J

Map location number 107
INTERIOR 1 PUTNAM
API 40 047 05029
SW SE sec. 30, T. 10 S., R. 8 E.
Fall River County, South Dakota
Kelly bushing elevation: 3,390 ft
Ground surface elevation: 3,381 ft
Log types shown: spontaneous potential and resistivity

Map location number 96
CITY OF BOX ELDER 4
API 40 103 60042
NW NW sec. 29, T. 2 N., R. 9 E.
Pennington County, South Dakota
Kelly bushing elevation: 3,055 ft
Ground surface elevation: 3,045 ft
Log types shown: spontaneous potential, resistivity, and conductivity

Map location number 82
LION 1 GOVERNMENT LIBERTIN
API 40 093 05020
SW NE sec. 9, T. 4 N., R. 11 E.
Meade County, South Dakota
Kelly bushing elevation: 2,595 ft
Ground surface elevation: 2,586 ft
Log types shown: gamma ray, spontaneous potential, and resistivity

Map location number 64
PHILLIPS 1 CHAFFEE RANCH FED
API 40 093 20025
NW SE sec. 14, T. 7 N., R. 10 E.
Meade County, South Dakota
Kelly bushing elevation: 2,592 ft
Ground surface elevation: 2,579 ft
Log type shown: gamma ray

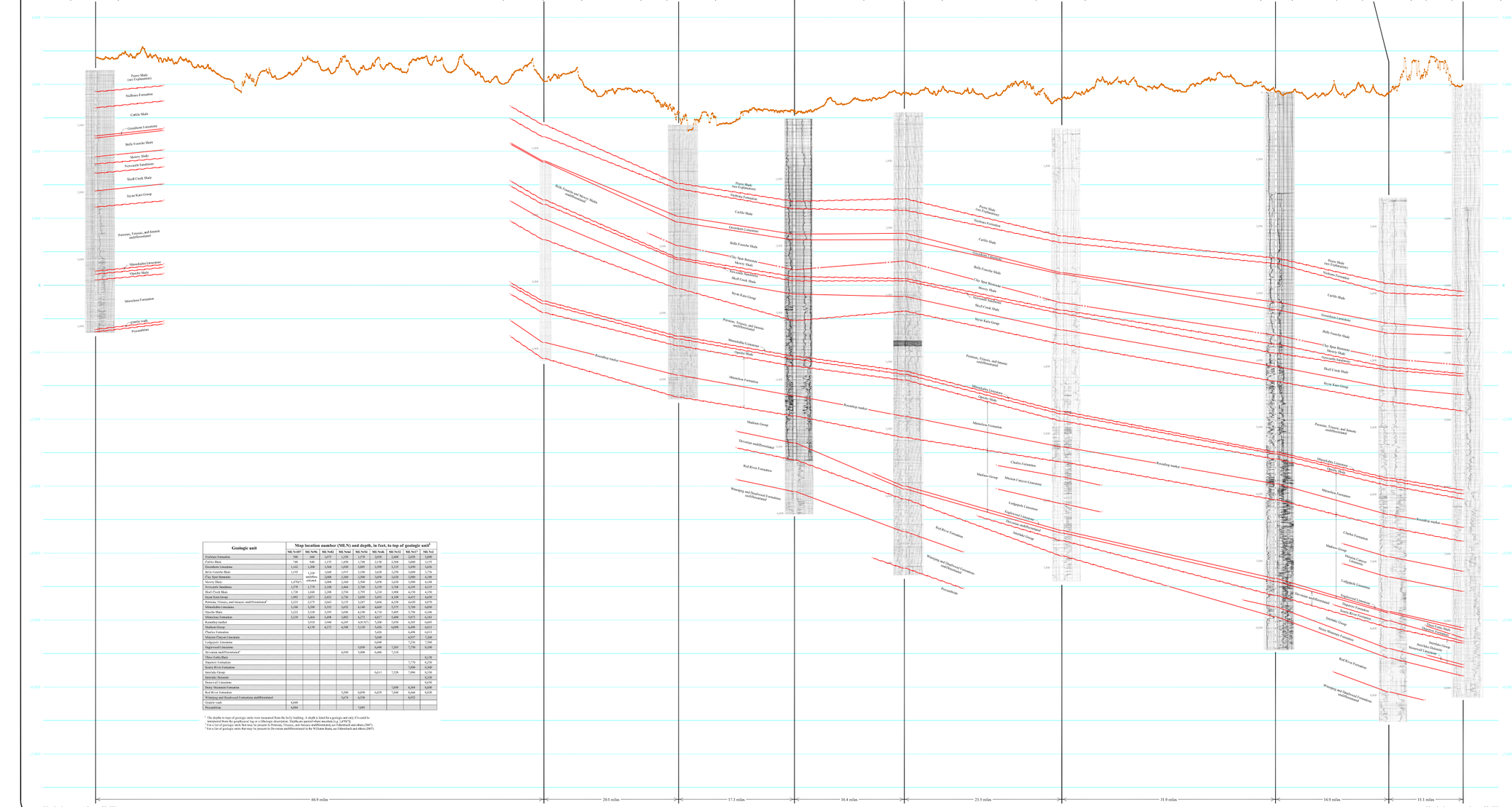
Map location number 54
MOBIL 1 MICKELSON
API 40 019 05015
NE NE sec. 7, T. 9 N., R. 9 E.
Butte County, South Dakota
Kelly bushing elevation: 2,860 ft
Ground surface elevation: 2,848 ft
Log types shown: spontaneous potential, resistivity, and conductivity

Map location number 46
WESTECH 4-16 MOREAU RIVER
API 40 019 20068
NW NW sec. 16, T. 13 N., R. 8 E.
Butte County, South Dakota
Kelly bushing elevation: 2,786 ft
Ground surface elevation: 2,775 ft
Log types shown: gamma ray, 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 17
LUFF 2-24 BROWN
API 40 063 20211
SE SE sec. 24, T. 21 N., R. 5 E.
Harding County, South Dakota
Kelly bushing elevation: 2,881 ft
Ground surface elevation: 2,864 ft
Log types shown: gamma ray, spontaneous potential, and resistivity

Map location number 2
LUFF 1-32 JANVRIN
API 40 063 20212
NE SE sec. 32, T. 23 N., R. 5 E.
Harding County, South Dakota
Kelly bushing elevation: 2,987 ft
Ground surface elevation: 2,974 ft
Log types shown: gamma ray, spontaneous potential, and resistivity


Pierre Shale (see Explanation)
Niobrara Formation
Carlile Shale
Greenhorn Limestone
Belle Fourche Shale
Mowry Shale
Newcastle Sandstone
Skull Creek Shale
Inyan Kara Group
Permian, Triassic, and Jurassic undifferentiated
Minnekahta Limestone
Opeche Shale
Minnelusa Formation
Granite wash
Precambrian
Rosebud marker
Madison Group
Devonian undifferentiated
Red River Formation
Winnipeg and Deadwood Formations undifferentiated
Charles Formation
Mission Canyon Limestone
Lodgepole Limestone
Englewood Limestone
Stonehenge Limestone
Whitewood Limestone
Bryan Mountain Formation
Interlake Group
Stonewall Limestone
Gunton Formation
Third Value Slide Dolomite
Stonewall Limestone
Interlake Dolomite
Stonewall Limestone
Big Horn Group
Geologic unit
Map location number (MLN) and depth, in feet, to top of geologic unit[1]
MLN=107
MLN=96
MLN=82
MLN=64
MLN=54
MLN=46
MLN=32
MLN=17
MLN=2
Niobrara Formation 500 840 1,075 1,320 1,370 2,070 2,400 2,650 3,090
Carlile Shale 740 840 1,135 1,470 1,740 2,170 2,560 3,010 3,335
Greenhorn Limestone 1,332 1,240 1,560 1,920 2,095 2,595 3,135 3,650 3,970
Belle Fourche Shale 1,352 1,250 1,640 1,915 2,188 2,620 3,270 3,650 3,776
Clay Spur Bentonite 1,470[2] 1,270 entered 2,000 2,260 2,308 2,650 3,420 3,980 4,180
Mowry Shale 1,470[2] entered 2,000 2,360 2,508 2,970 3,630 3,980 4,188
Newcastle Sandstone 1,578 1,370 2,100 2,464 2,708 3,150 3,788 4,105 4,335
Skull Creek Shale 1,720 1,668 2,208 2,530 2,795 3,210 3,968 4,130 4,350
Inyan Kara Group 1,902 2,075 2,433 2,720 3,050 3,493 4,190 4,655 4,650
Permian, Triassic, and Jurassic undifferentiated[3] 2,233 2,375 2,662 3,125 3,247 3,666 4,328 4,620 4,870
Minnekahta Limestone 3,330 3,290 3,552 3,652 4,180 4,669 5,275 5,700 5,850
Opeche Shale 3,352 3,330 3,595 3,696 4,198 4,710 5,405 5,796 6,108
Minnelusa Formation 3,510 3,404 3,698 3,802 4,272 4,817 5,490 5,972 6,183
Rosebud marker 3,910 3,940 4,245 4,815(?) 5,288 5,970 6,305 6,605
Madison Group 4,150 4,272 4,748 5,338 5,826 6,990 6,698 6,933
Charles Formation 5,826 6,458 6,913
Mission Canyon Limestone 5,848 6,507 7,080
Lodgepole Limestone 6,048 7,236 7,568
Englewood Limestone 5,850 6,448 7,295 7,748 8,108
Devonian undifferentiated[4] 6,950 5,968 6,486 7,141
Three Forks Shale 8,138
Duperow Formation 7,170 8,258
Souris River Formation 7,290 8,500
Interlake Group 6,611 7,530 7,996 8,268
Stonewall Limestone 8,450
Stony Mountain Formation 8,570
Red River Formation 5,230 6,050 6,920 7,948 8,464 8,920
Winnipeg and Deadwood Formations undifferentiated 5,674 6,358 8,952
Granite wash 6,048
Precambrian 6,094 7,085

[1] The depths to tops of geologic units were measured from the kelly bushing. A depth is listed for a geologic unit only if it could be interpreted from the geophysical log or a lithologic description. Depths are queried where uncertain (e.g. 1,470(?)).
[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).

Vertical exaggeration = 52.8X

66.9 miles | 20.1 miles | 17.1 miles | 16.4 miles | 23.5 miles | 31.9 miles | 16.9 miles | 11.1 miles

Vertical exaggeration = 52.8X

J'

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 10. Structural Cross Section J-J'

J.E. FOX, K.A. MCCORMICK, AND T.N. HAGGAR

2009

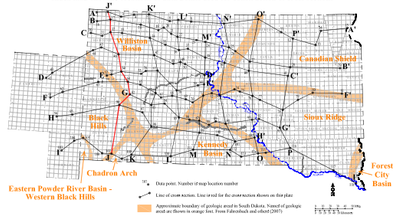
Prepared in cooperation with the Department of Geology and Geological Engineering, South Dakota School of Mines and Technology

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.

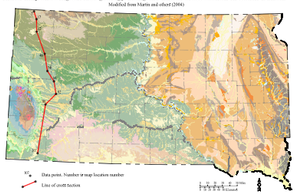
- Correlation line at a conformable geologic contact. Interpreted from a geophysical log or lithologic description. Queried where uncertain
- Correlation line at an unconformable geologic contact. Interpreted from a geophysical log or lithologic description. Queried where uncertain
- Correlation lines 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
- Bentonite bed

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



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

Modified from Martin and others (2004)



Map location number	Surface geologic unit
	Cross-Dakota
96	Alluvium
82	Pierre Shale
64	Pierre Shale
54	Pierre Shale
46	Fox Hills Formation
32	Hell Creek Formation
17	Hell Creek Formation
2	Hell Creek Formation

References

Fahrenbach, M.D., Sawyer, F.V., Sawyer, J.F., McClymont, 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