C — C'

Map location number 30
JONES 1 STATE
API 40 063 05010
SW NE sec. 35, T. 18 N., R. 1 E.
Harding County, South Dakota
Kelly bushing elevation: 3,277 ft
Ground surface elevation: 3,266 ft
Log types shown: spontaneous potential, resistivity, and conductivity

Map location number 31
RICHFIELD 1 STATE A
API 40 063 05008
SE NW sec. 16, T. 17 N., R. 4 E.
Harding County, South Dakota
Kelly bushing elevation: 3,135 ft
Ground surface elevation: 3,123 ft
Log types shown: spontaneous potential and resistivity

Map location number 32
RANGER 14-17 STATE
API 40 063 20284
SE SW sec. 17, T. 18 N., R. 6 E.
Harding County, South Dakota
Kelly bushing elevation: 2,887 ft
Ground surface elevation: 2,875 ft
Log types shown: gamma ray and resistivity

Map location number 33
SHELL 41-23 STATE
API 40 063 05013
NE NE sec. 23, T. 18 N., R. 8 E.
Harding County, South Dakota
Kelly bushing elevation: 3,040 ft
Ground surface elevation: 3,027 ft
Log types shown: spontaneous potential and resistivity

Map location number 34
SHELL 1 VEAL
API 40 105 05003
SE SE sec. 7, T. 17 N., R. 15 E.
Perkins County, South Dakota
Kelly bushing elevation: 2,670 ft
Ground surface elevation: 2,656 ft
Log types shown: spontaneous potential and resistivity

Map location number 35
AMERADA 1 ROY TRENT
API 40 137 20001
SW NE sec. 26, T. 16 N., R. 18 E.
Ziebach County, South Dakota
Kelly bushing elevation: 2,445 ft
Ground surface elevation: 2,434 ft
Log types shown: spontaneous potential, resistivity, and conductivity

Map location number 36
NORRIS OIL 1 CHEYENNE
API 40 137 20004
SE SW sec. 25, T. 15 N., R. 21 E.
Ziebach County, South Dakota
Kelly bushing elevation: 2,298 ft
Ground surface elevation: 2,288 ft
Log types shown: spontaneous potential, resistivity, and conductivity

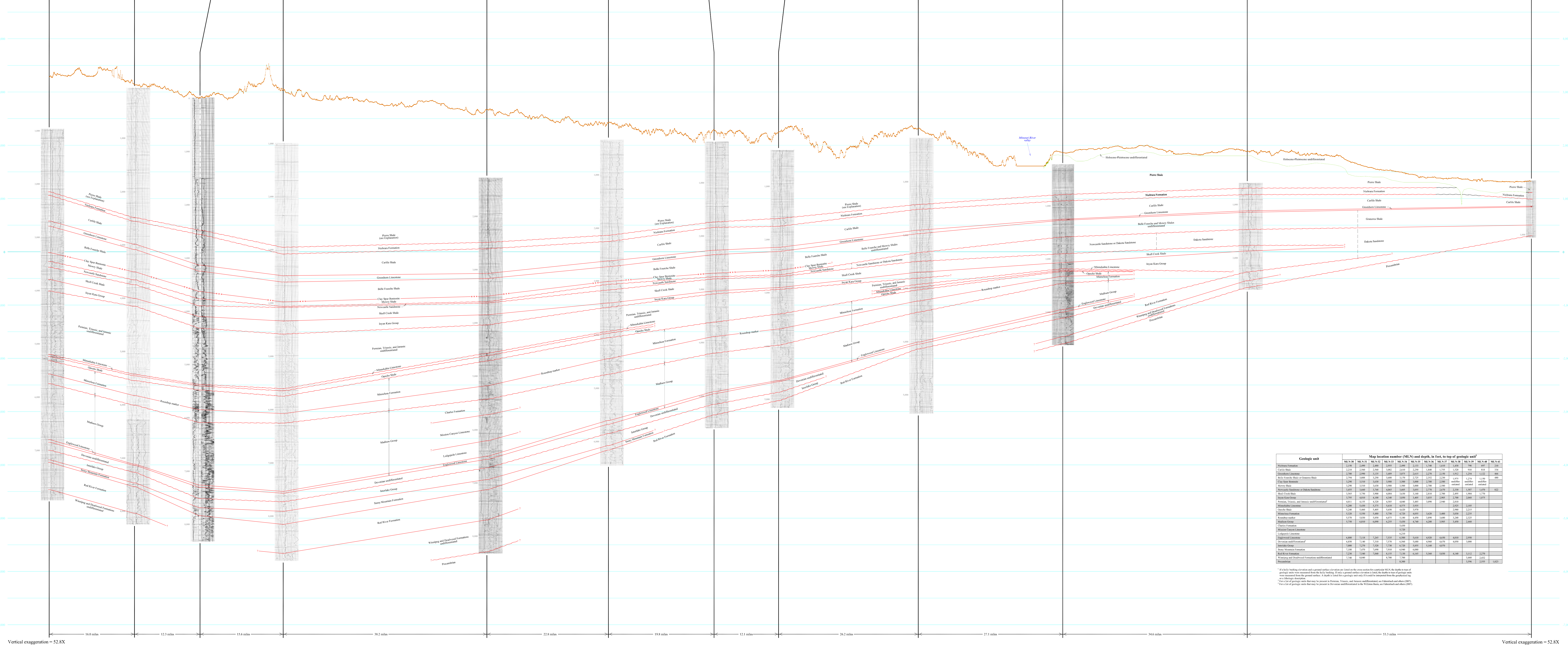
Map location number 37
HERNDON 1A OLEARY
API 40 041 05002
SE SW sec. 13, T. 15 N., R. 23 E.
Dewey County, South Dakota
Kelly bushing elevation: 2,236 ft
Ground surface elevation: 2,227 ft
Log types shown: spontaneous potential and resistivity

Map location number 38
GULF 1 JEWETT
API 40 041 20001
NW NW sec. 13, T. 13 N., R. 27 E.
Dewey County, South Dakota
Kelly bushing elevation: 2,319 ft
Ground surface elevation: 2,309 ft
Log types shown: spontaneous potential, resistivity, and conductivity

Map location number 39
CARTER OIL STRATIGRAPHIC TEST #1
API 40 107 05000
NW NE sec. 34, T. 118 N., R. 78 W.
Potter County, South Dakota
Kelly bushing elevation: 1,867 ft
Ground surface elevation: 1,861 ft
Log types shown: spontaneous potential and resistivity

Map location number 40
HUNT 2 SCHOOL LAND
API 40 069 05002
SW NE sec. 24, T. 116 N., R. 73 W.
Hyde County, South Dakota
Kelly bushing elevation: 1,889 ft
Ground surface elevation: 1,880 ft
Log types shown: spontaneous potential and resistivity

Map location number 41
SCHMIDT FARM
API 40 115 60034
NE NE sec. 26, T. 115 N., R. 64 W.
Spink County, South Dakota
Ground surface elevation: 1,325 ft
Log types shown: spontaneous potential and resistivity



Vertical exaggeration = 52.8X

Vertical exaggeration = 52.8X

Geologic unit	Map location number (MLN) and depth, in feet, to top of geologic unit[1]											
	MLN-30	MLN-31	MLN-32	MLN-33	MLN-34	MLN-35	MLN-36	MLN-37	MLN-38	MLN-39	MLN-40	MLN-41
Niobrara Formation	2,150	2,490	2,480	2,955	2,490	2,133	1,740	1,610	1,430	790	697	210
Carlile Shale	2,218	2,560	2,560	3,082	2,610	2,250	1,840	1,755	1,520	910	818	334
Greenhorn Limestone	2,700	2,990	3,135	3,489	3,075	2,615	2,270	2,150	1,912	1,254	1,122	466
Belle Fourche Shale or Graneros Shale	2,794	3,088	3,250	3,608	3,170	2,725	2,352	2,230	1,975 undiffer-entiated	1,274 undiffer-entiated	1,150 undiffer-entiated	480
Clay Spur Bentonite	3,290	3,510	3,630	3,980	3,500	3,000	2,700	2,580				
Mowry Shale	3,290	3,510	3,630	3,980	3,500	3,000	2,700	2,580				
Newcastle Sandstone or Dakota Sandstone	3,455	3,660	3,768	4,065	3,605	3,055	2,770	2,670	2,330	1,587	1,470	822
Skull Creek Shale	3,565	3,750	3,900	4,084	3,630	3,160	2,810	2,700	2,495	1,904	1,770	
Inyan Kara Group	3,795	4,010	4,100	4,340	3,850	3,405	3,035	2,905	2,700	2,068	1,875	
Permian, Triassic, and Jurassic undifferentiated[2]	4,011	4,155	4,320	4,585	4,040	3,485	3,090	2,940	2,810			
Minnekahta Limestone	5,200	5,430	5,375	5,610	4,575	3,935			2,925	2,185		
Opeche Shale	5,240	5,460	5,405	5,650	4,620	3,970			2,980	2,215		
Minnelusa Formation	5,320	5,550	5,480	5,750	4,720	4,055	3,620	3,400	3,030	2,235		
Roundtop marker	5,570	5,830	5,850	6,075	5,180	4,450	3,890	3,680	3,240	2,325		
Madison Group	5,750	6,010	6,090	6,255	5,430	4,740	4,200	3,985	3,450	2,460		
Charles Formation					5,430							
Mission Canyon Limestone					5,720							
Lodgepole Limestone					6,210							
Englewood Limestone	6,800	7,118	7,265	7,535	6,500	5,610	4,920	4,650	4,010	2,950		
Devonian undifferentiated[3]	6,850	7,140	7,310	7,570	6,560	5,680	4,960	4,670	4,050	3,000		
Interlake Group	7,000	7,270	7,520	7,730	6,720	5,855	5,160	4,870				
Stony Mountain Formation	7,180	7,470	7,690	7,910	6,940	6,080						
Red River Formation	7,230	7,540	7,840	8,155	7,130	6,165	5,360	5,030	4,140	3,112	2,270	
Winnipeg and Deadwood Formations undifferentiated	7,740	8,040		8,700	7,700					3,460	2,432	
Precambrian					8,300					3,596	2,555	1,023

[1] If a kelly bushing elevation and a ground surface elevation are listed on the cross section for a particular MLN, the depths to tops of geologic units were measured from the kelly bushing. If only a ground surface elevation is listed, the depths to tops of geologic units were measured from the ground surface. A depth is listed for a geologic unit only if it could be interpreted from the geophysical log or a lithologic description.
[2] For a list of geologic units that may be present in Permian, Triassic, and Jurassic undifferentiated, see Fahrenbach and others (2007).
[3] For a list of geologic units that may be present in Devonian undifferentiated in the Williston Basin, see Fahrenbach and others (2007).

STATE OF SOUTH DAKOTA
M. Michael Rounds, Governor

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
Steven M. Pirner, Secretary

DIVISION OF FINANCIAL AND TECHNICAL ASSISTANCE
David Templeton, Director

GEOLOGICAL SURVEY
Derric L. Iles, State Geologist

OIL AND GAS INVESTIGATION 2

Cross Sections Showing Geophysical Logs of Phanerozoic Rocks in South Dakota

Plate 3. Structural Cross Section C-C'

J.E. Fox, K.A. McCormick, and T.N. Haggar

2009

Prepared in cooperation with the Department of Geology and Geological Engineering, South Dakota School of Mines and Technology

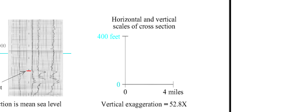
Explanation

The youngest geologic contact interpreted in areas west of the Missouri River is the contact between the Niobrara Formation and the Pierre Shale. It is recognized that younger geologic units often exist above the Pierre Shale, but they were not interpreted for this cross section.

- Correlation line at a conformable geologic contact. Interpreted from a geophysical log or lithologic description. Queried where uncertain
- Correlation line at an unconformable geologic contact. Interpreted from a geophysical log or lithologic description. Queried where uncertain
- Correlation line at an unconformable geologic contact. Interpreted from Tomhave and Schulz (2004)

Correlation lines are not intended to show detailed structure or actual elevation of a geologic unit between data points. Correlation lines are not projected to land surface near the Black Hills even though some geologic units crop out. The generalized nature of the cross section does not lend itself to illustration of these outcrop areas.

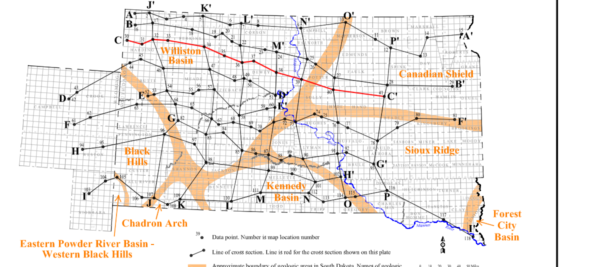
- Profile of land surface derived from U.S. Geological Survey digital elevation models
- Profile of the bedrock surface east of the Missouri River. Queried where uncertain. Due to the scale of the cross section, bedrock outcrop areas are not shown. Modified from Tomhave and Schulz (2004)
- × × × Bentonite bed
- Boundary of nomenclature change. Boundary shown in orange on index map below. Boundary and nomenclature generally coincide with Fahrenbach and others (2007)



Datum for cross section is mean sea level

Vertical exaggeration = 52.8X

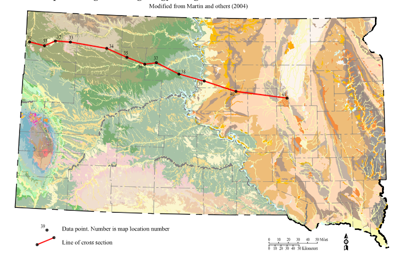
Index map showing locations of data points used for construction of cross sections



- Data point. Number is map location number
- Line of cross section. Line is red for the cross section shown on this plate
- Approximate boundary of geologic areas in South Dakota. Names of geologic areas are shown in orange font. From Fahrenbach and others (2007)

Index map showing surface geology along the line of cross section in South Dakota

Modified from Martin and others (2004)

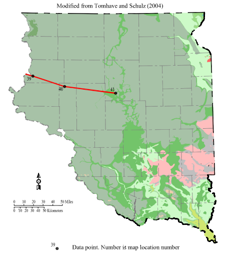


- Data point. Number is map location number
- Line of cross section

Index map showing bedrock geology along the line of cross section east of the Missouri River

Modified from Tomhave and Schulz (2004)

Map location number	Surface geologic unit	Bedrock geologic unit east of the Missouri River
30	Hell Creek Formation	
31	Hell Creek Formation	
32	Hell Creek Formation	
33	Ludlow Formation	
34	Ludlow Formation	
35	Hell Creek Formation	
36	Fox Hills Formation	
37	Fox Hills Formation	
38	Fox Hills Formation	
39	Eolian deposits	Pierre Shale
40	Till, stagnation moraine	Pierre Shale
41	Till, stagnation moraine	Pierre Shale



- Data point. Number is map location number
- Line of cross section

References

Fahrenbach, M.D., Steece, F.V., Sawyer, J.F., McCormick, K.A., McGillivray, G.L., Schulz, L.D., and Redden, J.A., 2007, *South Dakota stratigraphic correlation chart:* South Dakota Geological Survey Oil and Gas Investigation 1.

Martin, J.E., Sawyer, J.F., Fahrenbach, M.D., Tomhave, D.W., and Schulz, L.D., 2004, *Geologic map of South Dakota:* South Dakota Geological Survey General Map 10, scale 1:500,000.

Tomhave, D.W., and Schulz, L.D., 2004, *Bedrock geologic map showing configuration of the bedrock surface in South Dakota east of the Missouri River:* South Dakota Geological Survey General Map 9, scale 1:500,000.