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## Field Trip Guidebook for the Nebraska Well Drillers Association

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# FIELD TRIP GUIDE

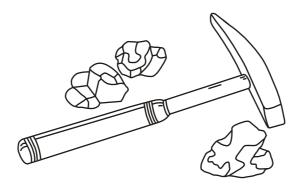
(for the Nebraska Well Drillers Association)

## SOUTH CENTRAL NEBRASKA AND NORTH CENTRAL KANSAS GEOLOGY

**Duane Eversoll** Conservation and Survey Division

Matt Joeckel Conservation and Survey Division

Lee Orton Nebraska Well Drillers Association



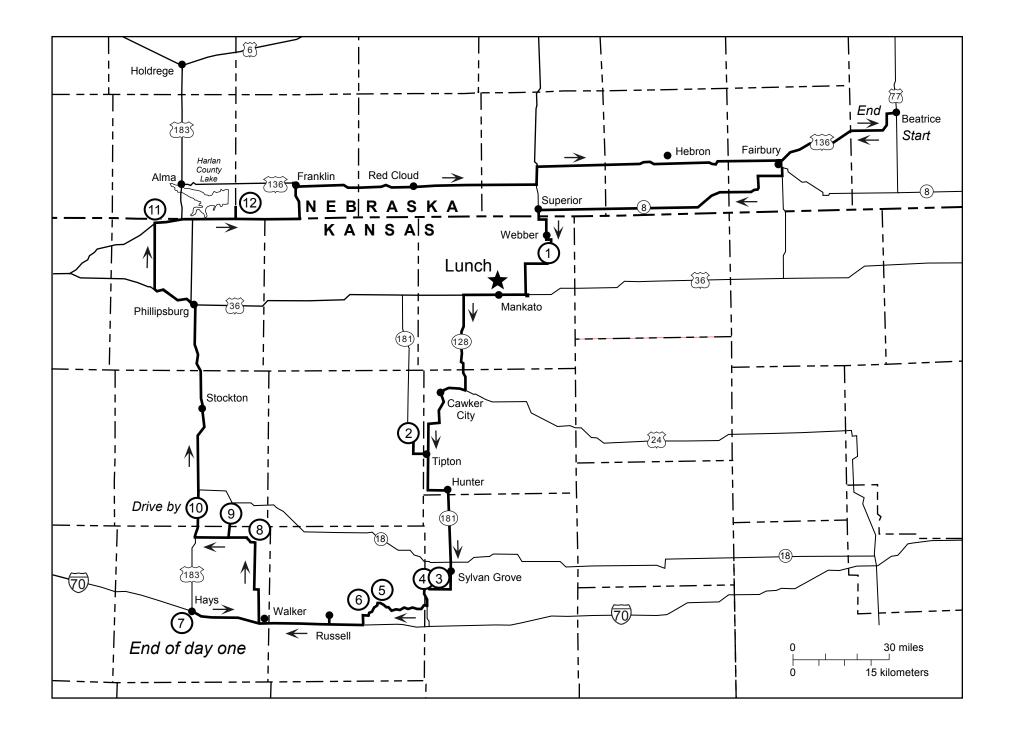
### NEBRASKA GEOLOGICAL SURVEY

Conservation and Survey Division Institute of Agriculture and Natural Resources University of Nebraska–Lincoln



September 9-10, 2014





#### NEBRASKA WELL DRILLERS ASSOCIATION SOUTHERN NEBRASKA-NORTHERN KANSAS GEOLOGY FIELD TRIP SEPTEMBER 9-10, 2014

#### Day One - September 9:

#### 7:30 a.m. - 8:00 a.m. - Registration

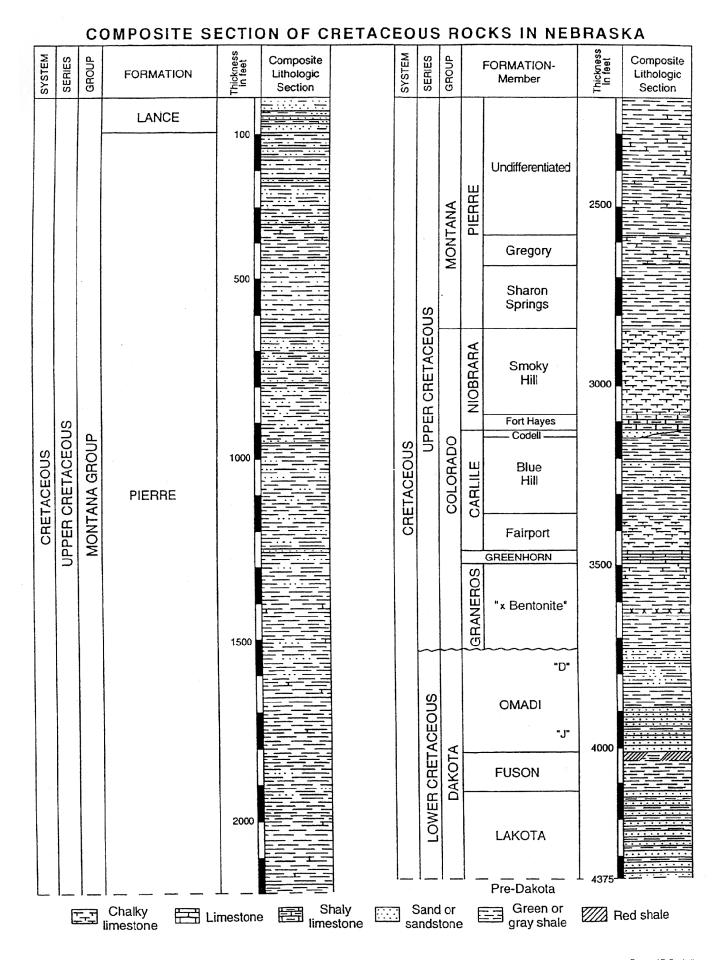
8:00 a.m. - Leave Beatrice driving west on Highway #136 to Highway #103, then south to Highway #8, turn west and view occasional outcrops of Cretaceous Dakota sandstones and shale. Drive by Endicott, Nebraska where Endicott Brick Company resides. Dakota Shale is used to manufacture their bricks. Continue on Highway #8 driving by some Greenhorn & Graneros outcrops in the hills southwest of Fairbury. Continue on Highway #8 to Superior (bathroom stop), south to Kansas on County Road by Webber, Kansas to Lovewell Reservoir. Stop 1 at Lovewell Reservoir to view Cretaceous Carlile Shale and a presentation on the Bostwick Division. Leave driving south & west and join Highway #14 turning south to Highway #36 then west to Mankato, Kansas. Lunch at Mankato, Kansas at Buffalo Roam Café. Leave driving west on #36 to Highway #128 turn south and continue to Highway #24. Turn west thru Cawker City turning south on County Road by Waconda Lake to Tipton and join Highway #181. Turn north on #181 to Stop 2 a Ft. Hays Limestone outcrop and anticline. Leave outcrop returning south on #181 thru Sylvan Grove to Stop 3 and 4 at Wilson Lake to view Graneros and Dakota outcrops. Leave south and west on Shoreline Road to Stop 5 to view a Graneros "x" bentonite layer. Continue to County Road west to Stop 6 and view a Greenhorn limestone "Fence Post" deposit. Drive south thru Bunker Hill, Kansas to Interstate I-70, turn west & drive to Hayes, Kansas arriving at Sleep Inn motel, dinner at Gella's Brewing Co., Hayes,.

#### Day Two - September 10:

#### Breakfast at Sleep Inn, Depart at:

7:45 a.m. - To tour Sternberg Museum at Stop 7. Leave going east on I-70 to Walker, Kansas. Turn north on County Road (380<sup>th</sup>) then turn west and north on County Road continue northwest to Stop 8 to view Greenhorn, Carlile and Niobrara outcrops along the Saline River. Continue and turn north on County Road (320<sup>th</sup>) to Stop 9 to examine Ft. Hayes Limestone, Codell Sandstone and Blue Hill Shale outcrops. Leave outcrop continue back on County Road south and west to Highway #183 then turning north to Stop 10 (drive by only) to view Ft. Hayes Limestone outcrops. Continue north on #183 crossing the Solomon Rivers thru Phillipsburg turning west on Highway #383 to County Road west of Woodruff, Kansas (approximately 4 miles). Stop 11 at an active Ogallala Quartzite (opaline sandstone) quarry where we will have a box lunch and the owners and guarry operator may visit with us about the guarry's history. Leave guarry on Highway #383 east to Highway #183 turn north into Nebraska across the Republican River Valley where the Niobrara and the Pierre outcrops along the south shores. At Alma turn east on Highway #136 to Harlan County Dam at Stop 12 for a drive by talk on Harlan County Reservoir. Leave Dam site and continue east on Highway #136 along the Republican River where outcrops of both Niobrara and Pierre Shale can be seen particularly along the south side of the valley. Quarries of Ogallala Quartzite also occur south of the valley southwest of Franklin, Nebraska. These guarries were the source of some of the rip-rap on the major dams in southwestern Nebraska. Continue on Highway #136 east back to Beatrice arriving around 5:00 p.m.

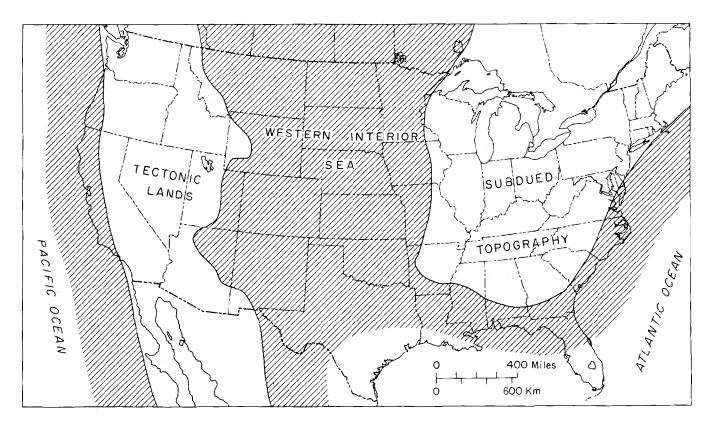
This field trip is intended to view the Cretaceous and Tertiary rocks in Nebraska and Kansas (Tertiary: Ogallala, and Cretaceous: Pierre, Niobrara, Carlile, Greenhorn – Graneros and Dakota). It will mainly be concentrated in Kansas due to the fact that more of a complete "geologic section" (an exposed surface or cut that may be vertical or horizontal) is present in Kansas. These rocks are present in Nebraska, but mostly in the sub-surface. They are primary and secondary aquifers for water particularly in some areas of eastern, southcentral and northeastern Nebraska. By visiting outcrops of these formations we can better understand their materials, properties and changes within each formation(s) as they relate in the sub-surface to Nebraska water and water well issues.



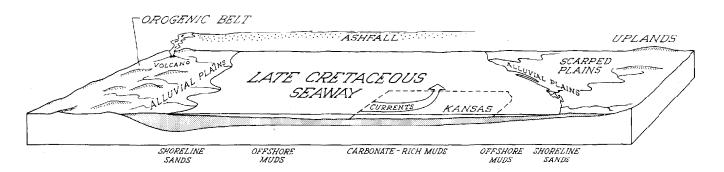
## COMPOSITE SECTION OF OUTCROPPING LOWER PERMIAN AND UPPER PENNSYLVANIAN ROCKS IN SOUTHEASTERN NEBRASKA

| 1               | SERIE<br>GROL   | JP          | FORMATION<br>OR<br>MEMBER  | LOCATION<br>OF<br>EXPOSURE  | COMPOSITE | SYSTEM | SERI<br>GRO<br>FORMA                 | UP                    | FORMATION<br>OR<br>MEMBER     | OF<br>EXPOSURE                   |        | COMPOSITE | SYSTEM                | SEF<br>GRO<br>FORM | JUP                 | FORMATION<br>CR<br>MEMBER                     | LOCATION<br>OF<br>EXPOSURE               | THICKNESS       | COMPOSITE<br>LITHOLOGIC<br>SECTION | SYSTEM | SER<br>GRC<br>FORM/ | DUP                                    | FORMATION<br>OR<br>N MEMBER    | LOCATION<br>OF<br>EXPOSURE | Sz E LITH             | MPOS<br>HOLO<br>SCTIO |
|-----------------|-----------------|-------------|----------------------------|-----------------------------|-----------|--------|--------------------------------------|-----------------------|-------------------------------|----------------------------------|--------|-----------|-----------------------|--------------------|---------------------|---|--|-----------------|------------------------------------|--------|---------------------|--|--------------------------------|----------------------------|-----------------------|-----------------------|
|                 | COUNCIL         | FCRAKER     | HUGHES<br>CRFEK            | NW<br>31-4N-16E<br>DO       |           |        |                                      | DALE                  | TARKIO                        | SW-SE<br>21-3N-17E               |        |           |                       |                    | TOPEKA              | SHELDON                                       | W1/2<br>21-10N-14E<br>. DO<br>SW-NE      | 525             |                                    |        |                     | z                                      | SOUTH<br>BEND                  | 5W-SE-NE<br>28-13N-13E     |                       |                       |
|                 |                 | z           | OAKS                       | DO                          |           |        |                                      | FORMATION             |                               |                                  | 275    |           |                       |                    | DT I                | IOWA POINT<br>HARTFORD                        | 9.11N-14E<br>DO<br>DO<br>00              | -               |                                    |        |                     | TON FORMATION                          |                                | DO                         | 820                   |                       |
|                 |                 | FORMATION   | HOUCHENS CR                | <b>DO</b>                   | 25        |        |                                      | FOR                   |                               | SE-SW<br>10-8N-14E               |        |           |                       |                    | FORMATION           | FRV NE<br>CRFFK                               | DO                                       | 550             |                                    | *      |                     | STANTON                                | FLIDORA                        | DC                         | *                     | 8<br>- W<br>8<br>- W  |
| ES              |                 | HAMLIN      | STINE                      | SE                          |           |        |                                      | WILLARD               | ELMONT                        | Do                               | 300    |           |                       |                    | CREEK               | LARSH<br>ROCK BLUFF                           | D00                                      |                 |                                    |        |                     | VILX                                   |                                | D0<br>D0                   |                       |                       |
|                 |                 | F           | VE POINT                   | DO                          | 50        |        |                                      |                       |                               |                                  |        |           |                       | c<br>N             | DEER                | 05KALOOSA                                     | DO                                       |                 |                                    |        |                     | PLATTSBURG                             |                                | D0<br>D0<br>D0             | 825                   |                       |
| BIG BLUE SERIES | ADMIRE GROUP    | FORMATION   |                            |                             |           |        |                                      | EMPORIA               | READING                       | D0<br>D0                         |        |           |                       |                    | NOL                 | OZAWKIE                                       | 00                                       | 575             |                                    |        |                     |  | BONNER<br>SPRINGS<br>FORMATION | w1/2-SE-SE<br>28-17N-13E   |                       | 777                   |
| SYSTEM          | ADA             | BRANCH      |                            | DO                          |           |        |                                      | FORMATION             |                               | Nt<br>31-9N-14E                  | 325    |           |                       |                    | TECUMSEH FORMATION  | CREEK   | DO                                       |                 |                                    |        |                     | FORMATION                              | FARLEY<br>ISLAND CR.           | DC                         | 850                   |                       |
|                 |                 | WEST        |                            |                             |           |        |                                      | AUBURN                | WAKARUSA                      | DO                               |        |           |                       |                    |                     | OST<br>KENOSHA<br>AVOCA                       | no<br>00<br>00                           | 600             |                                    |        |                     | WYANDOTTE FORM                         |                                | DC .                       | *                     |                       |
|                 |                 | FALLS CITY  | LEHMER<br>RESIRVE<br>MILES | E½<br>19:5N-16E<br>DO<br>DO |           |        |                                      | IER CREEK             | TAKARDIA                      | NE<br>27-1N-18E                  | 354    |           |                       |                    |                     | KING<br>HILL<br>BEIL                          | DO<br>DO                                 |                 |                                    | SERIE  | AYW.                | QUINDARO                               | NE-SE-SW<br>34-18N-12E<br>DC   | 875                        |                       |                       |
|                 |                 | ONAGA       | HAUXBY                     | DO                          |           |        |                                      | E SOLDIER             | SOUTH FORK                    | DO                               |        |           | PENNEXY VANIAN SYSTEM |                    | LECOMPTON FORMATION |   | DO<br>DO<br>DO                           | 621 6<br>7<br>7 |                                    |        | MISSOURI            | IOLA LANE                              | RISBIE                         | DO                         |                       |                       |
|                 |                 | <br>y       | TOWLE<br>BROWNVILLE        | DO                          |           | CVCTFL | SERIES<br>GROUP                      | BURLINGAME            | WINNEBAGO<br>TAYLCR<br>BRANCH | D0<br>D0                         | 37     |           |                       |                    |                     | SPRING<br>BRANCH                              | 00                                       |                 |                                    |        |                     |  |                                | NW-3E<br>1-17N-12E         | 8<br>8<br>8<br>8<br>8 | -0-0-0-               |
|                 |                 | WOOD SIDING | PONY CREEK<br>PLUMB        | 00                          | 124       |        |                                      |                       | SILVER<br>LAKE<br>RULC        | NI/2 25<br>NE 26<br>IN-18E<br>DD | -00    |           |                       | ERIES              | KANWAKA             | STULL<br>CLAY CREEK<br>JACKSON PK<br>KEREFORD | DO<br>DO<br>DO<br>SW-SE-SE<br>20-12N-14E |                 |                                    |        |                     | -                                      | CHANUTE<br>FORMATION           | DO                         | 900                   |                       |
|                 |                 |             | FRENCH<br>CREEK            | N52<br>20-4N-16E            |           |        | PENNSYLVANIAN<br>VIRGIL<br>WABALINGF | SCRANTON FORMATION    | CEDARVALE                     | CD                               |        |           |                       | VIRGIL             |                     | PLATTSMOUTH                                   | 00<br>DO                                 | 650             |                                    |        |                     |  | QUIVIRA                        | DO                         | *                     | *                     |
|                 |                 | FORMATION   | JIM CREEK                  | 00                          |           |        | 5                                    |                       | HAPPY                         | DO                               |        |           |                       |                    | FORMATION           | HEEBNER                                       | DO                                       | DO              |                                    |        | 11111               | SARPY                                  |                                | 00                         | \$25                  |                       |
|                 |                 | RCOT        | FRIEDRICH                  | , DO                        |           |        |                                      |                       | -                             |                                  |        |           |                       |                    | OREAD R             | SNYDERVILLE                                   | oq                                       |                 |                                    |        |                     | ECD MAX TION                           | FONTANA<br>FORMATION           | D0<br>D0<br>D0             |                       |                       |
|                 |                 |             | GRANDHAVEN                 | SE-NE<br>158N-14E           |           | -      |                                      |                       | WHITE<br>CLOUD                | ca                               |        | 5         |                       |                    |                     | TORONTG                                       | DO                                       |                 |                                    |        |                     |  | WINTERSET                      | D0                         | 950 Z =               |                       |
|                 | WABAUNSEE GROUP |             |                            |                             |           |        |                                      |                       |                               |                                  |        | 55        |                       |                    |                     |   |  | 700             |                                    |        |                     | DENNIS ECOM                            |                                |                            | 2<br>8<br>1<br>2<br>2 |                       |
|                 |                 | FORMATION   |                            |                             |           |        |                                      |                       |                               |                                  |        |           |                       |                    |                     |   | NW: NW NW<br>20-12N-14E<br>(CCRE HOLE)   |                 |                                    |        |                     |  |                                | D0<br>D0<br>DC             | 975                   | ¢-                    |
|                 |                 |             | DRY                        | υο .                        | 200       |        |                                      |                       |                               |                                  |        |           |                       |                    | CE FCRMATION        |   |  |                 |                                    |        |                     | CMODE                                  |                                | DO                         |                       |                       |
| VIRGIL SE       | WABAUN          | STOTLER     |                            |                             |           |        |                                      |                       |                               |                                  | 47     | 15        |                       |                    | LAWRENCE            |   |  |                 |                                    |        |                     | 4                                      |                                | D0<br>D0                   |                       |                       |
|                 |                 |             | DOVER                      | po                          | 225       |        |                                      |                       |                               |                                  |        |           |                       |                    |                     |   |  |                 |                                    |        |                     | PL                                     | LEASANTON<br>GROUP             | DO                         | 1000                  |                       |
|                 |                 | PILLSBURY   |                            | SE-SW<br>10-8N-14E          |           |        |                                      | -                     | HOWARD                        | Witg<br>21-10N-146               | IE 500 |           |                       |                    | CASS                | HASKELL >                                     |  | 750             |                                    | E      | H u                 | IMESTO                                 |                                |                            | * ¢ CRIN              |                       |
|                 |                 | ALE         | MAPLE HILL                 | DO                          | 250       |        | KA SEVERY                            | COAL<br>CREEK<br>HOLT |                               |                                  |        |           |                       | PLATTFORD          | UNNAMED             | DO  |  |                 | Z                                  | 220 RE | ACK                 | ALE $\Delta \hat{c}$ SHALE $\hat{c}$ G | HERT OR                        | PELEC                      | JLINE                 |                       |
|                 |                 | ZEANDALE    | WAMEGO                     | DO                          |           |        | CHA WINFF                            | TOPEKA                | TURNER<br>CREEK               | 00<br>90<br>01                   |        |           |                       |                    | ă                   |   | D0<br>D0                                 | 775             |                                    |        | ·•• ·               |  | ONE . 8                        |                            | BRYO                  |                       |

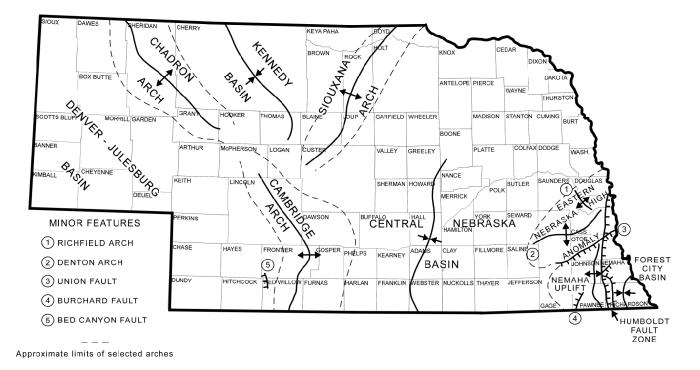
Raymond R. Burchett Nebraska Geological Survey Conservation and Survey Division Institute of Agriculture and Natural Resources University of Nebraska–Lincoln

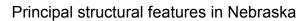


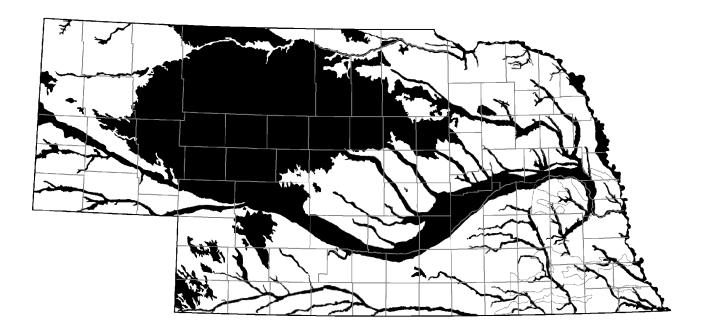
Paleographic map of United States during Greenhorn transgressional maximum (early Turonian). Map modified from Williams and Stelck (1975).



Block diagram depicting schematically a portion of Western Interior Sea during deposition of Greenhorn Limestone and nature bordering land areas. Shaded portion indicates Upper Cretaceous sediments (modified from Hattin, 1975a).







Locations of sand and gravel deposits at or near the surface in Nebraska