval from uppermost Guthrie Mountain shale to lower Bethany Falls limestone, points of overlap identified by circled letters; sequence measured and briefly described by Sawin; base of black shale at base of Mound City shale is at @ 952'; base of Sniabar limestone at @ 970'; top of Sniabar limestone at @ 989'; base of Swope (Middle Creek) limestone is at @ 995'; base of sequence near Center of East line, Sec. 9, T.24S., R.23E.; top near Center of East line, NE1/4, SE1/4, Sec. 9, T.24S., R.23E., Bourbon Co., Kansas.
- BB- 895 = Close to the top of the Bethany Falls limestone in road at @ 1075'; about 150 feet North of Center of East line, SE1/4, SE1/4, Sec. 10, T.24S., R.23E., Bourbon Co., Kansas.
- BB-896 = Bethany Falls limestone exposed in old quarry on South side of road and in roadcut on North side of road; NW corner, NE1/4, NE1/4, NW1/4, Sec. 21, T.24S., R.23E., Bourbon Co., Kansas.
- BB-897 = Bethany Falls limestone exposed in old quarry, lowest area in quarry is at 1030' with black, fissile shale; based on thicknesses of the Middle Creek limestone and Hushpuckney shale at BB-894, the base of the Swope Limestone is at 1010'; approx. 30 feet of Bethany Falls limestone but no top; N 1/2, SE1/4, SE1/4, Sec. 17, T.24S., R.23E., Bourbon Co., Kansas.
- BB-898 = Estimated top of Swope (Bethany Falls) Limestone at 1075'; about 200 feet North of Center of South line, SE1/4, SE1/4, Sec. 17, T.24S., R.23E., Bourbon Co., Kansas.
- BB-899 = Estimated top of Swope (Bethany Falls) Limestone at 1075'; Center of East line, NE1/4, NE1/4, Sec. 21, T.24S., R.23E., Bourbon Co., Kansas.
- BB-900 = Bethany Falls limestone exposed in old quarry on West side of road; just West of Center of East line, SE1/4, NE1/4, Sec. 21, T.24S., R.23E., Bourbon Co., Kansas.
- BB-901 = Top of Sniabar limestone at 1010' in road ditch on West side of road; about 100 feet South of Center of East line, Sec. 21, T.24S., R.23E., Bourbon Co., Kansas.
- BB-902 = Base of Swope (Middle Creek) Limestone at 1015' in road with black, fissile shale in road ditch on South side of road; below Swope is @ 5' of Ladore/Elm Branch Shale; near Center of South line, SE1/4, NE1/4, Sec. 21, T.24S., R.23E., Bourbon Co., Kansas.

- BB-903 = Exposure of Sniabar limestone on West side of road; about 250 feet North of Center of East line, SE1/4, Sec. 21, T.24S., R.23E., Bourbon Co., Kansas.
- BB-904 = Possible Critzer/Bourbon Flags in field at 950' (estimated, not seen); about 200 feet North of Center of East line, NE1/4, NE1/4, Sec. 28, T.24S., R.23E., Bourbon Co., Kansas.
- BB-905 = Grey to dark grey and black mudrock sequence exposed in bed of stream; about 150 feet East and 200 feet South of Center of North line, NW1/4, NW1/4, Sec. 34, T.24S., R.23E., Bourbon Co., Kansas.
- BB-906 = Good exposure of Worland, top of Altamont Limestone, exposed on the West side of road at bridge over Mill Creek, top of Worland at 890'; about 250 feet South of NE corner, Sec. 4, T.25S., R.23E., Bourbon Co., Kansas
- BB-907 = Top of limestone (Norfleet) in road ditch on East side of road at 947', assuming a thickness of 1.0' as at BB-500, the base is at 946'; about 250 feet North of Center of East line, SE1/4, Sec. 9, T.25S., R.23E., Bourbon Co., Kansas.
- BB-908 = Mudrock in drainage and road ditch on west side of road; about 100 feet West of Center of East line, NE1/4, NE1/4, Sec. 5, T.25S., R.23E., Bourbon Co., Kansas.
- BB-909 = Float from flaggy beds typical of the upper Mound City shale along hillside West of road; Center of East line, NE1/4, SE1/4, NE1/4, Sec. 32, T.24S., R.23E., Bourbon Co., Kansas.
- BB-910 = Ferruginous bed in upper part of Mound City shale at 998' at section corner; base of Sniabar limestone at @1010'; top of Snibar limestone at @ 1030'; base of Swope (Middle Creek) Limestone at @ 1036'; base near Center of East line, SE1/4, SE1/4, SE1/4, Sec. 20, T.24S., R.23E., and top near Center of East line of NE1/4, SE1/4, SE1/4, Sec. 20, T.24S., R.23E., Bourbon Co., Kansas.
- BB-911 = Sniabar limestone exposed in old quarry with base near 885', no top???; SW corner, SW1/4, SE1/4, SW1/4, Sec. 36, T.24S., R.22E., Bourbon Co., Kansas.
- BB-912 = Bethany Falls limestone in road at 1010', lots of residual chert; about 150 feet South and 300 feet East of Center of East line, SE1/4, NW1/4, Sec. 3, T.24S., R.22E., Bourbon Co., Kansas.
- BB-913 = Base of Swope (Middle Creek) Limestone at @ 960' in road; just East of Center of South line, SW1/4, NE1/4, Sec. 3, T.24S., R.22E., Bourbon Co., Kansas.
- BB-914 = Top of Sniabar limestone at @ 945' in road with flaggy beds exposed along road to junction East of site; near Center of SE1/4, SW1/4, NE1/4, Sec. 3, T.24S., R.22E., Bourbon Co., Kansas.
- BB-915 = APPROACH FROM THE SOUTH OR DURING A VERY DRY TIME.

- BB-916 = Possible base of Swope (Middle Creek) Limestone at 960', and possible top of Sniabar limestone at 945'; about 200 feet North of Center of East line, SE1/4, Sec. 4, T.24S., R.22E., Bourbon Co., Kansas.
- BB-917 = Good exposure of flaggy beds in upper part of Mound City shale at 900' on East side of road; basal bed of Sniabar limestone above flaggy beds probably exposed on East side of road; just East of Center of West line, SE1/4, NE1/4, NE1/4, Sec. 9, T.24S., R.22E., Bourbon Co., Kansas.
- BB-981 = Same as B-9, base of Swope (Middle Creek) Limestone at @ 1033', top of Swope (Bethany Falls) Limestone at @ 1065'; based on the measured section at B-9 the Ladore/Elm Branch is apparently thin here (thickness not recorded) and what was called the Critzer (probably Sniabar) limestone is about 25 feet thick here with a thick (75+ feet) of Mound City shale; near SE corner, Sec. 13, T.24S., R.22E., Bourbon Co., Kansas.
- BB-982 = Top of Hertha (Sniabar) Limestone in roadcuts on both sides of road at @ 1020'; near Center of South line, Sec. 26, T.24S., R.22E., Bourbon Co., Kansas.
- BB-983 = Same unit as at BB-982 with top of Hertha (Sniabar) Limestone at 970'; near Center of West line, NW1/4, SW1/4, SW1/4, Sec. 3, T.25S., R.22E., Bourbon Co., Kansas.
- BB-984 = Base of Swope (Middle Creek) Limestone estimated at @ 990' in road; about 200' West of Center of SE1/4, Sec. 3, T.25S., R.22E., Bourbon Co., Kansas.
- BB-985 = Top of Swope (Bethany Falls) Limestone at @ 1030' in field on both sides of road; near Center of South line, SE1/4, SW1/4, NW1/4, Sec. 3, T.25S., R.22E., Bourbon Co., Kansas.
- BB-986 = Base of Dennis (Canville) Limestone in road at @ 1045'; near Center of South line, SW1/4, NW1/4, Sec. 3, T.25S., R.22E., Bourbon Co., Kansas.
- BB-987 = Dennis (Winterset) Limestone in old quarry on North side of road with oolitic top at @ 1070' in road, base of Dennis (Canville) Limestone at 1040' in road; near center of South line, SE1/4, NW1/4, Sec. 4, T.25S., R.22E., Bourbon Co., Kansas.
- BB-988 = Base of Swope (Middle Creek) Limestone in road at @ 985', just North and East of B-12; about 100' East of Center of West line, SW1/4, SE1/4, NE1/4, Sec. 9, T.24S., R.22E., Bourbon Co., Kansas.
- BB-989 = Oolitic limestone in road at an elevation of 1067', Winterset; near Center of Sec. 21, T. 24S., R.22E., Bourbon Co., Kansas.
- BB-990 = Top of Denis (Winterset) Limestone at @ 1090' in road; just South of Center of NW1/4, SW1/4, SE1/4, Sec. 21, T.24S., R.22E., Bourbon Co., Kansas.