

FIELD GEOLOGY MAPS  
BOURBON COUNTY, KANSAS

by

Ronald R. West  
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Kansas Geological Survey  
Open-file Report 97-19

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

# **FIELD GEOLOGY MAPS**

## **BOURBON COUNTY, KANSAS**

**Preliminary Field Geology Maps for**

**Hammond  
Richards  
Marmaton  
Fort Scott  
Deerfield  
Hiattville  
Cato  
Garland**

**1:24,000-scale quadrangles**

**Ronald R. West and Robert S. Sawin**

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# BOURBON COUNTY, KANSAS

## INDEX TO 1:24 000-SCALE MAPS

|    |    |    |    |    |
|----|----|----|----|----|
| 1  | 2  | 3  | 4  | 5  |
| 6  | 7  | 8  | 9  | 10 |
| 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 |

- |                         |                            |
|-------------------------|----------------------------|
| 1 Blue Mound 1966       | 11 Moran SE 1966           |
| 2 Mapleton 1966         | 12 Uniontown 1966          |
| 3 Mantey 1958 (78 PR)   | 13 Marmaton 1958 (78 PR)   |
| 4 Prescott 1958 (78 PR) | 14 Fort Scott 1958 (78 PR) |
| 5 Hume 1940             | 15 Deerfield 1939          |
| 6 Bronson 1966          | 16 Porterville 1973        |
| 7 Xenia 1966            | 17 Hepler 1973             |
| 8 Devon 1958            | 18 Hiattville 1964         |
| 9 Hammond 1958          | 19 Cato 1959 (78 PR)       |
| 10 Richards 1939        | 20 Garland 1948            |

PR Photorevised

## EXPLANATIONS

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. All contacts are tentative, solid lines indicate more confidence than dashed lines.

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

Top of Verdigris Limestone Member/base of upper Cabiness Formation = V  
(orange) Verdigris is rarely more than a meter thick.

Base of Blackjack Creek Limestone Member/top of Excello Shale Member = B  
(purple)

Top of Higginsville Limestone Member/base of Labette Shale = H (dark blue)

Top of Anna Shale Member/base of Myrick Station Limestone Member\* = A  
(green)

Top of the Laberdie Limestone Member/base of Bandera Shale = L (light blue)

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

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

Qa = Alluvial deposits were mapped using the Soil Survey of Bourbon County, Kansas (February, 1981, Soil Conservation Service, U.S. Department of Agriculture). Recent alluvial deposits five feet or greater in thickness were included in this unit. Alluvial deposits include sand, gravel, silt, and clay that was deposited on floodplains by streams, creeks, and rivers.

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

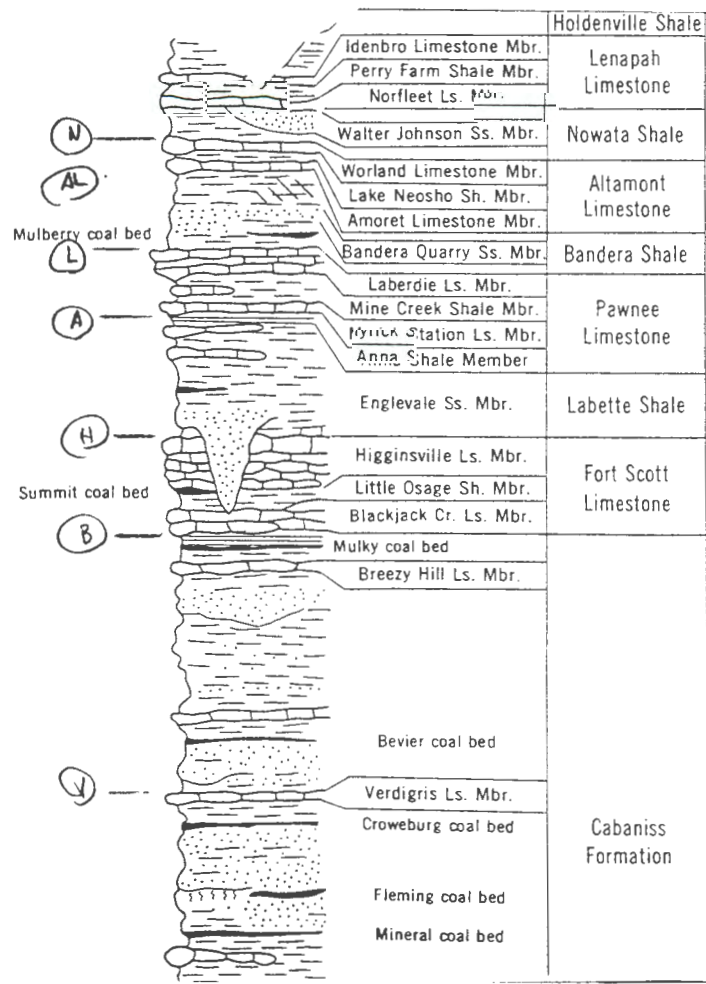
\* Note: Stratigraphically the Anna Shale Member is recognized as the basal member of the Pawnee Limestone, however our studies do not support the mappability of the base of the Anna Shale Member (Pawnee Limestone)/ top of the Labette Shale. We found the thickness of the Anna to be variable, sometimes absent, and often underlain by a black to very dark gray mudrock/shale of the uppermost Labette, making a reliable (i.e. mappable) contact questionable at best. In as much as Formations are defined by the North American Code of Stratigraphic Nomenclature as mappable lithostratigraphic units, we would propose that the Pawnee Limestone be defined to exclude the Anna and that the Anna be included in the Labette Shale.

\*\* In the quadrangles mapped the Altamont Limestone 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 nodular interval, if present. What is mappable 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. As our mapping efforts extend west and southwest of the quadrangles included herein we hope to clarify the lithostratigraphic contacts of the Altamont.

#### REFERENCES:

- Jewett, J. M., 1945, Stratigraphy of the Marmaton Group, Pennsylvanian, in Kansas. Kansas Geological Survey Bulletin 58, 148p.
- Howe, W. B., 1956, Stratigraphy of Pre-Marmaton Desmoinesian (Cherokee) Rocks in Southeastern Kansas. Kansas Geological Survey Bulletin 123, 132p.
- Price, R. C., 1981, Stratigraphy, Petrography, and Depositional Environments of the Pawnee Limestone Middle Pennsylvanian (Desmoinesian), Midcontinent North America. Unpublished Doctoral Dissertation, Univ. of Iowa, 279p.
- Schoewe, W. H., 1959, Coal Resources of the Cherokee Group in Eastern Kansas - I, Mulky Coal. Kansas Geological Survey Bulletin 134, (1959 Report of Studies) pt. 5, pp.181-222.
- Soil Survey of Bourbon County, Kansas, February, 1981, Soil Conservation Service, U.S. Department of Agriculture.
- West R. R. & 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.



Marmaton Group

DESMOINESIAN STAGE  
MIDDLE PENNSYLVANIAN SERIES

## CATO 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.

BB-87 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 958' near top of hill, near Pleasant View Cemetery; probably top of Fort Scott (Higginsville) Limestone at water level, 900', in creek; 58' of Labette Shale; from stream just North of the Center to the top of the hill South of the Center of the West line of Sec. 13, T.27S., R.24E., Bourbon County, Kansas along both sides of the road; top of section ends across the road from the Pleasant Hill Cemetery near Center East line SE1/4, SE1/4, NE1/4, Sec. 14, T.27S., R.24E., Bourbon Co., Kansas ; measured and described as BB-87 SEC.; Sawin Site #9.

BB-88 = Base of Fort Scott (Blackjack Creek) Limestone at 890'; near Center of East line NE1/4, SE1/4, Sec. 23, T.27S., R.24E., Bourbon Co., Kansas; Sawin Site #4.

BB-89 = Base of Fort Scott (Blackjack Creek) Limestone at 890'; ripplemarks in sandstones of the Lagonda, Breezy Hill limestone, Mulky Coal (1 dm), and Excello in road; just East of Center of South line NW1/4, Sec. 25, T.27S., R.24E., Crawford Co., Kansas; Sawin Site #1.

BB-90 = Top of Verdigris Limestone in the bed of Dry Wood Creek at 822'; near Center of East line NE1/4, SE1/4, SE1/4, Sec. 25, T.27S., R. 24E., Crawford Co., Kansas; Sawin Site #12.

BB-91 = Top of Verdigris Limestone in drainage in field at 829"; just East of Center of North line, NW1/4, Sec. 30, T.27S., R.25E., Crawford Co., Kansas; Sawin Site #13.

BB-92 = Base of Fort Scott (Blackjack Creek) Limestone, inferred, at 880'; near Center of East line, SE1/4, NE1/4, NE1/4, Sec. 23, T.27S., R.24E., Bourbon Co., Kansas; Sawin Site #11.

BB-93 = Top of Fort Scott (Higginsville) Limestone at 902'; just South of the NW Cor., Sec. 24, T.27S., R.24E., Bourbon Co., Kansas; Sawin Site #16.

BB-94 = Base of Fort Scott (Blackjack Creek) Limestone at 883'; Center of West line of SW1/4, NW1/4, Sec. 25., T.27S., R.24E., Crawford Co., Kansas; Sawin Site #3.

- BB-95 = Base of Fort Scott (Blackjack Creek) Limestone at 906' with Excello, Mulky Coal, Breezy Hill limestone, and Lagonda below; near Center of North line of NW1/4, NE1/4, Sec. 25., T.27S., R.24E., on the Bourbon Co.- Crawford Co., Kansas line; Sawin Site #15, measure and describe carefully.
- BB-96 = Excello, Fort Scott (Blackjack Creek, Little Osage, and Higginsville) in road; 15.4' of Fort Scott with eroded top, base Fort Scott (Blackjack Creek) Limestone at 890'; near Center of East line of SE1/4, SE1/4, NE1/4, Sec. 24, T.27S., R.24E., Bourbon Co., Kansas; Sawin Site #14.
- BB-97 = Blackjack Creek limestone in creek under road and along creek bank in pasture South of road; Little Osage shale mostly covered, but upper part exposed in pasture drainage North of road as is the lower part of the Higginsville limestone, more Higginsville is exposed in pond bank South of road; base of Fort Scott (Blackjack Creek) Limestone covered but inferred at 866' or less, top at @ 890'; from near the Center of North line of NE1/4, NW1/4, up the hill to near the Center of NE1/4, NW1/4, NW1/4, Sec. 24, T.27S., R.24E., Bourbon County, Kansas; from creek bed across wooded area into pasture to farm pond sequence; measured and described as BB-97 SEC.; Sawin Site #5.
- BB-98 = Possible top of Verdigris Limestone at 835' in road ditch; near Center of North line, NE1/4, NW1/4, NW1/4, Sec. 29, T.27S., R.25E., on the Bourbon Co.- Crawford Co., Kansas line; Sawin Site #17.
- BB-99 = Mudrock and sandstone of Lagonda, traces of Mulky Coal, some underclay, Excello, and Blackjack Creek; base of Fort Scott (Blackjack Creek) Limestone at 919'; Breezy Hill limestone NOT SEEN; near Center of North line, NW1/4, NE1/4, Sec. 29, T.27S., R.25E., on the Bourbon Co.- Crawford Co., Kansas line; Sawin Site #18.
- BB-100 = Breezy Hill limestone, Mulky Coal (@0.5'), Excello, and Blackjack Creek; base of Fort Scott (Blackjack Creek) Limestone at 922' in road; near NE Cor., Sec. 29, T.27S., R.25E., on the Bourbon Co.- Crawford Co., Kansas line; Sawin Site #19.
- BB-101 = Top of Verdigris Limestone at 836" in road ditch on South side of road; near Center of North line of NW1/4, NW1/4, NE1/4, Sec. 27, T.27S., R.25E., on the Bourbon Co.- Crawford Co., Kansas line; Sawin Site #20.
- BB-102 = Probably top of Verdigris Limestone at 825'; near Center of North line of NE1/4, NW1/4, Sec. 26, T.27S., R.25E., on the Bourbon Co.- Crawford Co., Kansas line; Sawin Site #21.
- BB-103 = Sandstone of Lagonda Formation in road; near Center of the North line of NE1/4, NW1/4, Sec. 32, T.27S., R.25E., Crawford Co., Kansas.
- BB-104 = Top of Verdigris Limestone at 860'; using three widely spaced points on top of Verdigris dip was determined to be 2.6 degrees East and strike N 8 degrees East; near Center of North line of NW1/4, Sec. 33, T.27S., R.25E., Crawford Co., Kansas; Sawin Site #22.

- BB-105 = Top of Verdigris Limestone at 849', based on hand levelling from intersection; near Center of North line of NE1/4, NE1/4, Sec. 22, T.27S., R.25E., Bourbon Co., Kansas; Sawin Site #23.
- BB-106 = Top of Verdigris Limestone at 845+' in road ditch and in old road South of County road; base of approximately 1.0' of Croweburg Coal is at 832'; large limestone concretions in road just above coal bed that appear to be in situ, such concretions are often associated with the Verdigris Limestone and underlying black mudrocks/shales; near Center of North line of Sec. 22, T.27S., R.25E., Bourbon Co., Kansas; Sawin Site 24.
- BB-107 = Top of Verdigris Limestone at 849', good point, like at BB-105; near Center of North line of NE1/4, NW1/4, Sec. 22., T.27S., R.25E., Bourbon Co., Kansas; Sawin Site #25.
- BB-108 = Top of Verdigris Limestone inferred to be at 849'; NW cor., Sec. 22, T.27S., R.25E., Bourbon Co., Kansas; Sawin Site #26.
- BB-109 = Approximately 1.0' of Croweburg Coal, underclay, and earthy limestone below; above coal is a black fissile shale and black, platy, fossiliferous limestone typical of the middle Verdigris Limestone in road at 830+'; near Center of West line of SW1/4, NW1/4, Sec. 21, T.27S., R.25E., Bourbon Co., Kansas; Sawin Site #27.
- BB-110 = Top of Verdigris Limestone inferred to be at 849' in road; near Center of West line of NW1/4, NW1/4, SW1/4, Sec. 21, T.27S., R.25E., Bourbon Co., Kansas; Sawin Site #28.
- BB-111 = Englevale Sandstone in Labette Shale at 927' in road; appears to cut out Fort Scott Limestone down to and including Blackjack Creek??; near NW Cor., Sec. 9, T.27S., R.25E., Bourbon Co., Kansas; Sawin Site #29.
- BB-112 = Englevale Sandstone in Labette Shale at 905' in road, near Gish School; near Center of North line of NW1/4, NW1/4, NE1/4, Sec. 8, T.27S., R.25E., Bourbon Co., Kansas; Sawin Site #30.
- L-922 = Base of 5.6' of Blackjack Creek limestone at 886.4' in old strip pit South of road, near water level (4 June'94); eroded top of Higginsville limestone at 902.35'; base of Fort Scott Limestone not mappable here; near Center of North line of NW1/4, Sec. 8, T.27S., R.25E., Bourbon Co., Kansas; see Schowe, 1959, KGS Bull.134, pt. 5, p. 197, pl.3A; Sawin Site #31.
- L-923 = Active quarry in Pawnee Limestone (Laberdie, Mine Creek, and Myrick Station exposed with Anna shale in quarry floor; near Center of South line of SW1/4, Sec. 29, T.26S., R.25E., Bourbon Co., Kansas.
- BB-113 = Englevale Sandstone in Labette Shale at 927' in road; near Center of West line of NE1/4, Sec. 8, T.27S., R.25E., Bourbon Co., Kansas; Sawin Site #32.
- BB-114 = Sandstone, probably Englevale, in road at 880'; just West of Center of South line of SW1/4, SE1/4, Sec. 8, T.27S., R.25E., Bourbon Co., Kansas; Sawin Site #33.

- BB-115 = Top of Verdigris Limestone at 826' in road ditch on South side of road, excellent exposure; near Center of North line of Sec. 16., T.27S., R.25E., Bourbon Co., Kansas; Sawin Site #34.
- BB-116 = Sandstone, probably Englevale, in road at 900' in road; near Center of North line of NE1/4, NW1/4, Sec. 9, T.27S., R.25E., Bourbon Co., Kansas; Sawin Site #35.
- BB-117 = Base of Higginsville limestone at 860'; top of Fort Scott (Higginsville) Limestone at 871'; near Center of West line of SW1/4, SW1/4, Sec. 17, T.27S., R.24E., Bourbon Co., Kansas; Sawin Site #6.
- BB-118 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 930'; near Center of West line of NW1/4, Sec. 12, T.27S., R.24E., Bourbon Co., Kansas; Sawin Site #7.
- BB-119 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 942'; near NW Cor., Sec. 12, T.27S., R.24E., Bourbon Co., Kansas; Sawin Site #8.
- BB-120 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 935'; Section 96 of Jewett, 1945; near Center of West line of SE1/4, SE1/4, NW1/4, Sec. 1, T.27S., R.24E., Bourbon Co., Kansas; Sawin Site #10.
- BB-121 = Top of Blackjack Creek limestone at 884', base of Fort Scott (Blackjack Creek) Limestone at 875'; near SE corner, SW1/4, SE1/4, Sec.7, T.27S., R.25E., Bourbon County, Kansas; in an old "strip pit" and/or quarry; Excello below; sequence measured and described as BB-121 SEC.; Sawin Site #36.
- BB-122 = Base of Fort Scott (Blackjack Creek) Limestone at 875' or less in road; near Center of South line of SW1/4, Sec. 7, T.27S., R.25E., Bourbon Co., Kansas; Sawin Site #37.
- BB-123 = Base of Fort Scott (Blackjack Creek) Limestone at 887' in road; near Center of West line of SW1/4, Sec. 18, T.27S., R.25E., Bourbon Co., Kansas; Sawin Site #38.
- BB-124 = Base of Fort Scott (Blackjack Creek) Limestone at 875' in road; near Center of West line of SW1/4, SW1/4, Sec. 7, T.27S., R.25E., Bourbon Co., Kansas; Sawin Site #39.
- BB-125 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 953' in road; near Center of North line of NE1/4, NE1/4, NW1/4, Sec. 12, T.27S., R.24E., Bourbon Co., Kansas; Sawin Site #40.
- BB-126 = Inferred top of Fort Scott (Higginsville) Limestone at 895'; @ 500' East of Center of North line of NE1/4, Sec. 12, T.27S., R.24E., Bourbon Co., Kansas; Sawin Site #41.
- BB-127 = Inferred top of Fort Scott (Higginsville) Limestone at 895'; near Center of East line of NE1/4, NE1/4, SE1/4, Sec. 12, T.27S., R.24E., Bourbon Co., Kansas; Sawin Site #42.

- BB-128 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 948' in road; excellent exposure of upper Labette Shale in road ditch on North side of road; near Center of South line of SW1/4, Sec. 1, T.27S., R.24E., Bourbon Co., Kansas; Sawin Site #43.
- BB-129 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 960' in road, good contact with Anna shale in road ditch on West side of road; near Center East line of NE1/4, Sec. 1, T. 27S., R.24E., Bourbon Co., Kansas; Sawin Site # 44.
- BB-130 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 955' in road ditch on South side of road; near Center of North line of NE1/4, Sec. 6, T.27S., R.25E., Bourbon Co., Kansas; Sawin Site #45.
- BB-131 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 955', Anna and Myrick Station exposed on East side of U.S. Hwy 69; near Center of West line of SW1/4, Sec. 32, T.26S., R.25E., Bourbon Co., Kansas; Sawin Site #46.
- BB-132 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 965' in road ditch on North side of road; near Center of South line of SE1/4, SE1/4, Sec. 29, T.26S., R.25E., Bourbon Co., Kansas; Sawin Site #47.
- BB-133 = Higginsville limestone exposed in creek bed at 885'; near Center of East line of SE1/4, NE1/4, Sec. 32, T.26S., R.25E., Bourbon Co., Kansas; Sawin Site #48.
- BB-134 = Englevale Sandstone in road at 875'; near Center of East line of SE1/4, SE1/4, Sec. 5, T.27S., R.25E., Bourbon Co., Kansas; Sawin Site #49.
- BB-135 = Lagonda, Mulky Coal, Excello, and Blackjack Creek in road ditch on West side of road; base of Fort Scott (Blackjack Creek) Limestone at 886'; near Center of East line of NE1/4, NE1/4, NE1/4, Sec. 5, T.27S., R.25E., Bourbon Co., Kansas; Sawin Site #50.
- BB-136 = Lagonda in creek bank on East side of road; near Center of West line of SW1/4, NW1/4, Sec. 4, T.27S., R.25E., Bourbon Co., Kansas; Sawin Site #51.
- BB-137 = Inferred base of Blackjack Creek limestone at 881'; near Center of West line of Sec. 5, T.27S., R.25E., Bourbon Co., Kansas; Sawin Site #52.
- BB-138 = Base of Fort Scott (Blackjack Creek) Limestone very near the top of the hill at @ 915'; Lagonda, @ 2 dm of Breezy Hill limestone, @ 1 dm of Mulky Coal, @ 2 dm of Excello, and lower part of Blackjack Creek limestone exposed on West side of road; near Center of East line of SE1/4, SE1/4, Sec. 4, T.27S., R.25E., Bourbon Co., Kansas; see Schowe, 1959, KGS Bull. 134, pt. 5, p. 198, plate 4B; Sawin Site #53.
- BB-139 = Top of Verdigris Limetone at 825' in road and fields South of road; near Center of North line of NW1/4, NE1/4, Sec. 10, T.27S., R.5E., Bourbon Co., Kansas; Sawin Site #54.

- BB-140 = Croweburg Coal under culvert into field on West side of road at 825'; near Center of East line of SE1/4, SE1/4, Sec. 16, T.27S., R.25E., Bourbon Co., Kansas; Sawin Site #55.
- BB-141 = Top of limestone above Mineral Coal at 792' in South bank of Dry Wood Creek; several feet below and 15+' of interval above exposed, excellent exposure, measure and describe; sections B-167 and B-168, see Section 87 of Howe, 1956; near Center of NW 1/4, NW 1/4, SW 1/4, Sec. 14, T.27S., R.25E., Bourbon Co., Kansas; Sawin Site #56.
- BB-166 = Base of Fort Scott (Blackjack Creek) Limestone at 896' in road North of Garland, Kansas; Excello below; near Center of East line of SE1/4, SE1/4, Sec. 35, T.26S., R.25E., Bourbon Co., Kansas.
- BB-167 = Base of Fort Scott (Blackjack Creek) Limestone at 896' in road South of Garland, Kansas; Excello below; near Center of East line of NE1/4, NE1/4, Sec. 2, T.27S., R.25E., Bourbon Co., Kansas.
- BB-172 = Base of Fort Scott (Blackjack Creek) Limestone at 910' in road; same as B-147 and B-159; near Center of South line of SE1/4, SW1/4, SE1/4, Sec. 28, T.26S., R.25E., Bourbon Co., Kansas.
- B-146 = Area of old strip pit; sequence from just below the Bevier Coal to soil measured and described by Howe in 1948; now reclaimed and nothing is exposed; near Center of SE1/4, NW1/4, Sec. 35, T.26S., R.25E., Bourbon Co., Kansas.
- B-165 = Strip pit in SW1/4, SE1/4, Sec. 18, T.27S., R.25E., Bourbon County, Kansas; Section 86 of Howe, 1956; interval from limestone below coal (Bevier according to Howe) through black, fissile, fossiliferous shale and bituminous limestones to thick (over 14 feet) of gray mud/clayrock; when measured and described by Howe in 1948 this was an operating pit of the Pellett Coal Co. which supplied coal to the immediate area; now inaccessible.
- B-166 = When measured and described by Jewett in 1939 this was an old strip pit West of the road, near Center of East line of Sec. 9 (Jewett's notes say Sec. 16, but that, we feel, is incorrect), T.27S., R.25E., Bourbon County, Kansas; over six feet of massive to thin bedded, dense, gray, fossiliferous limestone (Blackjack Creek) that weathers brown with over 3' of black, platy shale (Excello) containing hard, dense limestone concretions up to 1' in diameter; Section 101 of Jewett, 1945; now inaccessible.
- B-171 = Strip pit near Center of Sec. 5, T.27S., R.25E., Bourbon County, Kansas; over six feet of massive, dense, fossiliferous, vertically jointed, limestone that weathers yellowish brown (Blackjack Creek) with over four feet of blocky, black shale with phosphatic nodules (Excello) below separated from overlying limestone by a thin (several inches) of brown silty shale; measured and described by Schowe and A. D. in 1956; now inaccessible.

B-172 = Strip pit on hillside just West of Garland, Kansas, abandoned when measured and described by Howe in 1948; exposed units were identified as Blackjack Creek limestone and underlying black shale, probably Excello, down to water level; nothing exposed now; NW1/4, Sec. 1, T.27S., R.25E., Bourbon Co., Kansas.

Estimated Thicknesses of Mapped Intervals in Cato Quad.

Pawnee Ls. = 20' to 70+'

Labette Sh. = 30' to 70'

Fort Scott Ls. = 15' to 30'

post-Verdigris Ls. = 55' to 70+'

Verdigris Limestone = upto 30'

pre-Verdigris Ls. = 50+'

## DEERFIELD 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.

BB-33 = Top of Verdigris Limestone at 805'; just South of the Center of the East line, Sec. 13, T.26S., R.25E., Bourbon Co., Kansas.

BB-34 = Base of Blackjack Creek limestone at 855'; near Center of South line, SW1/4, SE1/4, Sec. 1, T.26S., R.25E., Bourbon Co., Kansas.

BB-35 = Quarry, Morris Rock Company, exposing interval from Mulky coal to Higginsville limestone; top of Fort Scott (Higginsville) at 900', base of Fort Scott (Blackjack Creek) at 875'; exposed sequence near Center of the South line, NE1/4, NE1/4, Sec.18., T.35N., R.33W., Vernon Co., Missouri; designated as Mo-1 in field notes, and generalized section described, needs to be measured and described in detail.

BB-36 = Labette Shale with Alvis Coal, fossiliferous limestone, and mudrock above coal; Englevale Sandstone near road level and Pawnee limestone float near top of hill; just South of the Center of the East line, NE1/4, NW1/4, NW1/4, Sec. 7, T.35N., R.33W., Vernon Co., Missouri; roadcut on North side of "new" U. S. Hwy 54;

BB-37 = Base of Blackjack Creek limestone at 845'; near Center of the East line, NE1/4, NE1/4, Sec. 26, T.25S., R. 25E., Bourbon Co., Kansas.

BB-38 = Top of Fort Scott (Higginsville limestone) at 861'; near SE cor., NE1/4, NE1/4, Sec. 26, T.25S., R.25E., Bourbon Co., Kansas.

BB-39 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at @900'; near center of NE1/4, NW1/4, SE1/4, Sec. 25, T.25S., R.25E., Bourbon Co., Kansas.

BB-40 = Uppermost Pawnee Limestone in road; near Center of the South line SE1/4, SE1/4, Sec. 35, T.25S., R.25E., Bourbon Co., Kansas.

BB-50 = Active strip pit, Mary Jane Mine, Verdigris Limestone to Croweburg Coal and below; PSA Loc. DFLD#1; near Center of SE1/4, Sec. 31, T.35N., R.33W., Vernon Co., Missouri.

BB-165 = Approximately 1.0' of coal, Bevier?, in road ditch on East side of road, with underclay and silty mudrock above; blocks of black, fossiliferous, calcareous mudrock to clayey limestone occurs as float in the field East of road; coal is at 843'; just East of the SE cor. Sec. 24, T. 26S., R.25E., Bourbon Co., Kansas.

BB-287 = Top of limestone like at BB-283 at 787' in road, possibly Verdigris Limestone; near Center of the West line, SW1/4, SW1/4, Sec. 29. T.36N., R.33W., Vernon Co., Missouri; CHECK IN WINTER.

Estimated Thicknesses of Mapped Intervals in Deerfield Quad.

Pawnee Ls. = up to 40' possibly

Labette Sh. = 25' to 40'

Fort Scott Ls. = 15' to 25'

post-Verdigris Ls. = 35' to 50'

Verdigris Limestone = up to 3.0'

## FORT SCOTT 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.

BB-1 = Labette Shale; along old U. S. Hwy 69 about 0.5 miles North of U. S. Hwy 54; near NE Cor., Sec. 24, T.25S., R.24E., Bourbon Co., Kansas.

BB-2 and BB-2a = Eroded top of Pawnee (Laberdie) Limestone in field on East side of road; along the West side of South 1/2, Sec. 13, T. 25S., R.24E., Bourbon Co., Kansas.

BB-3 = Labette Shale, due South of BB-2 at intersection with U. S. Hwy 54; measured section 71 of Jewett, 1945; probably not far from B-102 as the sequence is similar, a thin coal in ditch overlain by skeletal mudstone to clayey skeletal carbonate, above this carbonate is a thin bedded grayish clayey siltstone; near Center of West line of, NW1/4, Sec. 24, T.25S., R.24E., Bourbon Co., Kansas.

BB-4 = Limestone in stream bed (Higginsville?); due South of BB-3 at low water bridge; Pavey's Ford of 1889; near Center of West line of NW1/4, SW1/4, Sec. 24, T.25S., R.24E., Bourbon Co., Kansas.

BB-5 = Limestone in road ditch, probably Higginsville, becomes an algal wackestone north to drainage with alluvium in drainage; estimated top of Fort Scott (Higginsville) Limestone at 825'; due South of BB-4 at road junction; near SW Cor., Sec. 24, T. 25S., R.24E., Bourbon Co., Kansas.

BB-6 = Anna shale and lowest limestone (Myrick Station) of Pawnee in road ditch on South side of road; top of Anna shale at 847'; near Center of North line of NE1/4, NE1/4, NE1/4, Sec. 23, T.25S., R.24 E. Bourbon Co., Kansas.

BB-7 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 825' (CHECK for top at 835') in road ditch on east side of road; near Center of West line of SW1/4, SW1/4, Sec. 14, 25S., R. 24E., Bourbon Co., Kansas.

BB-8 = Same sequence as at BB-7 on East side of road, due South of BB-7, South of U. S. Hwy 54; top of Anna shale/base of Pawnee (Myrick Station) Limestone at 835' (CHECK for top at 835'); near Center of West line of NW1/4, NW1/4, Sec. 23, T.25S., R.24E., Bourbon Co., Kansas.

- BB-9 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 901' in road ditch on North side of road approximately 0.9 miles due South of BB-8; near Fort Scott/Marmaton Quad boundary; at SW cor., Sec. 23, T.25S., R.24E., Bourbon Co., Kansas. CHECK!
- BB-10 = Limestone on both sides of road, approximately 6.0' of thin, wavy bedded, algal wackestone with black, fissile shale below, no chaetetids (Higginsville and Little Osage); top of Fort Scott (Higginsville) Limestone estimated at 835'; just North of the Center of the East line, Sec. 26, T.25S., R.24E., Bourbon Co., Kansas. CHECK!
- BB-11 = Upper beds of Higginsville limestone at SE cor of intersection of Helyman and 2nd streets in Fort Scott, Kansas; very similar to BB-10; near Center of West line of NE1/4, SW1/4, Sec. 25, T.25S., R.24E., Bourbon Co., Kansas.
- BB-11A = Base of Fort Scott (Blackjack Creek) Limestone estimated at 805'; near Center of NE1/4, SW1/4, Sec. 25, T.25S., R.24E., Bourbon Co., Kansas.
- BB-12 = Fort Scott Limestone (Blackjack Creek, Little Osage, and Houx-Higginsville) in road ditch; base of Fort Scott Limestone (Blackjack Creek) at 830'; near Center of South line of SW1/4, SE1/4, Sec. 27, T.25S., R.25E., Bourbon Co., Kansas; road ditch along north side of road from creek westward to mailbox; sequence measured and described as BB-12 SEC.
- BB-13 = Higginsville and Little Osage, South and East of BB-12; near Center of East line of NE1/4, Sec. 34, T.25S., R.25E., Bourbon Co., Kansas.
- BB-14 = Sequence from Lagonda, Breezy Hill (thin), Mulky with underclay, Excello, Blackjack Creek, Little Osage, and Houx-Higginsville; base of Fort Scott (Blackjack Creek) at 835', top of Fort Scott (Houx-Higginsville) at 872'; in road ditch on North side of road; near Center of North line of NE1/4, NW1/4, Sec. 1, T.26S., R.24E., Bourbon Co., Kansas; EXCELLENT SECTION, MEASURE AND DESCRIBE!
- BB-15 = Blackjack Creek and Little Osage, including Summit Coal; near Center, SW1/4, SW1/4, NE1/4, Sec. 31, T.25S., R.25E., Bourbon County Kansas; stream bank on east side of Buck Run in the northwest corner of the intersection between 12th Street and U.S. Hwy 69 in Fort Scott, Kansas, behind (East) of Church of God; sequence measured and described as BB-15 SEC.
- BB-16 = Fort Scott Limestone (Blackjack Creek, Little Osage, and Houx-Higginsville); near SW Cor., NE1/4, Sec. 31, T.25S., R.25E., Bourbon County, Kansas; stream bank on the west side of Buck Run in the southwest corner of the intersection between 12th Street and U.S. Hwy 69 in Fort Scott, Kansas; sequence measured and described as BB-16 SEC.
- BB-17 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 912' along the South side of 12th Street in the eastern part of Fort Scott, Kansas; near Center of West line of Sec. 32, T.25S., R.25E., Bourbon Co., Kansas.

- BB-18 = Base of Fort Scott (Blackjack Creek) Limestone at 805' in road ditch about 15' above stream bed; near Center of North line of NE1/4, NE1/4, Sec. 33, T.25S., R.25E., Bourbon Co., Kansas.
- BB-19 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 875' in place in road; near Center of North line on NW1/4, Sec. 33, T.25S., R.25E., Bourbon Co., Kansas.
- BB-20 = Upper part of Lagonda, Breezy Hill, and underclay of the Mulky Coal which was mined in this area, see Schowe, 1959, KGS Bull.134, pt.5, p.213. Blocks of black, platy to fissile shale, probably Excello, can be seen in the west side of the creek bank upstream from where section was measured; these probably reflect collapse after the coal (Mulky) was removed; near Center of West line of NW1/4, NE1/4, Sec.31, T.25S., R.25E., Bourbon County, Kansas; steam bank on both sides of Buck Run just west of U.S.Hwy 69; sequence measured and described as BB-20 SEC.
- BB-21 = Pawnee Limestone, no top, no base, probably Laberdie; near Center of South line of SE1/4, SW1/4, Sec. 24, T.26S., R.24E., Bourbon Co., Kansas.
- BB-22 = Old quarries in Pawnee, probably Laberdie; near Center of East line of SE1/4, NE1/4, Sec. 25, T.26S., R.24E., Bourbon Co., Kansas.
- BB-23 = Old quarry in Pawnee, probably Laberdie; NW1/4, NE1/4, SE1/4, Sec. 19, T.26S., R.25E., Bourbon Co., Kansas.
- BB-24 = Old quarry in Pawnee, Laberdie; Section B-103; Center, SE1/4, SE1/4, Sec. 34, T.25S., R.25E., Bourbon Co., Kansas.
- BB-25 = Top of Verdigris Limestone at 840'; near Center of East line of SW1/4, SE1/4, Sec. 15, T.26S., R.25E., Bourbon Co., Kansas.
- BB-26 = Top of Verdigris Limestone at 840' on both sides of creek; downstream a few meters is a thin coal, probably the Croweburg that pinches out against a slight palaeotopographic high; just east of Center of South line of SE1/4, SW1/4, Sec. 15, T.26S., R.25E., Bourbon Co., Kansas.
- BB-27 = Englevale sandstone at 910' in road; near Center of South line of SW1/4, SE1/4, Sec. 14, T.26S., R.25E., Bourbon Co., Kansas.
- BB-28 = Possibly Breezy Hill limestone in road ditch at intersection; SW Cor., Sec. 13, T.26S., R.25E., Bourbon Co., Kansas.
- BB-29 = Base of Fort Scott (Blackjack Creek) Limestone at @900'; near Center of West line of SW1/4, SW1/4, Sec. 13, T.26S., R.25E., Bourbon Co., Kansas.
- BB-30 = Top of Verdigris Limestone at 805'; near Center of West line of NW1/4, NW1/4, Sec. 13, T.26S., R.25E., Bourbon Co., Kansas.

- BB-31 = Probably Verdigris Limestone interval (fossiliferous, clayey limestone) in creek bed; just below bridge is a monoclinial fold with a more or less North-South axis, beds dip about 1.0' per 50' horizontally to the South; SW cor., Sec. 12, T.26S., R.25E., Bourbon Co., Kansas.
- BB-32 = Mulky Coal was probably mined from this site; old strip pit near Center NE1/4, Sec. 23, T.26S., R.25E., Bourbon Co., Kansas.
- BB-41 = Base of Fort Scott (Blackjack Creek) Limestone at 855'; near Center of North line of NW1/4, NW1/4, Sec. 12, T.26S., R.25E., Bourbon Co., Kansas.
- BB-42 = Top of Fort Scott (Higginsville) Limestone at @880'; near Center of West line of Sec. 1, T.26S., R.25E., Bourbon Co., Kansas.
- BB-43 = Calcareous sandstone to sandy limestone in the upper Labette Shale; just North of Center of West line of NW1/4, Sec. 1, T.26S., R.25E., Bourbon Co., Kansas.
- BB-44 = Upper Labette Shale sequence ties into BB-185; near Center of North line of NW1/4, Sec. 1, T.26S., R.25E., Bourbon Co., Kansas.
- BB-45 = Upper Labette Shale; near Center of North line of NE1/4, Sec. 35, T.25S., R.25E., Bourbon Co., Kansas.
- BB-46 = Top of Anna shale at 900'-905' in road, Myrick Station limestone above; near Center of North line of NW1/4, Sec. 3, T.26S., R.25E., Bourbon Co., Kansas.
- BB-47 = Top of Fort Scott (Higginsville) Limestone at 850' in creek; just North of Center of South line of Sec. 33, T.25S., R.25E., Bourbon Co., Kansas.
- BB-48 = Base of Higginsville limestone with black, fissile shale, Little Osage, below; Center of west line of SW1/4, NE1/4, Sec. 33, T.25S., R.25E., Bourbon Co., Kansas.
- BB-49 = Top of Fort Scott (Higginsville) Limestone at @ 871' in road; near Center of East line of Sec. 34, T.25S., R.25E., Bourbon Co., Kansas.
- BB-146 = Top of Anna Shale/base of Pawnee (Myrick Station) Limestone at 938' in a new excavation North of the road; thin beds of limestone exposed at road intersection; just North of Center of South line of Sec. 3, T.26S., R.25E., Bourbon Co., Kansas.
- BB-147 = Eroded top of the Blackjack Creek limestone at 880' in creek bed South of road, base of Fort Scott (Blackjack Creek) Limestone estimated at 871'; near NE cor., Sec. 10, T.26S., R.25E., Bourbon Co., Kansas.
- BB-148 = Siltstone and mudrock of Lagonda in small creek just North of road; just North of Center of South line of Sec. 2, T.26S., R.25E., Bourbon Co., Kansas.
- BB-149 = Labette Shale in road; near Center of West line of NW1/4, SE1/4, Sec. 10, T.26S., R.25E., Bourbon Co., Kansas.

- BB-150 = Base of Fort Scott (Blackjack Creek) Limestone at 900' in exposure on West side of road; Section B-157; near Center of East line of SE1/4, NE1/4, Sec. 17, T.26S., R.15E., Bourbon Co., Kansas.
- BB-151 = Eroded top of Fort Scott (Higginsville) Limestone at 915' in road and field on West side of road near the middle of the section; near Center of East line of NE1/4, NE1/4, SE1/4, Sec. 17, T.26S., R.25E., Bourbon Co., Kansas.
- BB-152 = Upper Blackjack Creek limestone in road at intersection and lower Higginsville limestone exposed just West of road intersection; near SE Cor., Sec. 20, T.26S., R.15E., Bourbon Co., Kansas.
- BB-153 = Base of Fort Scott (Blackjack Creek) Limestone at @ 912' in road; just North of Center of East line of Sec. 20, T.26S., R.25E., Bourbon Co., Kansas.
- BB-154 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at @ 945' in road, Anna is well exposed; near Center of South line of Sec. 20, T.26S., R.25E., Bourbon Co., Kansas.
- BB-155 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 935' in road; dip slope of Pawnee from BB-154 to BB-155; near Center of South line of SE1/4, SW1/4, SW1/4, Sec. 20, T.26S., R.25E., Bourbon Co., Kansas.
- BB-156 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 933' in road; hand leveled to jct with U.S. Hwy 69; SW Cor., Sec. 20, T.26S., R.25E., Bourbon Co., Kansas.
- BB-157 = Base of Fort Scott (Blackjack Creek) Limestone at 930+' in road, Excello below; near Center of North line of NE1/4, NE1/4, Sec. 28, T.26S., R.25E., Bourbon Co., Kansas.
- BB-158 = Base of Fort Scott (Blackjack Creek) Limestone at 934' in road, Excello below; near Center of North line of NW1/4, NW1/4, NW1/4, Sec. 27, T.26S., R.25E., Bourbon Co., Kansas.
- BB-159 = Upto 15' of limestone in contact with sandstone, siltstone, mudrock interval below; contact between carbonate and siliciclastics is at 877', Fort Scott-Lagonda??; near Center of South line of SE1/4, Sec. 16, T.26S., R.25E., Bourbon Co., Kansas.
- BB-160 = Sandstone in road at 900'; near Center of South line of SW1/4, SW1/4, Sec. 16, T.26S., R.25E., Bourbon Co., Kansas.
- BB-161 = Exposure, in ascending order of: underclay, coal, black shale, carbonate concretions/nodules, in creek bed on East side of road; near Center of West line of SW1/4, Sec. 15, T.26S., R.25E., Bourbon Co., Kansas.
- BB-162 = Top of Verdigris Limestone at 832' in stream on West side of road, produces slight rapids in stream, possible East dip; just West of Center of Sec. 15, T.26S., R.25E., Bourbon Co., Kansas.

- BB-163 = Approximately 15' of sandstone (Englevale) in road just West of the SW cor. of Clarksburg Cemetery, underlain by @ 2 dm of black shale (Excello), @ 3.5 dm (1.0') of coal (Mulky), and then underclay; Breezy Hill limestone is absent here and sandstone cuts out all the Fort Scott Limestone; near SW Cor., Sec. 23, T.26S., R.25E., Bourbon Co., Kansas.
- BB-164 = Sandstone (Englevale) at 885' in road; near Center of East line of Sec. 14, T.26S., R.25E., Bourbon Co., Kansas.
- BB-173 = Fort Scott Limestone; estimated 6'0" of Blackjack Creek limestone, 5.6' of Little Osage Shale, and 6.0' of Higginsville limestone; base of Fort Scott (Blackjack Creek) Limestone at @ 920' in road; top of Fort Scott (Higginsville) Limestone eroded, but based on estimated thicknesses it is at, or above 937.5'; near Center of East line of SE1/4, NE1/4, Sec. 28, T.26S., R.25E., Bourbon Co., Kansas.
- BB-174 = Base of Fort Scott (Blackjack Creek) Limestone at 800'; top of Fort Scott (Higginsville) Limestone at @ 820'; Excello, Mulky Coal, and underclay in ditch on North side of road; just West of SE Cor., Sec. 21, T.25S., R.25E., Bourbon Co., Kansas.
- BB-175 = Top of Fort Scott (Higginsville) Limestone estimated at 815' to 820' across Marmaton River; according to Jewett, 1945, Sec. 73 and B-104, there is 23.0' of Fort Scott exposed here; near Center of South line of NE1/4, NW1/4, Sec. 21, T.25S., R.25E., Bourbon Co., Kansas.
- BB-176 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at @ 880'; near Center of West line of NW1/4, SE1/4, Sec. 28, T.25S., R.25E., Bourbon Co., Kansas.
- BB-177 = Base of Fort Scott (Blackjack Creek) Limestone at @ 800'; just East of Center of West line of Sec. 27, T.25S., R.25E., Bourbon Co., Kansas.
- BB-178 = Base of Fort Scott (Blackjack Creek) Limestone at 802'; just East of Center of South line of SE1/4, NW1/4, Sec. 27, T.25S., R.25E., Bourbon Co., Kansas.
- BB-179 = Top of Fort Scott (Higginsville) Limestone at 850'; near Center of West line of SW1/4, SE1/4, Sec. 27, T.25S., R.25E., Bourbon Co., Kansas.
- BB-180 = Base of Fort Scott (Blackjack Creek) Limestone at 825'; near Center of South line of SE1/4, SW1/4, Sec. 26, T.25S., R.25E., Bourbon Co., Kansas.
- BB-181 = Base of Fort Scott (Blackjack Creek) Limestone at 825'; near Center of South line of SW1/4, SE1/4, SW1/4, Sec. 26, T.25S., R.25E., Bourbon Co., Kansas.
- BB-182 = Sandstone (Englevale) in road ditch to the East and just North of the intersection near Center of South line of Sec. 26, T.25S., R.25E., Bourbon Co., Kansas.

- BB-183 = Estimated top of Fort Scott (Higginsville) Limestone at 845' to 850'; near Center of East line of SE1/4, SW1/4, Sec. 26, T.25S., R.15E., Bourbon Co., Kansas.
- BB-184 = Higginsville limestone exposed along North side of U. S. Hwy 54 just west of this site; top of Fort Scott (Higginsville) Limestone at 860'; near Center of South line, SE1/4, SE1/4, SE1/4, Sec. 26, T.25S., R.25E., Bourbon Co., Kansas.
- BB-185 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 945' in road ditch along South side of road; good section from Upper Labette Shale to Myrick Station limestone; near Center of North line of NW1/4, NE1/4, NW1/4, Sec. 1, T.26S., R.25E., Bourbon Co., Kansas.
- BB-186 = Top of Fort Scott (Higginsville) Limestone at 855'; roadcut along U. S. Hwy 54, near Center of South line of SE1/4, SW1/4, NW1/4, Sec. 26, T.25S., R.25E., Bourbon Co., Kansas.
- BB-187 = Base of Fort Scott (Blackjack Creek) Limestone at 816'; roadcut along U. S. Hwy 54, near Center of East line of Sec. 27, T.25S., R.25E., Bourbon Co., Kansas.
- BB-188 = Verdigris Limestone in Marmaton River at low water bridge; @ 1.1' thick, strikes N.57 degrees W.; dips S.-SW. at 4 degrees; top of Verdigris limestone at 760'; near Center of West line of Sec. 23, T.25S., R.25E., Bourbon Co., Kansas.
- BB-190 = Base of Fort Scott (Blackjack Creek) Limestone at 788' in roadcut along North side of road; just East of Center of Sec. 17, T.25S., R.25E., Bourbon Co., Kansas.
- BB-191 = Possibly Verdigris Limestone in Wolverine Creek; just West of Center of Sec. 17, T.25S., R.25E., Bourbon Co., Kansas.
- BB-192 = Top of Fort Scott (Higginsville) Limestone at 830'; near Center of East line of NE1/4, SE1/4, SE1/4, Sec. 18, T.25S., R.25E., Bourbon Co., Kansas.
- BB-193 = Top of Fort Scott (Higginsville) Limestone at 830'; base of Fort Scott (Blackjack Creek) Limestone at 795' based on 28.0' of Fort Scott reported by Jewett, 1945, Section 72; also checks with Bourbon County sections B-105, B-106, B-107, and B-201, and exposures in roadcut Southwest of BB-193; near Center of North line of NE1/4, NW1/4, Sec. 19, T.25S., R.25E., Bourbon Co., Kansas.
- BB-194 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 880' with Myrick Station limestone exposed on both sides of road; near Center of South line of Sec. 2, T.26S., R.24E., Bourbon Co., Kansas.
- BB-195 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 885', dip slope; near Center of South line of SW1/4, SW1/4, SW1/4, Sec. 1, T.26S., R.24E., Bourbon Co., Kansas.

BB-196 = Base of Fort Scott (Blackjack Creek) Limestone at 846' (excellent contact); top of Fort Scott (Higginsville) Limestone at 857'; 11.3' of Fort Scott Limestone; near Center of South line of SW1/4, SW1/4, Sec. 1, T.26S., R.24E., Bourbon Co., Kansas.

BB-197 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 954'; Myrick Station on slight rise North of road; exposed from bottom to top are: Childers School limestone; mudrock; very thin bed of platy, fossiliferous, black limestone; Anna shale; thin clayey mudrock; and Myrick Station limestone; measure and describe carefully; near Center of South line of SE1/4, SE1/4, SE1/4, Sec. 1, T.26S., R.24E., Bourbon Co., Kansas.

BB-198 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 932'; near Center of North line of NE1/4, Sec. 1, T.26S., R.24E., Bourbon Co., Kansas.

BB-235 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 972' in new road cut South of Fort Scott, Kansas on U. S. Hwy 69; Anna shale exposed in ditch; basal, dense, dark gray Myrick Station limestone, thin mudrock bed, upper Myrick Station limestone; near Center of East line of Sec. 18, T.26S., R.25E., Bourbon Co., Kansas.

NOTE: Elevation of 3' to 4' bed of calcareous sandstone in the Labette Shale just East of BB-235 drops 23' vertically in 300' horizontally in a southeasterly direction; top of this sandstone is at 966' and 300' SE the top is at 943' based on hand leveling; the base of the Anna shale is at 972' and 300' southeast it is at 949'.

BB-369 = Old quarry and road in Gunn Park at Fort Scott, Kansas; estimated base of Fort Scott (Blackjack Creek) Limestone at 835'; estimated top of Fort Scott (Higginsville) Limestone at 875'; near Center of South line of NE1/4, SW1/4, Sec. 36, T.25S., R.24E., Bourbon Co., Kansas.

BB-370 = Estimated top of Fort Scott (Higginsville) Limestone at 880'; near Center of South line of Sec. 1, T.26S., R.24E., Bourbon Co., Kansas.

BB-371 = Estimated base of Fort Scott (Blackjack Creek) Limestone at between 845' and 850'; near Center of South line of SW1/4, SE1/4, SW1/4, Sec. 1, T.26S., R.24E., Bourbon Co., Kansas.

BB-372 = Near top of Anna shale; based on weathered Myrick Station limestone with VERY black soil below weathered limestone; near Center of NW1/4, NE1/4, Sec. 18, T.26S., R.25E., Bourbon Co., Kansas.

BB-373 = Thin bedded, hard, brown limestone in road ditch on East side of road, a limestone in upper Labette Shale; well weathered Anna shale and Myrick Station limestone above Labette; near Center of West line of NW1/4, NW1/4, SE1/4, Sec. 18, T.26S., R.25E., Bourbon Co., Kansas.

BB-374 = Upper Pawnee (Laberdie) Limestone exposed in pond bank on West side of road, recognizable dip to the SW; near Center of East line of SE1/4, SW1/4, Sec. 18, T.26S., R.25E., Bourbon Co., Kansas.

- BB-375 = Top of Anna shale/base of Pawnee (Laberdie) Limestone at 885'; near Center of South line of NW1/4, SW1/4, SW1/4, Sec. 13, T.26S., R.24E., Bourbon Co., Kansas.
- BB-377 = Top of Anna shale/base of Pawnee (Laberdie) Limestone at 878' in curve on the North side of the road; sequence from below the brown limestone in the upper Labette Shale well into the Laberdie; near Center of SE1/4, SE1/4, Sec. 23, T.26S., R.24E., Bourbon Co., Kansas.
- BB-378 = Top of Fort Scott (Higginsville) Limestone at @ 912'; near Center of South line of SE1/4, SE1/4, Sec. 17, T.26S., R.25E., Bourbon Co., Kansas.
- BB-379 = Top of Fort Scott (Higginsville) Limestone at @ 912'; near Center of East line of NE1/4, SE1/4, Sec. 17, T.26S., R.25E., Bourbon Co., Kansas.
- BB-380 = Top of Fort Scott (Higginsville) Limestone at @ 912'; near Center of East line of NE1/4, NE1/4, Sec. 17, T.26S., R.25E., Bourbon Co., Kansas.
- L-937 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 860' in roadcut on U. S. Hwy 69; first outcrop North of L-768 on East side of U. S. Hwy 69; near Center of West line of NW1/4, SW1/4, NE1/4, Sec. 18, T.25S., R.25E., Bourbon Co., Kansas
- BB-422 = Top of Pawnee (Laberdie) Limestone at 825'; near Center of West line of Sec. 14, T.25S., R.24E., Bourbon Co., Kansas. PROBABLY FORT SCOTT, CHECK!!
- BB-428 = Base of Fort Scott (Blackjack Creek) Limestone at 809'; near Center of West line of SE1/4, NE1/4, NE1/4, Sec. 25, T.25S., R.24E., Bourbon Co., Kansas.
- L-768 = Top of Anna shale/base of Pawnee(Myrick Station) Limestone at 867'; roadcut on both sides of U. S. Hwy 69 just North of Fort Scott, Kansas; near Center of South line of SW1/4, SW1/4, SE1/4, Sec. 18, T.25S., R.25E., Bourbon Co., Kansas.
- L-338 = Same as B-105, B-106, B-107 (Jewett, 1945, Sec. 72), and B-201; B-107 and B-201 measured and described by Jewett in 1938 in the NE1/4, Sec. 19, T.25S., R.25E., Bourbon Co., Kansas; B-105 and B-106 were measured and described by Howe in 1948 near the Center of the SE1/4, NW1/4, Sec. 19, T.25S., R.25E., Bourbon Co., Kansas; the latter describe the sequence from the Mulky Coal through the Fort Scott through two coaly intervals in the Labette Shale; the Mulky Coal was mined by stripping and the Blakjack Creek was quarried for cement; total thickness of Fort Scott Limestone reported by Jewett was 27.9'; Howe reported 29'4".

- L-339 = Little Osage shale and Higginsville limestone exposed in old cement plant quarry at Fort Scott, Kansas; (reclaimed and inaccessible now); near Center of South line of NW1/4, NW1/4, SW1/4, Sec. 17, T.25S., R.25E., Bourbon Co., Kansas; same general area as L-338.
- B-141 = Upper Labette Shale through Anna shale into limestone of the lower Pawnee Limestone; near Center of South line of SW1/4, SE1/4, Sec. 12, T.26S., R.24E., Bourbon Co., Kansas; measured and described by Jewett in 1938, inaccessible now; Sec. 90 of Jewett, 1954, Sec. 90.
- B-149 = Upper Lagonda Fm. through underclay, Mulky Coal and Excello into the soil in roadcut at cross-roads; near Center of North line of Sec. 27, T.26S., R.25E., Bourbon Co., Kansas; measured and described by Howe in 1948, inaccessible now; Sec. 92 of Howe, 1956.
- B-150 = Upper part of underclay, probably Bevier Coal and overlying shale/mudrock in small private strip pit northwest of Garland, Kansas; near the SW Cor., NW1/4, SE1/4, Sec. 26, T.26S., R.25E., Bourbon Co., Kansas; measured and described by Howe in 1948, reclaimed area and inaccessible now.
- B-151 = Bevier Coal and overlying shale/mudrock with fossiliferous limestone concretions, in a small stripping operation along a stream, same as B-154; near Center of West line of NW1/4, Sec. 25, T.26S., R.25E., Bourbon Co., Kansas; measured and described by Howe in 1948; Sec. 95 of Howe, 1956; reclaimed area and inaccessible now.
- B-152 = Underclay, Bevier Coal and overlying sequence up to a claystone with a limonitic zone and weathered limestone, in creek and abandoned strip pit (same as B-153) in North half of NW1/4, Sec. 25, T.26S., R.25E., Bourbon Co., Kansas; same general area as B-151 and B-154; measured and described by Howe in 1948; Sec. 94 of Howe, 1956; reclaimed area and inaccessible now.
- B-155 = Strip pit of Bevier Coal as reported by Schowe and A.D. in an old, undated, section; this study indicates that this is the Croweburg Coal with @ 11' of black shale/mudrock between top of coal and base of dark gray, dense, fossiliferous, jointed limestone that weathers a reddish brown, the Verdigris; in NE1/4, NW1/4, Sec. 22, T.26S., R.25E., Bourbon Co., Kansas.
- B-156 = Crossbedded sandstone and sandy shale/mudrock with irregular contact in the Lagonda Fm. just South of railroad tracks in road cut on East side of road, just South of Center of west line of NW1/4, Sec. 21, T.26S., R.25E., Bourbon Co., Kansas; measured and described by Schowe in 1937??
- B-157 = Mulky Coal, Excello shale and Blackjack Creek limestone in roadcut on West side of road @ 1 mile East of Drive-In Theatre on U. S. Hwy 69; about 0.15 mile North of SE Cor., NE1/4, Sec. 17, T.26S., R.25E., Bourbon Co., Kansas; measured and described by Schowe and A.D. in 1956; our studies puts the base of Fort Scott (Blackjack Creek) Limestone at 900'.

B-158 = Pawnee Limestone from upper 1.1' of Myrick Station limestone through thin (0.3') of Mine Creek shale and 14+' of Laberdie limestone in quarry across the road from the Country Club in Fort Scott, Kansas; just South of Center of West line of SE1/4, Sec. 6, T.26S., R.25E., Bourbon Co., Kansas; measured and described by Jewett, probably in 1938; Sec. 91 of Jewett, 1945; now filled with water.

Sec.74 of Jewett, 1945 = underclay, Mulky Coal, Excello shale, and 13.5' of Fort Scott Limestone with only @ 2.0' of Higginsville limestone exposed; measured and described by R. C. Moore in area of old strip pit; near Center of NW1/4, NW1/4, Sec. 26, T. 25S., R.25E., Bourbon Co., Kansas; inaccessible now.

#### Estimated Thicknesses of Mapped Intervals in Fort Scott Quad.

Bandera Sh. = <10'

Pawnee Ls. = 15' to 50+'

Labette Sh. = 10' to 75' (Note: Englevale Sandstone appears to cut out the Fort Scott Limestone at BB-163)

Fort Scott Ls = 10' to 40'

post-Verdigris Ls. = 60' to 95'

Verdigris Limestone = up to 3.0'

pre-Verdigris Ls. = 5' or less

## GARLAND 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.

BB-142 = Siltstone and mudrock exposed in stream bank at 790' just above water level in East bank of Buck Run with soil above; near Center of South line, SW1/4, SE1/4, Sec. 12, T.27S., R.25E., Bourbon Co., Kansas; Sawin Site #1.

BB-143 = Top of limestone above Mineral Coal at 815'; @ 2 dm of Verdigris limestone (upper bed is @ 1.5 dm, lower bed is @ 0.5 dm with clayey parting between); sharp contact with underclay and coaly streak below, measure and describe; 0.6 mile North of SW Cor. Sec. 30, T.34N., R.33W., Vernon Co., Missouri; Sawin Site #2.

BB-144 = Top of limestone above Mineral Coal at 812' in road ditch on west side of road with black shale below; SE Cor, NE1/4, Sec. 24, T.27S., R.25E., Bourbon Co., Kansas; Sawin Site #3.

BB-145 = Sequence containing Fleming Coal, sampled 1.5 cm of calcareous bed above coal, elevation at the top of this calcareous bed is 830'; good exposure, measure and describe; 0.15 mile East of NW Cor., Sec. 30, T.34N., R.33W., Vernon Co., Missouri; Sawin Site #4.

BB-168 = Base of Fort Scott (Blackjack Creek) Limestone at 900' in road North of Garland, Kansas; Excello below; just South of the Center of East line, Sec. 36, T.26S., R.25E., Bourbon Co., Kansas.

BB-169 = Top of Verdigris Limestone at 830' in road South of Garland, Kansas; Center of East line SE1/4, SE1/4, NE1/4, sec. 1, T.27S., R.25E., Bourbon Co., Kansas.

BB-170 = Top of Verdigris Limestone at 830' in road; Center of East line of SE1/4, NE1/4, SE1/4, Sec. 1, T.27S., R.25E., Bourbon Co., Kansas.

BB-171 = Top of Verdigris Limestone at 830' in road; near SE Cor., Sec. 1, T.27S., R.25E., Bourbon Co., Kansas.

Estimated Thicknesses of Mapped Intervals in Garland Quad.

Fort Scott Ls. (Blackjack Creek ls.) =  $\pm 5'$

post-Verdigris Ls. =  $\pm 70'$

Verdigris Limestone = up to  $3.0'$

pre-Verdigris Ls. =  $\pm 15'$

## HAMMOND 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.

BB-189 = Base of Fort Scott (Blackjack Creek) Limestone at @ 870', but poor exposure; Excello shale below; near NE Cor., Sec. 15, T.25S., R.25E., Bourbon Co., Kansas.

BB-199 = Area of three quarries in Pawnee Limestone; quarry Southwest of intersection appears to have best exposures, others overgrown by vegetation, limestone beds with channels of coarse calcarenites; beds appear to dip between 5 and 10 degrees to the East; about 1.0' of black shale/mudrock (Mine Creek) in floor of quarry; quarries are NW, SW, and SE of NE Cor., Sec. 18, T.25S., R.25E., Bourbon Co., Kansas; originally interpreted as Fort Scott Limestone.

BB-200 = Top of Pawnee (Laberdie) Limestone at 845'; suggests about 42' of Pawnee at this site; strong possibility of structure, possibly a fault or flexure; originally interpreted as Fort Scott Limestone; near Center of North line of NE1/4, Sec. 18, T.25S., R.25E., Bourbon Co., Kansas.

NOTE: Road between BB-199 and BB-201 down to Wolverine Creek is close to the dip slope of the eroded top of the Pawnee Limestone. There is a slight West (regional) dip of Laberdie limestone on the East side of Wolverine Creek, with a steeper, East dip on the West side of the creek; dip reversal appears to occur along the stream.

BB-201 = Top of Pawnee (Laberdie) Limestone at 800'; possibly Myrick Station limestone exposed in creek; near Center of North line of NW1/4, NW1/4, Sec. 17, T.25S., R.25E., Bourbon Co., Kansas; originally interpreted as Higginsville limestone.

BB-202 = Base of Fort Scott (Blackjack Creek) Limestone at 794' in road; just East of Center of North line of NE1/4, NW1/4, Sec. 17, T.25S., R.25E., Bourbon Co., Kansas.

BB-203 = Top of Fort Scott (Higginsville) Limestone at @ 849'; badly weathered exposure in road ditch on both sides of road; near Center of North line of NW1/4, NE1/4, NE1/4, Sec. 17, T.25S., R.25E., Bourbon Co., Kansas.

BB-204 = Top of Fort Scott (Higginsville) Limestone at 845' in road; base of Fort Scott (Blackjack Creek) Limestone at 813' in creek bed on the North side of road; near Center of South line of SW1/4, SW1/4, SE1/4, Sec. 9, T.25S., R.25E., Bourbon Co., Kansas.

NOTE: The Higginsville limestone here contains limestone beds that are thin, hard, dense, less fossiliferous than "typical" Higginsville; top of Little Osage shale is exposed in the road; and the base of the Blackjack Creek is in the creek bed.

BB-204A = Exposure just West of BB-204; top of Fort Scott (Higginsville) Limestone is close to 840'; near Center of South line of SW1/4, Sec. 9, T.25S., R.25E., Bourbon Co., Kansas.

BB-205 = Top of thin bedded sandstone in the Labette Shale at 875' on the South side of road; possibly Englevale Sandstone; just East of Center of North line of NE1/4, NW1/4, NE1/4, Sec. 16, T.25S., R.25E., Bourbon Co., Kansas.

BB-206 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 900'; just East of Center of North line of NE1/4, Sec. 16, T.25S., R.25E., Bourbon Co., Kansas.

BB-207 = Eroded top of Fort Scott (Higginsville) Limestone at 870'; base of Fort Scott (Blackjack Creek) Limestone at 850', good point; near Center of North line of NE1/4, Sec. 15, T.25S., R.25E., Bourbon Co., Kansas.

BB-207A = Exposure just West of BB-207 going up hill; top of Fort Scott (Higginsville) Limestone at 870' + 3 or 4 feet; good exposure of Higginsville in road ditch on North side of road going up hill from stream valley; near Center South line of SW1/4, SE1/4, Sec. 10, T.25S., R.25E., Bourbon Co., Kansas.

BB-207B = Exposure just West of BB-207A near the top of the hill, top of Anna shale/base of Pawnee (Myrick Station) Limestone at 908' in road ditch on North side of road; near Center of South line of Sec. 10, T.25S., R.25E., Bourbon Co., Kansas.

BB-207C = Exposure just West of BB-207B and just East of junction with road going North, sandstone in the Labette Shale in road ditch on North side of road; near Center of South line of SW1/4, SW1/4, SW1/4, Sec. 10, T.25S., R.25E., Bourbon Co., Kansas.

BB-207D = Exposure just West of BB-207C going up hill; top of Anna shale/base of Pawnee (Myrick Station) Limestone at 900' in road ditch on North side of road; just East of Center of South line of SE1/4, SE1/4, Sec. 9, T.25S., R.25E., Bourbon Co., Kansas.

BB-208 = Base of Fort Scott (Blackjack Creek) Limestone at 850'; coal stripped here was Mulky; Center of South line of SW1/4, SE1/4, Sec. 11, T.25S., R.25E., Bourbon Co., Kansas.

- BB-209 = Quarry in Higginsville limestone; top of Fort Scott (Higginsville) Limestone at 865' in quarry face; 15' of limestone; at Hammond/Richards Quad. boundary just North of Center of South line of SE1/4, Sec. 11, T.25S., R.25E., Bourbon Co., Kansas; 15'
- BB-215 = Base of Fort Scott (Backjack Creek) Limestone at 810' in road; Blackjack Creek, Little Osage, and lower 3.0' of Higginsville exposed; near Center of South line of SW1/4, SW1/4, Sec. 34, T.23S., R.25E., Bourbon Co., Kansas.
- BB-217 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 870' in road cut; near Center of West line of NW1/4, NW1/4, NW1/4, Sec. 5, T.24S., R.25E., Bourbon Co., Kansas.
- BB-218 = Gray mudrock and brownish sandy bed (Labette) in creek bank on East side of road; near center of West line of Sec. 5, T.24S., R.25E., Bourbon Co., Kansas.
- BB-219 = Thin Myrick Station limestone (about 2.0') in road ditch on West side of road; near Center of East line of NE1/4, NE1/4, NE1/4, Sec. 7, T.24S., R.25E., Bourbon Co., Kansas.
- BB-220 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 830' in road ditch on West side of road; just North of Center of West line of SE1/4, NE1/4, NE1/4, Sec. 7, T.24S., R.25E., Bourbon Co., Kansas.
- L-914 = Top of Pawnee (Laberdie) Limestone at 855' on U. S. Hwy 69 at Bridge No. 15.23; see KDOT profile; Mine Creek shale @ 4.0' thick; Pawnee Limestone best exposed on East side of U. S. Hwy 69 measure and describe carefully; near Center of North line of Sec. 17, T.25S., R.25E., Bourbon Co., Kansas; originally interpreted as Higginsville;
- BB-221 = Site 0.5 miles North of L-914 on U. S. Hwy 69; Anna shale in ditch on East side of road, mostly Myrick Station limestone; basal beds of Myrick Station are dense, dark gray, weathering reddish brown limestone; top of Anna shale/base of Pawnee (Myrick Station) Limestone at 825' to 830' based on KDOT data; top of Pawnee (Laberdie) Limestone at 845' to 850'; just North of Center of NW1/4, NW1/4, SE1/4, Sec. 6, T.25S., R.25E., Bourbon Co., Kansas.
- BB-222 = Site 0.7 miles North of BB-221 on U. S. Hwy 69, with Laberdie limestone and Mine Creek shale like at L-914; Mine Creek shale is 3.0' thick here; top of Anna shale/base of Pawnee (Myrick Station) Limestone at 825' to 830' based on KDOT data; just North and East of Center of NW1/4, SW1/4, SE1/4, Sec. 3, T.25S., R.25E., Bourbon Co., Kansas; originally interpreted as Higginsville and Little Osage.
- BB-223 = Road cut on U. S. Hwy 69 at Bridge No. 18.26; 3.0' of Worland limestone overlain by Nowata Shale and underlain by Bandera Shale; apparent dip of Worland limestone is 3 degrees NW; base of Altamont (Worland only at this site) Limestone is at 916' based on KDOT profile; near Center of South line of SW1/4, SE1/4, SW1/4, Sec. 19, T.24S., R.25E., Bourbon Co., Kansas.

- BB-224 = Possible Nowata Shale on Bandera Shale, Altamont Limestone missing; 0.75 mile North of BB-223 on U. S. Hwy 69; just West of Center of South line of SW1/4, NE1/4, NW1/4, Sec. 19, T.24S., R.25E., Bourbon Co., Kansas.
- BB-225 = Bridge No. 21.32 on U. S. Hwy 69; near Center of South line of Sec. 6, T.24S., R.25E., Bourbon Co., Kansas.
- BB-227 = Top of Pawnee (Laberdie) Limestone at 835'; just West of Center of North line of NW1/4, NW1/4, NE1/4, Sec. 18, T.24S., R.25E., Bourbon Co., Kansas.
- BB-228 = Small, old quarry North of road, @ 8.0' of limestone, base not seen; top of Pawnee (Laberdie) Limestone at 835', KDOT top at 832'; near Center of North line of Sec. 18, T.24S., R.25E., Bourbon Co., Kansas.
- BB-229 = Base of Altamont Limestone, probably Worland, at 900'; B-97 and B-101; near Center of Sec. 11, T.25S., R.24E., Bourbon Co., Kansas.
- BB-230 = Top of Pawnee (Laberdie) Limestone at 850+' at corner; this is the site of B-101 (B-97 is nearby but no longer accessible), upper Labette Shale, Anna shale, and Myrick Station limestone are exposed; just West of Center of East line of Sec. 11, T.25S., R.24E., Bourbon Co., Kansas.
- BB-231 = Base of Altamont (a nodular limestone) Limestone at 895'; near Center of Sec. 2, T.25S., R.24E., Bourbon Co., Kansas.
- BB-232 = Possibly Walter Johnson Sandstone in the Nowata Shale in road at 915'; near Center of South line of SW1/4, SW1/4, NW1/4, Sec. 2, T.25S., R.24E., Bourbon Co., Kansas.
- BB-284 = Labette Shale in road ditch on North side of road; near Center of South line of SE1/4, SW1/4, SW1/4, Sec. 5, T.25S., R.25E., Bourbon Co., Kansas.
- BB-285 = Base of Fort Scott (Blackjack Creek) Limestone at 830' in field road; near Center of South line of SE1/4, SW1/4, Sec. 2, T.25S., R.25E., Bourbon Co., Kansas.
- BB-286 = Top of Fort Scott (Higginsville) Limestone at @ 855' in road; just South of Center of West line of NW1/4, NW1/4, Sec. 11, T.25S., R.25E., Bourbon Co., Kansas.
- BB-293 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 840' with 25' of Labette Shale exposed below Anna shale; near Center of South line of SW1/4, SE1/4, SE1/4, Sec. 33, T.23S., R.25E., Bourbon Co., Kansas.
- BB-294 = Possible top of Fort Scott (Higginsville) Limestone at 830' in road; about 6.0' of thin, wavy bedded, hard, dense, light gray algal limestone (Higginsville) exposed in field West of road; near Center of West line of SW1/4, SW1/4, Sec. 34, T.23S., R.25E., Bourbon Co., Kansas.

- BB-295 = Sandstones, siltstones, and mudrocks of the Labette Shale exposed in road ditches along roads West and North of West Liberty Church; @ 0.2 mile North and @ 1.0 mile West of SE Cor., Sec. 3, T.24S., R.25E., Bourbon Co., Kansas.
- BB-296 = Top of Fort Scott (Higginsville) Limestone at 840' in field drainage East of the road, good point; just South of Center of West line of NW1/4, SW1/4, Sec. 2, T.24S., R.25E., Bourbon Co., Kansas.
- BB-297 = Area of old strip pits with blocks of Higginsville and Blackjack Creek limestones and Little Osage shale, probably mined the Summit Coal based on the drainage because just North along the East side of the road is an outcrop of Higginsville limestone like that at BB-294; Center of West line of NW1/4, Sec. 2, T.24S., R.25E., Bourbon Co., Kansas.
- BB-298 = Top of Fort Scott (Higginsville) Limestone at @ 832'; near Center of South line of SW1/4, SE1/4, SE1/4, Sec. 34, T.23S., R.25E., Bourbon Co., Kansas.
- BB-299 = Probable top of Fort Scott (Higginsville) Limestone at 835' in road and in field West of the road; Center of East line of SE1/4, SE1/4, NE1/4, Sec. 3, T.24S., R.25E., Bourbon Co., Kansas.
- BB-300 = Top of Fort Scott (Higginsville) Limestone at 850' in road and in field South of the road; near Center of North line of NW1/4, NE1/4, Sec. 11, T.24S., R.25E., Bourbon Co., Kansas.
- BB-303 = Base of Fort Scott (Blackjack Creek) Limestone at 810' in road; possible top of Fort Scott (Higginsville) Limestone at 830' just West of BB-303, but not exposed; Labette Shale exposed near top of the hill; near Center of North line of NW1/4, NE1/4, NE1/4, Sec. 9, T.24S., R.25E., Bourbon Co., Kansas.
- BB-304 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 870' in road with black, fossiliferous limestone of the upper Labette just East of Myrick Station limestone in road; North 1.0 mile the top of Anna shale/base of Pawnee (Myrick Station) Limestone is at 840'; 30' of North dip per mile; just East of Center of North line of Sec. 9, T.24S., R.25E., Bourbon Co., Kansas.
- BB-305 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 869' in road; Myrick Station limestone, thin, @ 1.0' of Anna shale, and Labette Shale with thin, black, fossiliferous limestone and sandstone exposed in road; just East of Center of North line of NW1/4, NW1/4, Sec. 9, T.24S., R.25E., Bourbon Co., Kansas.
- BB-307 = Top of Fort Scott (Higginsville) Limestone at @ 869' in road; poorly exposed; near Center of South line of SE1/4, SW1/4, SW1/4, Sec. 11, T.24S., R.25E., Bourbon Co., Kansas.
- BB-308 = Base of Fort Scott (Blackjack Creek) Limestone at 845' in road; near Center of South line of SW1/4, SE1/4, Sec. 10, T.24S., R.25E., Bourbon Co., Kansas.

- BB-309 = Thin, (5 cm), dark gray, dense limestone in creek bed with Lagonda Formation type mudrock below, possibly the Breezy hill limestone; near Center of South line of Sec. 10, T.24S., R.25E., Bourbon Co., Kansas.
- BB-310 = Base of Fort Scott (Blackjack Creek) Limestone at @ 847' in road with Excello shale in road ditch on North side of road; near Center of South line of SE1/4, SE1/4, SW1/4, Sec. 10, T.24S., R.25E., Bourbon Co., Kansas.
- BB-311 = Top of Fort Scott (Higginsville) Limestone at @ 870' in road and in field South of road; near Center of South line of SW1/4, Sec. 10, T.24S., R.25E., Bourbon Co., Kansas.
- BB-312 = Sandstone and thin limestone in Labette Shale at 670' in road; near Center of South line of SE1/4, SE1/4, Sec. 9, T.24S., R.25E., Bourbon Co., Kansas.
- BB-313 = Anna shale in road ditch on South side of road, estimated top of Anna shale/base of Pawnee (Myrick Station) Limestone at 870', which is less than exact; near Center of North line of NW1/4, NW1/4, Sec. 16, T.24S., R.25E., Bourbon Co., Kansas.
- BB-314 = Higginsville ;limestone exposed on both sides of road, upper part of Little Osage shale exposed in ditch on East side of road; a bit farther North of this site (BB-314) is the Blackjack Creek limestone, Excello shale, a black, fossiliferous limestone (probably the Breezy Hill) and a silty mudrock; estimated base of the Fort Scott (Blackjack Creek) Limestone at 835'; Center of East line of NE1/4, SE1/4, Sec. 9, T.24S., R.25E., Bourbon Co., Kansas.

Sequence as measured by Bob Sawin as follows:

Top covered  
 Higginsville limestone - 3.0' exposed  
 Little Osage shale - @ 3.0' covered  
 Blackjack Creek limestone - 3.7'  
 Excello shale (black) - 2.0'  
 Black limestone (Breezy Hill) - 0.4'  
 Silty mudrock (Lagonda) - 7.7'

- BB-315 = Higginsville limestone exposed in road ditch on East side of road 0.1 mile South of the NW cor. of the West Liberty Cemetery; estimated top of Fort Scott (Higginsville) Limestone at 830'; estimated base of Fort Scott (Blackjack Creek) Limestone 0.13 mile South of above point at 810'; near Center of West line of NW1/4, NW1/4, Sec. 10, T.24S., R.25E., Bourbon Co., Kansas.
- BB-316 = Possible top of Anna shale/base of Pawnee (Myrick Station) Limestone at 900' in road and ditch; near Center of South line of Sec. 14, T.24S., R.25E., Bourbon Co., Kansas.

- BB-328 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 845' with Anna shale and Myrick Station limestone in road ditch on South side of road; good point; near Center of North line of Sec. 2, T.25S., R.25E., Bourbon Co., Kansas.
- BB-329 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 840' in road; near Center of West line of Sec. 35, T.24S., R.25E., Bourbon Co., Kansas.
- BB-330 = Large (3' to 4') partially silicified septarian concretions in Labette Shale 200' West of road in field drainage; just West of Center of East line of SE1/4, SE1/4, Sec. 22, T.24S., R.25E., Bourbon Co., Kansas.
- BB-331 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 885' in road; just South of Center of West line of SE1/4, SE1/4, NE1/4, Sec. 22, T.24S., R.25E., Bourbon Co., Kansas.
- BB-332 = Estimated top of Blackjack Creek limestone in creek bank on East side of road at 855'; near Center of West line of SW1/4, NW1/4, Sec. 14, T.24S., R.25E., Bourbon Co., Kansas.
- BB-333 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at @ 850' in road on "down side" of fault or flexure?; near Center of North line of NE1/4, NW1/4, NW1/4, Sec. 35, T.24S., R.25E., Bourbon Co., Kansas.
- BB-334 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 855' in road; near Center of North line of NE1/4, NE1/4, NW1/4, Sec. 35, T.24S., R.25E., Bourbon Co., Kansas.
- BB-336 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 870' (@ 5.65' below top of hill) in road cut on West side of U. S. Hwy 69 0.4 mile North of intersection of U. S. Hwy 69 and road to Fulton, Kansas; near Center of East line of NE1/4, NE1/4, SW1/4, Sec. 31, T.23S., R.25E., Bourbon Co., Kansas; revisit in winter measure and describe sequence; see generalized measured section in field notes, p. 40.
- BB-382 = Base of Fort Scott (Blackjack Creek) Limestone at 860'; good point; black shale below is Excello; near Center of North line of NW1/4, NW1/4, Sec. 14, T.25S., R.25E., Bourbon Co., Kansas.
- BB-383 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 878'; near Center of West line of Sec. 9, T.25S., R.25E., Bourbon Co., Kansas.
- BB-384 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 865'; near Center of West line of NW1/4, Sec. 9, T.25S., R.25E., Bourbon Co., Kansas.
- BB-385 = Pawnee Limestone in field to the NE; terrain typical of Pawnee Lines tone; NW Cor., Sec. 9, T.25S., R.25E., Bourbon Co., Kansas.

- BB-386 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 830' in road; top of Myrick Station limestone at 845' in road ditch; about 1.0' of Mine Creek shale (black) in road ditch on South side of road; along North side of NW1/4, NE1/4, NE1/4, Sec. 7, T.25S., R.25E., Bourbon Co., Kansas.
- BB-387 = Exposure of Pawnee Limestone in creek on East side of road; eroded top of Laberdie through Mine Creek into upper Myrick Station; Mine Creek shale is black, platy mudrock that thins from @ 2.0' to less than 0.5' in 50' laterally; structurally complex area, tight folds/flexure or fault?; Center of West line of NW1/4, NW1/4, Sec. 17, T.25S., R.25E., Bourbon Co., Kansas.
- BB-388 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 850' in railroad ditch on North side of road on the West side of the tracks; just West of Center of North line of Sec. 8, T. 25S., R.25E., Bourbon Co., Kansas.
- BB-389 = Approximately 5.0' of sandstone in the Labette Shale exposed on the West side of creek bank just South of road; near NE Cor., Sec. 7, T.25S., R.25E., Bourbon Co., Kansas.
- BB-390 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 900'; good point; near Center of East line of SE1/4, SE1/4, SE1/4, Sec. 9, T.25S., R.25E., Bourbon Co., Kansas.
- BB-391 = Eroded top of Fort Scott (Higginsville) Limestone at @ 815'; near Center of North line of NE1/4, NW1/4, NE1/4, Sec. 34, T.24S., R.25E., Bourbon Co., Kansas.
- BB-392 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 820'; good point; Myrick Station limestone 6.0' thick with **typical chaetetids**, collected specimen; Center of North line of NW1/4, NW1/4, Sec. 34, T.24S., R.25E., Bourbon Co., Kansas.
- BB-393 = Black shale in pond bank on South side of road, probably Anna shale; near Center of North line of NE1/4, NE1/4, NE1/4, Sec. 4, T.25S., R.25E., Bourbon Co., Kansas.
- BB-394 = Terrain has a Bandera "look"; Center of West line of SW1/4, SW1/4, Sec. 34, T.24S., R.25E., Bourbon Co., Kansas.
- BB-395 = Thin bed of brown limestone with cone-in-cone in upper Labette Shale in road ditch; just West of Center of NE1/4, Sec. 22, T.24S., R.25E., Bourbon Co., Kansas.
- BB-396 = Top of Fort Scott (Higginsville) Limestone at 867' in road ditch on West side of road 100' North of the midpoint of section line; near Center of East line of SE1/4, SE1/4, NE1/4, Sec. 15, T.24S., R.25E., Bourbon Co., Kansas.
- BB-397 = Laberdie limestone "in place" on East side of road; Center of West line of SW1/4, SW1/4, Sec. 20, T.24S., R.25E., Bourbon Co., Kansas.

- BB-398 = Base of Fort Scott (Blackjack Creek) Limestone at 825' in road ditch on South side of road where Lagonda, Breezy Hill limestone, and Excello shale are exposed below; Mulky coal not noted; near Center of North line of NW1/4, sec. 2, T.24S., R.25E., Bourbon Co., Kansas.
- BB-399 = Base of Fort Scott (Blackjack Creek) Limestone at 812' in road ditch on South side of road; near BB-298; near Center of North line of NE1/4, NE1/4, NE1/4, Sec. 3, T.24S., R.25E., Bourbon Co., Kansas.
- BB-400 = Top of Blackjack Creek limestone at @ 810' in road ditch on East side of road; going South (up hill) poorly exposed Higginsville limestone and better exposed Labette Shale are encountered; near Center of West line of NW1/4, NW1/4, SW1/4, Sec. 4, T.24S., R.25E., Bourbon Co., Kansas.
- BB-401 = Top of Pawnee (Laberdie) Limestone at 890' in bank of road ditch on West side of road; just North of Center of Sec. 6, T.24S., R.25E., Bourbon Co., Kansas.
- BB-402 = Top of Pawnee (Laberdie) Limestone at 860' in field on both sides of road; just east of Center of South line of SW1/4, Sec. 1, T.25S., R.24E., Bourbon Co., Kansas.
- BB-403 = Top of Pawnee (Laberdie) Limestone at 860' in field on both sides of road; no rocks seen, but changes in terrain and Bandera-type roads supports a Pawnee top; just South of Center of West line of NW1/4, SW1/4, Sec. 1, T.25S., R.24E., Bourbon Co., Kansas.
- BB-404 = Thin bedded sandstone in Bandera Shale in creek on East side of road; Center of west line of NW1/4, NW1/4, Sec. 1, T.25S., R.24E., Bourbon Co., Kansas.
- BB-405 = Reasonable base of Altamont Limestone between 905' and 910'; most of road and terrain has the Bandera "look"; near Center of North line of NE1/4, NW1/4, Sec. 1, T.25S., R.24E., Bourbon Co., Kansas.
- BB-406 = Reasonable base of Altamont Limestone between 905' and 910'; most of road and terrain has the Bandera "look"; just West of Center of South line of SE1/4, SW1/4, SE1/4, Sec. 25, T.24S., R.24E., Bourbon Co., Kansas.
- BB-407 = Top of limestone, probably Worland at 920' in road; just West of Center of South line of SW1/4, SE1/4, SW1/4, Sec. 25, T.24S., R.24E., Bourbon Co., Kansas.
- BB-409 = Top of Altamont (Worland) Limestone at 920' in road and road ditch of North-South? road; limestone less pedogenetic here than at BB-408; near Center of South line of SW1/4, SE1/4, SW1/4, Sec. 21, T.24S., R.24E., Bourbon Co., Kansas. CHECK, A NORTH-SOUTH ROAD DOESN'T HIT WITH LOCALITY PLOT.
- BB-410 = Altamont, probably Worland, Limestone in pond bank on East side of road; appears to be 2' to 3' of limestone above water level of pond; along East line of SW1/4, NW1/4, SW1/4, Sec. 19, T.24S., R.25E., Bourbon Co., Kansas.

- BB-411 = Top of Altamont (Worland) Limestone at @ 900'; about 2.0' of limestone exposed on both sides of road with sandstone float, probably from the Nowata, above; near Center of West line of NW1/4, NW1/4, Sec. 19, T.24S., R.25E., Bourbon Co., Kansas.
- BB-412 = Old highway borrow pit on west side of old U. S. Hwy 69 with @ 2.0' of Worland-like limestone exposed, below limestone is a gray green to yellow brown mudrock with phosphate nodules; mapped top of Altamont at @ 900' and base at 893+'; near Center of East line of NE1/4, SE1/4, NE1/4, Sec. 132, T.24S., R.24E., Bourbon Co., Kansas.
- BB-413 = Top of Pawnee (Laberdie) Limestone at @ 826' in field (old quarry) and road ditch on East side of road; just South of Center of West line of SW1/4, SW1/4, NW1/4, Sec. 1, T.24S., R.24E., Bourbon Co., Kansas.
- BB-414 = Top of Pawnee (Laberdie) Limestone at @ 835'; Center of North line of NW1/4, NW1/4, Sec. 1, T.24S., R.24E., Bourbon Co., Kansas.
- BB-415 = Thin, 2' to 3', Altamont Limestone; top at 880', base at 875'; Center of West line of SW1/4, NW1/4, Sec. 12, T.24S., R.24E., Bourbon Co., Kansas.
- BB-416 = Top of Altamont Limestone at 885', base at 880'; like at BB-415; Center of West line of SW1/4, NW1/4, SW1/4, Sec. 12, T.24S., R.24E., Bourbon Co., Kansas.
- BB-417 = Base of Altamont Limestone at 880'; possibly 6.0' thick here, thus top at 886'; above is a sandstone followed by a thin (0.5') fossiliferous limestone; measure and describe; near Center of West line of SW1/4, SW1/4, SW1/4, Sec. 12, T.24S., R.24E., Bourbon Co., Kansas.
- BB-418 = Estimated top of Altamont (2' to 3' of Worland) Limestone at 915' in road ditch on both sides of road; just North of SW Cor., Sec. 23, T.24S., R.24E., Bourbon Co., Kansas.
- BB-419 = Top of Altamont (Worland like) Limestone at 889'; both sides of road in Center of NE1/4, NW1/4, Sec. 11, T.24S., R.24E., Bourbon Co., Kansas.
- BB-420 = Top of Pawnee (Laberdie) Limestone at 836' in road ditch on South side of road; near Center of North line of NW1/4, NE1/4, NW1/4, Sec. 2, T.24S., R.24E., Bourbon Co., Kansas.
- BB-421 = Top Anna shale/base of Pawnee (Myrick Station) Limestone at 810' in creek bed on South side of road; exposed Myrick Station is probably the interval below the chaetetid-bearing beds; estimated thickness of Pawnee Limestone in this area as 16+'; just East of Center of North line of NE1/4, Sec. 2, T.24S., R.24E., Bourbon Co., Kansas.
- B-38 = Characteristic exposure of basal part of Pawnee, brown weathered limestone with some black shale below; Center of South line of Sec. 35, T.24S., R.24E., Bourbon Co., Kansas; described by Jewett in 1939, we found no exposure at this site in 1997.

B-44 = Pawnee Limestone, @ 20' with black shale below; near Center of West line of Sec. 11, T.24S., R.25E., Bourbon Co., Kansas; measured and described by Jewett in 1939, we found no exposure at this site in 1997.

B-200 = Upper part, over 80', of Labette Shale to near the base of the Pawnee Limestone; Sec. 32, T.23S., R.25E., Bourbon Co., Kansas; not seen, but based on our mapping the Labette Shale occurs along the South line of this section and probably could be uncovered in road ditch at this location; measured and described by Jewett in 1939. Outside chance, based on lack of exact location of this site by Jewett that it is in the North half of Sec. 23 in the Prescott Quad.

#### Estimated Thicknesses of Mapped Intervals in Hammond Quad.

Nowata Sh. = 25' to 50'+

Altamont Ls. = 0 to 10'+ (Altamont absent at BB-224, Nowata on Bandera)

Bandera Sh. = 50' to 65'

Pawnee Ls. = 20' to 50'

Labette Sh. = 20' to 60'

Fort Scott Ls. = 10' to 35'

post-Verdigris Ls. = up to 40'

Verdigris Ls. = up to 3'

## HIATTVILLE 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.

BB-55 = Top of Anna shale at 950'; Sawin Site #3, Bennison measured 75' of Labette Shale here; Center of East line of SE1/4, SE1/4, Sec. 32, T.27S., R.24E., Crawford Co., Kansas.

BB-56 = Top of Fort Scott (Higginsville) Limestone at 880'; in bed of West Branch of Dry Wood Creek just West of Center of North line of SW1/4, SW1/4, Sec. 33, T.27S., R.24E., Crawford Co., Kansas.

BB-57 = Top of Anna shale at 950'; Sawin Site #21; in road just South of Center of East line of NE1/4, NE1/4, Sec. 32, T.27S., R.24E., Crawford Co., Kansas.

BB-58 = Earthy limestone below Anna shale associated with coaly smut; near Center of North line of NE1/4, NW1/4, NE1/4, Sec. 33, T.27S., R.24E., Crawford Co., Kansas.

BB-59 = Englevale Sandstone in creek, sandstone appears to strike North-South with a NW dip suggesting a plunging anticline or an isoclinal fold??; near Center of East line of SE1/4, Sec. 28, T.27S., R.24E., Crawford Co., Kansas.

BB-60 = Base of Fort Scott Limestone (Blackjack Creek) at 885'; base of Higginsville limestone at 900'; Sawin Site #1; just West of Center of South line SE1/4, SE1/4, SW1/4, Sec. 14, T.27 S., R.24E., Bourbon County, Kansas; above stream and along north side of road; sequence measured and described as BB-60 SEC.

BB-61 = Top of Pawnee Limestone at 945'; roadcut on Ks. Hwy 7 near Center of East line of SE1/4, SW1/4, Sec.7, T.27S., R.24E., Bourbon Co., Kansas.

- BB-62 = Top of Pawnee Limestone at @937' based on handleveling from Sawin's Site 39, with Bandera Shale above exposing Mulberry Coal and overlying thin limestone; Revisited and revised - top of Laberdie at @945' with sandy mudrock to clayey sandstones of the Bandera in grassy pasture South of road up to about 5 dm of exposed underclay, followed by 1 dm of coal (Mulberry), and overlain by 7.5 dm of very fossiliferous limestone (collected sample); measure and describe in detail; roadcut on Ks. Hwy 7 and in field to the South; near Center of North line of NE1/4, NW1/4, NE1/4, Sec. 7, T.27S., R.24E., Bourbon Co., Kansas.
- BB-63 = Top of Anna shale at 975' just below top of hill which is at an elevation of 981'; Center of South line of Sec. 28, T.27S., R.24E., Crawford Co., Kansas.
- BB-67 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 850'; excellent exposure; Sawin Site #52; revisit, measure and describe; in creek just East of Center of West line of SE1/4, SE1/4, Sec. 30, T.26S., R.24E., Bourbon Co., Kansas.
- BB-68 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 890'; measure sequence exposed between BB-68 and BB-69; Sawin Site #54; near Center of South line of SE1/4, SE1/4, SE1/4, Sec. 25, T.26S., R.23E., Bourbon Co., Kansas.
- BB-69 = Near top of the Pawnee Limestone at @933', East along road the top of the Pawnee Limestone is near 930'; sawin Site #56; near SW Cor., Sec. 25, T.26S., R.23E., Bourbon Co., Kansas
- BB-70 = Base of Altamont Limestone estimated, because of cover, at 975'; Sawin Site #72; Center of East line of SW1/4, SE1/4, Sec. 27, T.27S., R.23E., Bourbon Co., Kansas.
- BB-71 = Altamont Limestone in road at 975'; Sawin Site #70; Center of East line of SE1/4, NE1/4, Sec. 3, T.27S., R.23E., Bourbon Co., Kansas.
- BB-72 = Base of Altamont Limestone at 980' with Bandera Sandstone in ditch, estimate 6.0' of limestone (Amoret) with Lake Neosho (1.0') grayish to yellowish brown shale above; possible that this is the Worland limestone with the shale above being the Nowata; Sawin Site 69; just South of Center of East line of Sec. 3, T.27S., R.23E., Bourbon Co., Kansas.
- BB-74 = Base of Altamont Limestone at 980' with Bandera Shale below; Sawin Site #67; just east of SW Cor. Sec. 2, T.27S., R.23E., Bourbon Co., Kansas.
- BB-75 = Top of Pawnee Limestone at 925' with Bandera Shale above containing Mulberry Coal just below a thin fossiliferous limestone followed by sandstone above limestone, also some mudrocks exposed above the limestone and below the coal; possibly upper Laberdie limestone of Price, 1981 dissertation: Sawin Site #64; near Center of South line of SE1/4, Sec. 2, T.27S., R.23E., Bourbon Co., Kansas.

- BB-76 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at @888'; 30 to 35' of Pawnee with earthy limestone (Childers School Limestone? of Price, 1981) exposed in creek bed: Sawin Site #73; near Center of South line of SW1/4, SW1/4, SE1/4, Sec. 11, T.27S., R.23E., Bourbon Co., Kansas.
- BB-77 = Pawnee Limestone at 910' in road; Sawin Site #87; Center of West line of SW1/4, NW1/4, Sec. 14, T.27S., R.23E., Bourbon Co., Kansas.
- BB-78 = Labette Shale (gray, silty mudrock) in creek at 905'; Sawin Site #85; just West of Center of North line of SW1/4, SW1/4, SW1/4, Sec. 14, T.27S., R.23E., Bourbon Co., Kansas.
- BB-79 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 908'; Sawin Site #75; just East of Center of South line of SE1/4, SW1/4, SE1/4, Sec. 12, T. 27S., R.23E., Bourbon C., Kansas.
- BB-80 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 920'; Sawin Site #76, B-162, and Sec. 93 of Jewett, 1945; just East of SW Cor., Sec. 7, T.27S., R.24E., Bourbon Co., Kansas.
- BB-81 = "Algal" buildups in Pawnee (Laberdie?) Limestone in field on North side of Ks Hwy 7, just North of Center of South line of SW1/4, SW1/4, SE1/4, Sec. 5, T.27S., R.24E., Bourbon County, Kansas.
- BB-82 = Pawnee Limestone at top of hill at 963', near contact with Bandera Shale above which is between BB-62 and BB-83; Sawin Site #96; Center of West line of Sec. 8, T.27S., R.24E., Bourbon Co., Kansas.
- BB-83 = Top of Anna shale in wooded stream bed near NE cor., Sec. 7, T.27S., R.24E., Bourbon Co., Kansas; Sawin Site #39; ties into BB-62 (top of Pawnee/base of Bandera); 15.1' of Pawnee Limestone, top of Anna shale/base of Pawnee (Myrick Station) Limestone at 922' with earthy Childers School Limestone below, top of Pawnee Limestone at 937' near Center of West line of Sec. 8, T.27S., R.24E., Bourbon Co., Kansas.
- BB-84 = Probably Alvis Coal in road ditch North side of road, top of 0.5' of coal at @915' with sandy mudrock above and underclay below; Sawin Site #14; near Center of South line of SE1/4, SW1/4, SW 1/4, Sec.15, T.27S., R.24E., Bourbon Co., Kansas
- BB-85 = Lagonda Shale down to water level, thin Breezy Hill limestone, @ 2dm of Mulky Coal, Excello, with base of Fort Scott (Blackjack Creek) Limestone at 892'; Sawin Site #13; near SE Cor., Sec. 15, T.27S., R.24E., Bourbon Co., Kansas.
- BB-86 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 972'; Sawin Site #9; just North of Center of North line of NW1/4, NW1/4, Sec. 25, T.27S., R.24E., Bourbon-Crawford County line, Kansas.
- BB-337 = Very near top of Pawnee (Laberdie) Limestone at 927' North of road; Center of South line of SE1/4, SW1/4, SW1/4, Sec. 26, T.26S., R.23E., Bourbon Co., Kansas.

B-163 = Pawnee Limestone (Myrick Station, Mine Creek, and Laberdie) in roadcut and creek bank exposure on West side of Ks Hwy 7 near Center of East line of NE1/4, SW1/4, Sec. 7, T.27S., R.24E., Bourbon Co., Kansas; measured and described by Jewett in 1939 and suggested as "Perhaps best as type exposure of Pawnee formation"; not a good type section now as base and top of Pawnee are not exposed, badly overgrown now but still useful; base of Anna shale near 905'.

Estimated Thicknesses of Mapped Intervals in Hiattville Quad.

Nowata Sh. = >20'

Altamont Ls. = 5' or less

Bandera Sh. = 50' up to 55"

Pawnee Ls. = 40' to 70+'

Labette Sh. = 35' to 50'

Fort Scott Ls. = 20' to 25'

## MARMATON QUADRANGLE

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

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

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BB-51/BB-376 = Top of Anna shale/base of Pawnee (Laberdie) Limestone at 885' in road cut; near Center of SW1/4, SE1/4, SW1/4, Sec. 14., T.26S., R.24E., Bourbon Co., Kansas.

BB-52 = Core hole and log of KGS#1 Ater; surface elevation = 854.5', Laberdie limestone; 17.5' of Pawnee Limestone with top of Anna shale at 837'; 51' of Labette Shale with top of Fort Scott (Higginsville) Limestone at 786'; 30' of Fort Scott Limestone with base (Blackjack Creek) at 756'; NW Cor. Sec.33, T.25S., R.24E., Bourbon Co., Kansas.

BB-53 = Core hole and log of KGS#2 Ater; surface elevation = 867'; 16+' of Pawnee Limestone with top of Anna shale at 851'; 47.5' of Labette Shale with top of Fort Scott (Higginsville) Limestone at 803.5'; 31.5' of Fort Scott Limestone with base (Blackjack Creek) at 772'; Center of East line of SE1/4, SW1/4, Sec. 33, T.25S., R.24E., Bourbon Co., Kansas.

BB-54 = Top of Anna shale at 846' (good point); section 32 of Price, 1981 dissertation, Union Bend School; North of Lake Fort Scott; just West of SE Cor., Sec. 28, T.25S., R.24E., Bourbon Co., Kansas.

BB-64 = Top of Anna shale/base of Pawnee Limestone at 872' along West side of creek bed; section 34 of Price, 1981 dissertation, Jubellie Quarry; approximately 45' of Pawnee Limestone here; Bourbon County Section B-140; my site L-810; quarry in SW1/4, SE1/4.SW1/4, Sec. 16, T.26S., R.24E., Bourbon Co., Kansas.

BB-65 = Top of Anna shale/base of Pawnee Limestone at @ 890' (contact covered); Sawin Site #4; just West of Center of South line of SE1/4, SE1/4, Sec. 23, T.26S., R.23E., Bourbon Co., Kansas.

- BB-65A = Excellent exposure of Pawnee Limestone, Anna shale, and upper dark bluish gray mudstones of the Labette Shale exposed North and East of BB-65 in the Elm Creek Lake Spillway; top of Anna shale/base of Pawnee (Myrick Station) Limestone at 890'; algal mounds in Laberdie at lake level; near Center of East line of SE1/4, SE1/4, Sec. 23, T.26S., R.23E., Bourbon Co., Kansas; measure and describe carefully.
- BB-66 = Top of Pawnee Limestone at @ 932'; Sawin Site #5; just West of Center of South line of Sec. 23, T.26S., R.23E., Bourbon Co., Kansas.
- B-145 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 865'; top of Pawnee (Laberdie) Limestone not seen, but estimated at 897' based on Section 89 in Jewett, 1945 who recorded 21.5' of Pawnee excluding the Anna shale; near Center of South line of SE1/4, SE1/4, Sec. 8, T.26S., R.24E., Bourbon Co., Kansas.
- BB-236 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 835', distinct 1.5 degree dip to the East; resembles exposure at BB-341; exposed by the fence on the North side of U. S. Hwy 54; near Center of South line of SE1/4, SE1/4, Sec. 15, T.25S., R.24E., Bourbon Co., Kansas.
- BB-237 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 850'; along U. S. Hwy 54, near Center of South line of SW1/4, SE1/4, Sec. 15, T.25S., R.24E., Bourbon Co., Kansas.
- BB-239 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 865' in pond bank on South side of road; just South of Center of North line of NW1/4, Sec. 21, T.25S., R.24E., Bourbon Co., Kansas.
- BB-240 = Base of Altamont (Worland, like Worland in western part of Hammond Quad.) Limestone at 915' in road ditch on both sides of U. S. Hwy 54; above the Bandera Shale is @ 2.0' of thin bedded, brownish, rubbly, clayey, nodular limestone (Amoret?) overlain by @ 2.0' of massive algal limestone (Worland?); total thickness of Altamont is 3' to 4' and top is mapped at 920'; along South line of SW1/4, SE1/4, SW1/4, Sec. 17, T.25S., R.24E., Bourbon Co., Kansas.
- BB-241 = Top of Altamont (Worland) Limestone between 930' and 940' on both sides of U. S. Hwy 54; Center of South line of Sec. 18, T.25S., R.24E., Bourbon Co., Kansas.
- B-88 = Base of Altamont Limestone at 901' in road; 6' to 8' of Altamont based on measured section; Center of West line of NW1/4, SW1/4, NW1/4, Sec. 13, T.25S., R.23E., Bourbon Co., Kansas.
- BB-242 = Base of Altamont (Worland) Limestone at @ 885' on both sides of U. S. Hwy 54; at section corner there is just a thin bit of Nowata Shale as at BB-243; Center of South line of SW1/4, SE1/4, Sec. 15, T.25S., R.23E., Bourbon Co., Kansas.
- BB-243 = Top of Altamont (Worland) Limestone at 895' with Nowata Shale at SE Cor., Sec. 15, T.25S., R.23E., Bourbon Co., Kansas.

BB-244 = Near top of Altamont (Worland) Limestone at 880'; in road ditch near Center of South line of SE1/4, SW1/4, SW1/4, Sec. 23, T.25S., R.23E., Bourbon Co., Kansas.

BB-245 = Top of Altamont (Worland) Limestone at 895'; near Center of South line of SE1/4, SW1/4, SE1/4, Sec. 23, T.25S., R.23E., Bourbon Co., Kansas; Worland here is very much like Worland at BB-233 and L-809 North of Devon, Kansas.

NOTE: Regional dip to the West in the vicinity of BB-244 and BB-245 is reasonable.

BB-246 = Probably base of Altamont Limestone at 901' in road; just North of Center of East line of SE1/4, SE1/4, Sec. 26, T.25S., R.23E., Bourbon Co., Kansas.

BB-247 = Top of Pawnee (Laberdie) Limestone at 864'; probably 15' to 20' of Pawnee Limestone in narrow canyon that drains into the Marmaton River to the southwest; near Center of West line of SW1/4, NW1/4, SW1/4, Sec. 36, T.25S., R.23E., Bourbon Co., Kansas.

BB-248 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone estimated at 835'; 30+' of limestone exposed on both sides of road and below bridge over Marmaton River; similar to Pawnee Limestone at BB-247; probably top of Pawnee (Laberdie) Limestone at 864'; Center of South line of SE1/4, SE1/4, Sec. 35, T.25S., R.23E., Bourbon Co., Kansas.

BB-249 = Top of Pawnee (Laberdie) :Limestone at 877'; @ 0.15 mile South along Center line of Sec. 16, T.26S., R.24E., Bourbon Co., Kansas.

BB-250 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at @ 840' in trench silo on edge of hill overlooking Marmaton River floodplain to the South; near Center of NE1/4, SE1/4, NW1/4, Sec. 6, T.26S., R.24E., Bourbon Co., Kansas.

BB-251 = Top of Pawnee (Laberdie) Limestone at 920+' in road; Center of South line of SW1/4, SE1/4, Sec. 15, T.26S., R.24E., Bourbon Co., Kansas.

BB-252 = Top of Pawnee (Laberdie) Limestone at 908' in road and field West of road; @ 0.15 mile South along Center line of Sec. 20, T.26S., R.24E., Bourbon Co., Kansas.

BB-253 = Top of Pawnee (Laberdie) Limestone at 917+' in road; near Center of South line of SW1/4, SW1/4, Sec. 16, T.26S., R.24E., Bourbon Co., Kansas.

- BB-253A = Excellent exposure of Pawnee Limestone North and East of bridge over Pawnee Creek; top of Anna shale/base of Pawnee (Myrick Station) Limestone at @ 810' about 1 meter above stream bed (22 Nov.'96) along South side of west flowing stream (Pawnee Creek); just North of Center of South line of SW1/4, SE1/4, SW1/4, Sec. 8, T.26S., R.24E., Bourbon Co., Kansas; measure and describe in detail) see generalized sequence in field notes, p. 42).
- BB-254 = Pawnee (Laberdie) Limestone in creek bed and hillside to the Northwest; near Center of SW1/4, SW1/4, SW1/4, Sec. 8, T.26S., R.24E., Bourbon Co., Kansas.
- B-132 = Top of Pawnee (Laberdie) Limestone at 860' in road and in field West of road; @ 0.65 mile North along Center line of Sec. 13, T.26S., R.23E., Bourbon Co., Kansas.
- B-135 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 810' in South bank of Paint Creek; top of Pawnee (Laberdie) Limestone at 850' in road just South of bridge; Center of West line of SW1/4, SW1/4, Sec. 12, T.26S., R.23E., Bourbon Co., Kansas.
- BB-255 = Top of Pawnee (Laberdie) Limestone at 870' in North-South road; near Center of South line of SE1/4, NE1/4, NE1/4, Sec. 14, T.26S., R.23E., Bourbon Co., Kansas; North dip of 20'/1700' (0.35 mile).
- BB-256 = Top of Pawnee (Laberdie) Limestone at 875' in road; SE of Center of SE1/4, NE1/4, Sec. 14, T.26S., R.23E., Bourbon Co., Kansas.
- BB-257 = Top of Pawnee (Laberdie) Limestone at 901' in road and in field South of road; near Center of South line of SW1/4, NE1/4, Sec. 14, T.26S., R.23E., Bourbon Co., Kansas.
- BB-258 = Top of Pawnee (Laberdie) Limestone at 909' in road and pond bank on the East side of the road; @ 0.12 mile North along Center line of Sec. 14, T.26S., R.23E., Bourbon Co., Kansas.
- BB-259 = Top of Pawnee (Laberdie) Limestone at 916' in road and pond bank on the West side of the road; Center of Sec. 23, T.26S., R.23E., Bourbon Co., Kansas.
- BB-260 = Top of Pawnee (Laberdie) Limestone at 925' in road and pond bank on the West side of the road; @ 0.3 mile North along Center line of Sec. 23, T.26S., R.23E., Bourbon Co., Kansas.
- BB-261 = Pawnee (Laberdie) Limestone float blocks in creek bed at about 918'; near Center of South line of SE1/4, SW1/4, SE1/4, Sec. 22, T.26S., R.23E., Bourbon Co., Kansas.
- BB-271 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 865' in farm road; Center of East line of NE1/4, SE1/4, Sec. 10, T.26S., R.23E., Bourbon Co., Kansas.

- BB-272 = Top of Pawnee (Laberdie) Limestone at 895' in field West of the road; near Center of East line of SE1/4, NE1/4, Sec. 10, T.26S., R.23E., Bourbon Co., Kansas.
- BB-273 = Top of Pawnee (Laberdie) Limestone at 890' in road; just South of Center of East line of NE1/4, NE1/4, Sec. 10, T.16S., R.23E., Bourbon Co., Kansas.
- BB-274 = Inferred top of Pawnee (Laberdie) Limestone at 890' in road, poorly exposed; Center of South line of SE1/4, SW1/4, Sec. 2, T.26S., R.23E., Bourbon Co., Kansas.
- BB-275 = Top of Pawnee (Laberdie) Limestone at 852' in road; near Center of East line of SE1/4, NE1/4, SE1/4, Sec. 11, T.26S., R.23E., Bourbon Co., Kansas.
- BB-276 = Pawnee (Laberdie) Limestone at 825' in drainage; near Center of East line of SE1/4, Sec. 11, T.26S., R.23E., Bourbon Co., Kansas.
- BB-277 = Top of Pawnee (Laberdie) Limestone at 852' in road; near Center of South line of SE1/4, SE1/4, NE1/4, Sec. 11, T.26S., R.23E., Bourbon Co., Kansas.
- B-133 = Measured section of Bandera Shale with channeloid sandstone; near NW Cor., Sec. 12, T.26S., R.23E., Bourbon Co., Kansas.
- BB-278 = Top of Pawnee (Laberdie) Limestone at 849' in road and field East of road; Center of west line of SW1/4, NW1/4, Sec. 1, T.26S., R.23E., Bourbon Co., Kansas.
- BB-279 = Old quarry , probably Pawnee Limestone) 0.2 mile South of road junction on East side of road; near Center of SW1/4, NW1/4, NW1/4, Sec. 1, T.26S., R.23E., Bourbon Co., Kansas; site of Bourbon County Sections B-138 and B-139; CHECK IN WINTER WITHOUT VEGETATION.
- B-137 = Base of Altamont (upper as reported by Jewett in 1938) Limestone at 895'; near Center of North line of NE1/4, Sec. 3, T.26S., R.23E., Bourbon Co., Kansas.
- BB-280 = Top of Pawnee (Laberdie) Limestone at 841' in road ditch; Center of North line of NE1/4, NW1/4, NW1/4, Sec. 2, T.26S., R.23E., Bourbon Co., Kansas.
- B-136 = Top of Pawnee (Laberdie) Limestone at 845' in road; near Center of South line of SE1/4, SW1/4, SW1/4, Sec. 35, T.25S., R.23E., Bourbon Co., Kansas.
- BB-281 = Possible top of Anna shale/base of Pawnee (Myrick Station) Limestone at 815' in road cut; near Center of Sec. 1, T.26S., R.23E., Bourbon Co., Kansas; CHECK IN WINTER WITHOUT VEGETATION.
- BB-282 = Top of Pawnee (Laberdie) Limestone at 850' in road; @ 0.25 mile North along Center line of Sec. 1, T.26S., R.23E., Bourbon Co., Kansas; CHECK IN WINTER WITHOUT VEGETATION.

- BB-338 = Upper Pawnee terrain and limestone exposed in field on both sides of road; elevation is 908' near Center of West line of SW1/4, NW1/4, Sec. 23, T.26S., R.23E., Bourbon Co., Kansas.
- BB-339 = Labette Shale, Anna shale, Pawnee (Myrick Station, Mine Creek, and Laberdie) Limestone exposed in West bank of stream on the North side of road; just SE of Center of NW1/4, SE1/4, SE1/4, Sec. 15, T.26S., R.23E., Bourbon Co., Kansas; top of Anna shale/base of Pawnee (Myrick Station) Limestone at 862'; algal Laberdie, like at BB-65A); measure and describe carefully (see generalized sequence in field notes, p. 41).
- BB-340 = Very near the top of the Pawnee (Laberdie) Limestone at @ 890'; near Center of South line of SW1/4, SE1/4, SE1/4, Sec. 15, T.26S., R.23E., Bourbon Co., Kansas.
- BB-341 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 892'; SW cor., Sec. 15 and NW cor. Sec. 22, T.25S., R.24E., Bourbon Co., Kansas; lower Pawnee Limestone is like that at B-145; area of B-95 were upper Labette Shale and lowermost Pawnee was measured and described by Jewett, in 1938 in Sec. 15, T.25S., R.24E., Bourbon Co., Kansas.
- BB-341A = Top of Pawnee (Laberdie) Limestone in ditch on both sides of road, well seen on East side of road in drainage at 917'; just South of Center of West line of SW1/4, SW1/4, NW1/4, Sec. 21, T.26S., R.25E., Bourbon Co., Kansas.
- BB-342 = Base of Altamont Limestone at 915' in road ditch on both sides of U. S. Hwy 54; SW Cor., sec. 17 and NW cor., Sec. 20, T.25S., R.25E., Bourbon Co., Kansas.
- BB-342A = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at @ 835' in East bank of Pawnee Creek in Hollister Wildlife Are; near Center of South line of SW1/4, SW1/4, Sec. 19, T.26S., R.25E., Bourbon Co., Kansas.
- BB-343 = Possibly Bandera Shale in road above 870'; @ 0.1 mile East of Center of Sec. 18, T.26S., R.24E., Bourbon Co., Kansas.
- BB-344 = Top of Pawnee (Laberdie) Limestone at 882' in road; good point; near Center of East line of NE1/4, NE1/4, Sec. 18, T.26S., R.24E., Bourbon Co., Kansas.
- BB-345 = Top of Pawnee (Laberdie) Limestone at 897' in field North of road just West of B-145; good point; near Center of South line of SW1/4, SE1/4, Sec. 8, T.26S., R.24E., Bourbon Co., Kansas.
- BB-346 = Upper Pawnee (Laberdie) Limestone (no top) at corner in drainage ditch to the North; near Center of South line of SE1/4, Sec. 5, T.26S., R.24E., Bourbon Co., Kansas.
- BB-347 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at @ 860'; near Center of North line of NE1/4, NE1/4, NE1/4, Sec. 9, T.26S., R.24E., Bourbon Co., Kansas.

- B-142 = Same as B-143 and B-144; top of Anna shale/base of Pawnee (Myrick Station) Limestone at 862'; see measured sections; near Center of South line of SW1/4, SE1/4, SE1/4, Sec. 10, T.26S., R.24E., Bourbon Co., Kansas.
- BB-348 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 867'; West end of dam at Lake Fort Scott; just West of SE Cor., Sec. 15, T.26S., R.24E., Bourbon Co., Kansas; chaetetid float sample, similar to Laberdie sample from B-142.
- BB-349 = Labette Shale exposed in trench silo on North side of road; near Center of SE1/4, SE1/4, NW1/4, Sec. 3, T.26S., R.24E., Bourbon Co., Kansas.
- BB-350 = Brown limestone of upper Labette Shale exposed in road ditch on West side of road; near Center of East line of NE1/4, NE1/4, NW1/4, Sec. 3, T.26S., R.24E., Bourbon Co., Kansas.
- BB-351 = Clayey, silty sandstone beds of the Labette Shale in drainage on East side of road; near Center of West line of SW1/4, SW1/4, Sec. 34, T.25S., R.24E., Bourbon Co., Kansas.
- BB-352 = Hard, clayey sandstone bed in Labette Shale in drainage on East side of road; near Center of West line of SW1/4, NW1/4, Sec. 34, T.25S., R.24E., Bourbon Co., Kansas.
- BB-353 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 847' on West side of road; near Center of West line of NE1/4, Sec. 33, T.25S., R.24E., Bourbon Co., Kansas.
- BB-354 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 850' in road; near Center of West line of NE1/4, sec. 4, T.26S., R.24E., Bourbon Co., Kansas.
- BB-355 = Labette Shale in road; near Center of West line of SE1/4, SE1/4, NE1/4, Sec. 4, T.26S., R.24E., Bourbon Co., Kansas.
- BB-356 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 856' in road; near Center of South line of SE1/4, SE1/4, NE1/4, Sec. 33, T.25S., R.24E., Bourbon Co., Kansas.
- BB-357 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 865' in road; near Center of East line of Sec. 6, T.26S., R.23E., Bourbon Co., Kansas; good point.
- BB-358 = Top of Pawnee (Laberdie) Limestone at 864' in road; just East of Center of North line of NE1/4, NW1/4, NE1/4, Sec. 1, T.26S., R.23E., Bourbon Co., Kansas.
- BB-359 = Estimated top of Pawnee (Laberdie) Limestone at 849' in road; near Center of South line of SW1/4, SE1/4, Sec. 1, T.26S., R.23E., Bourbon Co., Kansas.
- BB-360 = Estimated top of Pawnee (Laberdie) Limestone at 855' in road; near Center of South line of SE1/4, SE1/4, SE1/4, Sec. 1, T.26S., R.23E., Bourbon Co., Kansas.

- BB-361 = Very close to the top of Pawnee (Laberdie) Limestone at 860' at curve in road; near Center of East line of NW1/4, NE1/4, NW1/4, Sec. 7, T.26S., R.24E., Bourbon Co., Kansas.
- BB-362 = Estimated top of Pawnee (Laberdie) Limestone at 852' in road; near Center of South line of SE1/4, SE1/4, NW1/4, Sec. 12, T.26S., R.23E., Bourbon Co., Kansas.
- BB-363 = Estimated top of Pawnee (Laberdie) Limestone at 852' in road; near Center of South line of NW1/4, Sec. 12, T.26S., R.23E., Bourbon Co., Kansas.
- BB-364 = Top of Pawnee (Laberdie) Limestone at 852' in road; near Center of South line of SW1/4, SE1/4, NE1/4, Sec. 11, T.26S., R.23E., Bourbon Co., Kansas.
- BB-365 = Top of Pawnee (Laberdie) Limestone at 870' in road just West of Center of South line of SE1/4, SW1/4, NE1/4, Sec. 11, T.26S., R.23E., Bourbon Co., Kansas.
- BB-366 = Top of Pawnee (Laberdie) Limestone at 868 to 870' in road ditch; just South of Center of West line of Sec. 36, T.25S., R.23E., Bourbon Co., Kansas.
- BB-367 = Top of Pawnee (Laberdie) Limestone at 860' in field South of road; near Center of North line of NE1/4, Sec. 35, T.25S., R.23E., Bourbon Co., Kansas.
- BB-368 = Well weathered base of the Altamont Limestone at 897' in road cut on the East side of road; near Center of West line of Sec. 26, T.25S., R.23E., Bourbon Co., Kansas.
- BB-423 = Top of Altamont Limestone at 906'; roadcut on U. S. Hwy 54 just West of Center of South line of SW1/4, SE1/4, Sec. 14, T.25S., R.23E., Bourbon Co., Kansas.
- BB-424 = Top of Altamont Limestone at 895' in road; just North of Center of East line of NE1/4, Sec. 26, T.25S., R.23E., Bourbon Co., Kansas.
- BB-425 = Top of 6' to 8' of Altamont Limestone at 893' in road; SW Cor., Sec. 24, T.25S., R.23E., Bourbon Co., Kansas.
- BB-426 = Estimated top of thin Altamont Limestone at 915'; just East of Center of South line of SE1/4, Sec. 19, T.25S., R.24E., Bourbon Co., Kansas.
- BB-427 = Estimated top of Altamont Limestone at 925'; near Center of East line of NE1/4, SE1/4, Sec. 19, T.25S., R.24E., Bourbon Co., Kansas.

L-928 = Top of Fort Sott (Higginsville) Limestone estimated at 810'; when very dry sequence from Excello shale well into the Higginsville limestone is exposed, normally only the upper part of Blackjack Creek limestone into Higginsville are accessible; Fort Scott Limestone well developed here with Summit Coal and Howe limestone clearly recognizable; NE1/4, SW1/4, NW1/4, Sec. 2, T.26S., R.24E., Bourbon Co., Kansas; spillway of Rock Creek Lake; measured and described as Loc. No. 928 by R. R. West & R. S. Sawin 20 May '94.

B-96 = Anna shale into Pawnee Limestone including Myrick Station limestone, Mine Creek shale, and lower part of Laberdie limestone; measured and described by Jewett in 1938 on the East side of Ks. Hwy 7 on the South side of Mill Creek in Sec. 15, T.25S., R.24E., Bourbon Co., Kansas; we were unable to locate this exposure.

B-130 = Bandera Shale, over 59', starting near the very top of the Pawnee (Laberdie) Limestone and ending near the base of the Altamont Limestone; along North line of NE1/4, NE1/4, Sec. 27, T.25S., R.23E., Bourbon Co., Kansas.

#### Estimated Thicknesses of Mapped Intervals in Marmaton Quad.

Nowata Sh. = 5' to 30'

Altamont Ls. = <5' to 10+'

Bandera Sh. = 30' to 50+'

Pawnee Ls. = <20' to 50'

Labette Sh. = @50'

Fort Scott Ls. = 25' to 30'

## **RICHARDS 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.

BB-209 = Quarry in Higginsville limestone, 9' to 15' of limestone at Hammond/Richards Quad. boundary; just North of Center of South line of SE1/4, Sec. 11, T.25S., R.25E., Bourbon Co., Kansas. top of Fort Scott (Higginsville) Limestone at 865' in quarry face; 15' of limestone.

BB-210 = Top of Fort Scott (Higginsville) Limestone at 855', 9' to 10' of Higginsville limestone like at BB-294; near Center of South line of SE1/4, SE1/4, Sec. 2., T.24S., R.25E., Bourbon Co., Kansas.

BB-211 = Dark gray mudrock to black, platy/fissile shale just West of drainage; near Center of East line of SE1/4, SW1/4, NW1/4, Sec. 1. T.24S., R.25E., Bourbon Co., Kansas.

BB-212 = Base of Fort Scott (Blackjack Creek) Limestone at 840'; near Center of West line of Sec. 1, T.24S., R.25E., Bourbon Co., Kansas.

B-43 = Same as B-45; sequence from mudrock below Mulky Coal to the base of the Pawnee Limestone near the SE Cor., NE1/4, SE1/4, Sec. 2., T.24S., R.25E., Bourbon County, Kansas; measured and described by Jewett in 1939, inaccessible now; based on Jewett's section the Labette Shale is over 42' thick and the Fort Scott Limestone is over 21' thick, we say "over" because in both units there are covered intervals for which no thickness is given.

BB-213 = Top of Fort Scott (Higginsville) Limestone at 865'; near Center of West line of SW1/4, SW1/4, SW1/4, Sec. 1, T.24S., R.25E., Bourbon Co., Kansas.

BB-214 = Exposure from Lagonda to Mulky Coal to Excello shale to Blackjack Creek limestone, to Little Osage shale to Higginsville limestone; see sections B-43 and B-45; base of Fort Scott (Blackjack Creek) Limestone at 840'; near Center of West line of SW1/4, NW1/4, Sec. 1. T.24S., R.25E., Bourbon Co., Kansas.

BB-283 = Limestone in road ditch on West side of road @ 150' North of section corner, top at 795', possibly Verdigris Limestone; interesting joint pattern, three sets oriented as follows: N. 12 degrees W., N. 43 degrees W., and S. 45 degrees W.; see Section 49 of Jewett, 1945; near Center of West line of NW1/4, NW1/4, NW1/4, Sec. 13, T.25S., R.25E., Bourbon Co., Kansas; sample collected containing, what appears to be a platy alga??

BB-288 = Base of Fort Scott (Blackjack Creek) Limestone at 860' in road; just South of Center of East line of SE1/4, NE1/4, NE1/4, Sec. 19, T.36N., R.33W., Vernon Co., Missouri.

BB-289 = Higginsville limestone in road ditch on North side of road; near Center of South line of SE1/4, SW1/4, Sec. 7, T.36N., R.33W., Vernon Co., Missouri.

BB-290 = Base of Higginsville limestone at @ 820'; in Higginsville limestone is 10' thick then the top of the Fort Scott (Higginsville) Limestone is at 830'; if 15' thick then the top is at 835'; near Center of North line of NE1/4, Sec. 36, T.24S. R.25E., Bourbon Co., Kansas.

BB-291 = Attitude of the top of the Blackjack Creek limestone based on four points; (a), (b), (c) and (d); at (a) top is at 826', at (b) it is at 816'. at (c) it is at 814', and at (d) it is at 810'; thus there is a dip of 12' in 700' laterally to the SSW; if the Blackjack Creek is 5.0' thick then the base of the Fort Scott Limestone is at 821' at (a), 811' at (b), 809' at (c), and 805' at (d); the top of the Blackjack Creek limestone here is very irregular and appears pedogenic in places like at BB-15 and L-928; general location is near Center of NE1/4, NE1/4, Sec. 35, T.24S., R.25E., Bourbon Co., Kansas; location of points (a), (b), (c), and (d) are as follows: (a) = near Center of West line of NE1/4, SE1/4, SE1/4, Sec. 26, T.24S., R.25E., Bourbon Co., Kansas; (b) = near Center of SE1/4, SE1/4, Sec. 26, T.24S., R.25E., Bourbon Co., Kansas; (c) = near Center of North line of NE1/4, NE1/4, Sec. 35, T.24S., R.25E., Bourbon Co., Kansas; and (d) = near Center of NE1/4, NE1/4, NE1/4, Sec. 35, T.24S., R.25E., Bourbon Co., Kansas.

BB-292 = Top of Fort Scott (Higginsville) Limestone at 795' in the West bank of Shiloh Creek South of the road, good point; 13.5' of limestone; near Center of North line of NW1/4, NE1/4, NE1/4, Sec. 2, T.25S., R.25E., Bourbon Co., Kansas.

BB-301 = Sandstone in Lagonda Formation along both sides of road; @ 0.375 mile North along Center line of Sec. 20, T.37N., R.33W., Vernon Co., Missouri.

BB-302 = Limestone, Higginsville, in field South of the road; probable top of Fort Scott (Higginsville) Limestone at 890'; along South line of SW1/4, SE1/4, SW1/4, Sec. 20, T.37N., R.33W., Vernon Co., Missouri.

BB-306 = Top of Fort Scott (Higginsville) Limestone at 868'; SE Cor., Sec. 11, T.24S., R.25E.; good point; along North line of NW1/4, NE1/4, NW1/4, Sec. 29, T.37N., R.33W., Vernon Co., Missouri.

BB-317 = Possible top of Anna shale/base of Pawnee (Myrick Station) Limestone at 905' in road and ditch; near Center of South line of SW1/4, Sec. 13, T.24S., R.25E., Bourbon Co., Kansas.

BB-318 = Possible top of Anna shale/base of Pawnee (Myrick Station) Limestone at 910' in road and ditch; near Center of West line of NW1/4, NW1/4, Sec. 24, T.24S., R.25E., Bourbon Co., Kansas.

- BB-319 = Top of Fort Scott (Higginsville) Limestone at 852' in drainage on west side of road; just South of Center of East line of SE1/4, Sec. 23, T.24S., R.25E., Bourbon Co., Kansas.
- BB-320 = Black shale (@ 1 dm) with thin bed (1 dm) of "rotten" coal underlain by 2.0' of gray mudrock in drainage South of road; near Center of North line of NE1/4, NE1/4, NE1/4, Sec. 26, T.24S., R.25E., Bourbon Co., Kansas.
- BB-321 = Sequence of gray mudrock to thin, laterally discontinuous coal and black, fissile shale below an algal limestone (Higginsville) in road ditch on both sides of road; top of Fort Scott (Higginsville) Limestone at 860'; near Center of North line of NE1/4, NW1/4, NW1/4, Sec. 25, T.24S., R.25E., Bourbon Co., Kansas.
- BB-322 = Sandstone in Labette Shale; near Center of North line of NW1/4, NE1/4, NW1/4, Sec. 25, T.24S., R.25E., Bourbon Co., Kansas.
- BB-323 = Top of Anna shale/base of Pawnee (Myrick Station) Limestone at 915' on South side of road; near Center of North line of SE1/4, SE1/4, Sec. 6, T.36N., R.33W., Vernon Co., Missouri.
- BB-324 = Limestone within Lagonda Formation at 830' in road; just West, @ 0.05 mile, of Center of South line of Sec. 18, T.36N. R.33W., Vernon Co., Missouri.
- BB-325 = Top of Fort Scott (Higginsville) Limestone at 815' in field West of road; good point; near Center of East line of NE1/4, NE1/4, NE1/4, Sec. 1, T.25S., R.25E., Bourbon Co., Kansas.
- BB-326 = Top of Fort Scott (Higginsville) Limestone at 818' in field South of road; just East of Center of North line on NE1/4, NE1/4, Sec. 1, T.25S., R.25E., Bourbon Co., Kansas; good point.
- BB-327 = Top of Fort Scott (Higginsville) Limestone at 812' in road ditch on both sides of road; near Center of South line of SE1/4, Sec. 36, T.24S., R.25E., Bourbon Co., Kansas.
- BB-335 = Top of Fort Scott (Higginsville) Limestone at @ 830' in a gully in a field South of road; poorly exposed, highly weathered; near Center of North line of NW1/4, NE1/4, NE1/4, Sec. 35, T.24S., R.25E., Bourbon Co., Kansas.
- BB-381 = Top of limestone (possibly Verdigris), as at BB-283, at 788' in field North of road; just North of Center of East line of SE1/4, SE1/4, Sec. 11, T.25S., R.25E., Bourbon Co., Kansas.

Estimated Thicknesses of Mapped Intervals in Richards Quad.

Pawnee Ls. = 15' to 20'

Labette Sh. = 30' to 40'

Fort Scott Ls. = 10' to 25'

post-Verdigris Ls. = 50' to 55'

Verdigris Ls. = up to 3'

pre-Verdigris = 10 to 15'

## **BOURBON COUNTY QUADRANGLE MAPS**

The following eight quadrangle maps represent field maps that are submitted by the Kansas Geological Survey as part of the STATEMAP Agreement #1434-HQ-96-AG-01488 for FY96 (May 1, 1996 to April 30, 1997). The following quadrangles are filed with the Kansas Geological Survey as KGS Open-File Report 97-19 "Preliminary Geologic Field Maps of portions of Bourbon County, Kansas".

Quadrangles included--

Complete Quadrangles

**Marmaton**

**Hammond**

**Fort Scott**

Partial Quadrangles (Areas of Bourbon County on quadrangle are mapped)

**Richards**

**Deerfield**

**Garland**

**Cato**

**Hiattville**

