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7.5 Minute Series Geologic Quadrangle Map 17

Geologic Map of the Hermosa Quadrangle, South Dakota

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Prepared in cooperation with the South Dakota School of Mines and Technology, Rapid City, South Dakota

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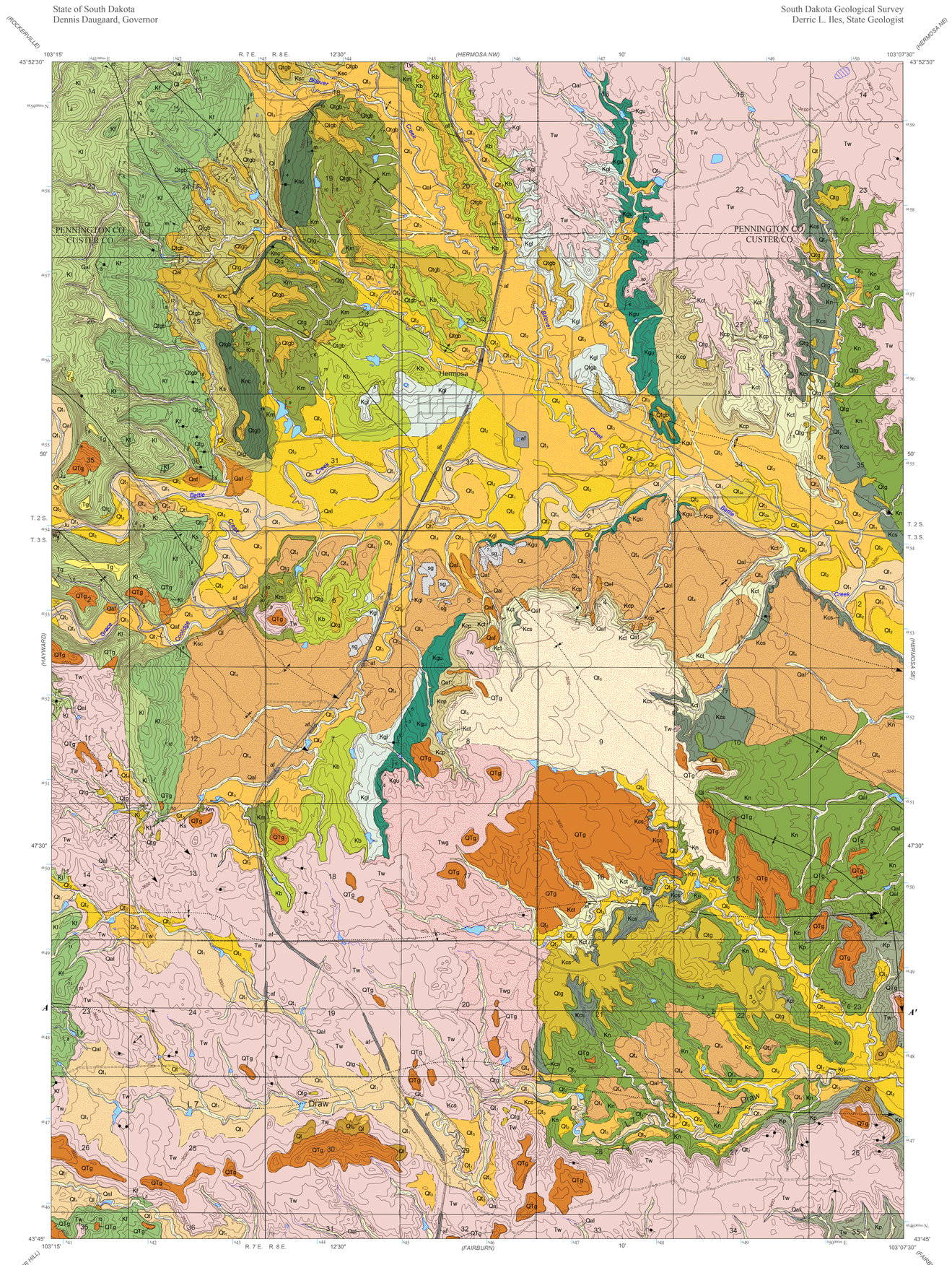
State of South Dakota
Dennis Daugaard, Governor

South Dakota Geological Survey
Derric L. Iles, State Geologist



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Map base modified from U.S.Geological Survey 1:24,000 scale Hermosa digital line graph.
Projection is Universal Transverse Mercator, Zone 13N.
Datum is 1983 North American.
UTM grid information generated from the ArcMap layout grid function.

The Geological Survey Program, Department of Environment and Natural Resources, engages in an ongoing data collection and interpretation process. An outcome of that process is to reflect those interpretations on maps such as this one. Reasonable efforts have been made to ensure that this map accurately reflects the source data used in its preparation. This map is date specific. As additional data become available, geologic interpretations may be revised and the map may be updated by the Geological Survey Program. This map should not be enlarged or otherwise used in an attempt to interpret more detail than can be seen at a scale of 1:24,000.

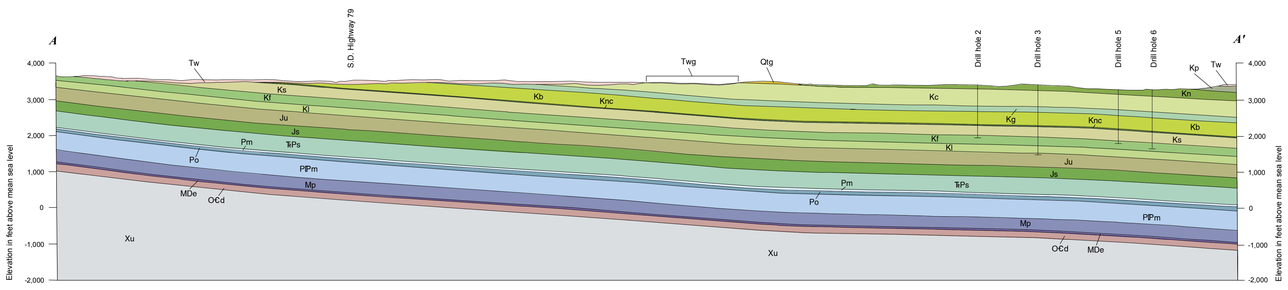
SCALE 1:24,000

1 0.5 0 1 Mile
1,000 0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 Feet
1 0.5 0 1 Kilometer

Contour Interval 20 Feet

NORTH
1° 15'
22 MILS
8° 6'
141 MILS
UTM GRID AND 2012 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

South Dakota
Quadrangle location



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EXPLANATION

Quaternary

- Qal — **Alluvium** - Dominantly sand, silt, and clay transported during non-overbank flow of streams. Maximum thickness unknown
- Ql — **Landslide** - Small areas of hillside collapse, typically associated with the Skull Creek Shale and the White River Group
- Qaf — **Alluvial fan** - Poorly sorted, unconsolidated, mud, silt, sand, and gravel at mouths of tributaries to Battle Creek and Grace Coolidge Creek. Thickness less than 25 ft (7.5 m)
- Qt — **Terrace deposit (undifferentiated)** - Overbank deposits of mud, sand, and gravel composed chiefly of well rounded, poorly sorted Precambrian quartzite, quartz, and Paleozoic chert at various heights not equal to labeled terrace levels along Battle Creek and Grace Coolidge Creek. Thickness less than 15 ft (4.5 m)
- Qt_5 — **Terrace deposit** - Sand and gravel, including boulders, composed chiefly of well rounded, poorly sorted Precambrian quartzite, quartz, and minor schist and amphibolite as well as Paleozoic chert. Approximately 240 ft (72.7 m) above Battle Creek. Equivalent to the Rapid terrace of Plumley (1948). Thickness less than 20 ft (6.1 m)
- Qt_4 — **Terrace deposit** - Floodplain and channel deposits of silt, sand, and gravel similar in composition to terrace deposit Qt_5. 40-50 ft (12.1-15.2 m) above Battle Creek and L 7 Draw. Equivalent to the Sturgis terrace of Plumley (1948). Thickness less than 15 ft (4.5 m)
- Qt_3 — **Terrace deposit** - Overbank and channel deposits of mud, sand, and gravel. 16-29 ft (4.9-8.8 m) above Battle Creek and L 7 Draw, and 5 ft (1.5 m) above Billover Creek. Thickness less than 10 ft (3.0 m)
- Qt_2 / Qt_{2a} — **Terrace deposit** - Overbank deposits of mud and sand and channel deposits of sand and gravel formed on former floodplain. Qt_2 is 11-13 ft (3.3-3.9 m) above present creek. Qt_{2a} is slightly lower than Qt_2 above creek. Equivalent to the Bear Butte terrace of Plumley (1948)
- Qt_1 — **Terrace deposit** - Overbank deposits of mud and sand of current floodplain. 3-7 ft (0.9-2.1 m) above Battle and Grace Coolidge creeks and L 7 Draw. Thickness less than 10 ft (3.0 m)
- Qtg — **Terrace gravel** - Clay, silt, sand, and rounded cobbles and boulders composed dominantly of Precambrian rocks. 60-180 ft (18.2-54.6 m) above present stream level. Thickness 0-40 ft (0-12.1 m)
- Qtgb — **Gravel deposit: Billover Creek drainage** - Rounded cobbles and boulders predominantly of Precambrian quartzite and quartz. 60-80 ft (18.2-24.2 m) above Billover Creek. Thickness less than 15 ft (4.5 m)
- QTg — **Gravel deposit** - Poorly consolidated, clay to boulder-sized clasts composed dominantly of Precambrian quartzite, quartz, and Paleozoic chert. 60-240 ft (18.2-72.7 m) above present stream level. Thickness less than 80 ft (24.2 m)

Disconformity

Tertiary

- Tg — **Tertiary gravel** - Poorly consolidated, clay to boulder-sized clasts composed dominantly of Precambrian quartzite, quartz, and Paleozoic chert. 380 ft (115.8 m) above present stream level. Thickness 5-10 ft (1.5-3.0 m)

Oligocene to Eocene

- Tw / Twg — **White River Group** - Ledge-forming pebble and cobble conglomerate, arkosic sandstone, and green, gray and brown mudstone, siltstone and clay with white, vuggy, and finely crystalline freshwater limestone. Fossils in basal portion of unit along Battle Creek in adjacent Hayward quadrangle are Chadronian in age (Bielstein, 2004). Maximum thickness approximately 90 ft (27.4 m)
  White River Group gilgai unit (Twg) - Brownish-gray, pebbly mudstone. Expansive clays cause gilgai ridges. Maximum thickness approximately 60 ft (18.3 m)

Angular unconformity

Cretaceous

Upper Cretaceous

- Kp — **Pierre Shale** - Medium-gray shale. A 10 ft (3.0 m) thick bentonite bed occurs about 50 ft (15.2 m) above the base. Contains ironstone concretions and fracture fillings of hematite. Campanian in age (Gries and Martin, 1985). Exposed thickness approximately 80 ft (24.2 m)
- Kn — **Niobrara Formation** - Weathers to light-gray and tan. White-speckled calcareous shale and marl, a calcareous zone of septarian concretion is present within 20 ft (6.1 m) of the upper contact. Upper contact is a semi-continous, ledge forming concretionary bed. Late Santonian to Early Campanian in age (Gries and Martin, 1985). Thickness 220 ft (67.1 m)

Disconformity

- Kc — **Carlile Shale** - Turonian to Coniacian in age (Gries and Martin, 1985). Includes the Sage Breaks Shale, Turner Sandy, and Pool Creek Shale members, but undifferentiated in cross section. Combined thickness 475 ft (144.8 m)
  - Kcs — **Sage Breaks Shale Member** - Medium-gray shale. Zones of septarian concretions occur at base and in the upper 50 ft (15.2 m). Maximum thickness approximately 200 ft (61.0 m)
  - Kct — **Turner Sandy Member** - Fine-grained, tan and orange-tan, quartz arenite, siltstone, and shale. Basal, medial, and upper zones of calcareous concretions up to 10 ft (3.0 m) in diameter of cemented sandstone form resistant ledges. The quartz arenite contains low-angle cross beds, bioturbation (including Skolithus), and pelecypod and ammonite fossils. Much of the member is poorly consolidated and forms grass-covered slopes. Thickness 110 ft (33.5 m)

Disconformity

- Kcp — **Pool Creek Shale Member** - Dark-gray, non calcareous, silty shale with layers of limestone concretions at upper contact. Dark-brown, calcareous mudstone layers occur in lower portions. Maximum thickness approximately 165 ft (50.3 m)
- Kgu — **Greenhorn Limestone (upper)** - Thin-bedded, cream to tan limestone with abundant *Mytiloides mytiloides (Mantell)* fossils (Gries and Martin, 1985) and interbedded shale. Forms ridge in southern portion of quadrangle and hill slopes north of Battle Creek. Weathers to light-gray slabs. Cenomanian to Upper Turonian in age (Cobban, 1951; Cicimurri, 2006). Thickness 54-100 ft (16.4-30.5 m)
- Kgl — **Greenhorn Limestone (lower)** - Light-gray, calcareous shale, weathers light-tan. Contains thin beds of pelecypod-bearing limestone. Middle and Upper (?) Cenomanian in age (Cicimurri, 2006). Thickness 100-200 ft (30.5-61.0 m)
- Kb — **Belle Fourche Shale** - Dark brownish-black shale. Basal 50 ft (15.2 m) contain iron-manganese concretions up to 10 ft (3.0 m) in diameter that weather to pebble-sized fragments. Cenomian in age (Gries and Martin, 1985). Thickness 180-200 ft (54.5-61.0 m)
- Km — **Mowry Shale** - Light-gray mudstone, siliceous shale and quartz arenite. Siliceous shale weathers to platy chips in lower 120-135 ft (36.4-41 m) and uppermost 30 ft (9.1 m) and contains abundant thin beds of quartz arenite and dark-gray to purple and black, iron and manganese concretionary zones. Middle portion is tan and light-orange, fine-grained, friable, micaceous, thinly laminated, well-sorted, sub-rounded, rippled, slightly calcareous, quartz arenite up to 50 ft (15.2 m) thick. Red line indicates sandstone dike up to 3 ft (1.0 m) thick. This sandstone is equivalent to the Dakota Sandstone of eastern South Dakota (Roadifer, 1962). Albian in age (Cobban, 1951). Thickness 280 ft (84.8 m)

Disconformity

Lower Cretaceous

- Knc — **Newcastle Sandstone** - White, fine-grained, muscovite-bearing, quartz arenite with low-angle crossbeds. Forms cliff and cuesta north of Highway 36. Lower several feet contain abundant clasts of charcoal. Albian in age (Gries and Martin, 1985). Equivalent to the Muddy Sandstone of Montana and Wyoming. Thickness 35-200 ft (10.6-61.0 m)

Disconformity

- Ks — **Skull Creek Shale** - Medium-gray mudstone, with abundant thin beds and lenses of fine-grained, quartz arenite and dark-brown to maroon-weathering, fine-grained concretions. Typically produces landslides in areas of steep slopes. Albian in age (Gries and Martin, 1985). Thickness 210-230 ft (63.6-69.6 m)
- Kf — **Fall River Formation** - Variegated, interbedded, very fine to fine-grained quartz arenite and mudstone. The upper sandstone is orange-tan to light-brown, typically massive, wave-rippled, and transitional to the overlying Skull Creek Shale over a few feet thickness. Fresh samples have pyrite, but the sandstone is oxidized in wells several miles downdip of the outcrop. Albian in age (Gries and Martin, 1985). Approximate thickness 150 ft (45.7 m)

Disconformity

- Kl — **Lakota Formation** - Orange-tan, light-maroon and white, fine-grained, quartz arenite and mudstone. Includes lensoid channel sandstones up to 40 ft (12.1 m) thick in variegated mudstone. The upper portion consists of light-gray, maroon, red, and brown mudstone of the Fuson Member. Approximate thickness 330 ft (100.6 m)

Disconformity

Jurassic

Upper Jurassic

- Ju — **Unkpapa Sandstone** - Buff- to orange-tan, calcareous, fine-grained, friable, silty quartz arenite. Massive with abundant cross-bedding. Only upper portion of formation is exposed within mapped area. Thickness 100-280 ft (30.0-85.3 m)
- Js — **Sundance Formation** - Shown only in cross section

Disconformity

Triassic

Lower Triassic

- TrPs — **Spearfish Formation** - Shown only in cross section

Disconformity

Permian

Upper Permian

- Pm — **Minnekahta Limestone** - Shown only in cross section

Disconformity

Lower Permian

- Po — **Opeche Shale** - Shown only in cross section

Disconformity

Pennsylvanian

Upper Pennsylvanian

- PPm — **Minnelusa Formation** - Shown only in cross section

Disconformity

Mississippian

Lower Mississippian

- Mp — **Pahasapa Limestone** - Shown only in cross section

Devonian

Upper Devonian

- MDe — **Englewood Limestone** - Shown only in cross section

Disconformity

Ordovician and Cambrian

Lower Ordivician / Upper Cambrian

- OCd — **Deadwood Formation** - Shown only in cross section

Precambrian

Lower Proterozoic

- Xu — **Undifferentiated Early Proterozoic rocks** - Shown only in cross section

FOLDS

- Anticline — Location of trace axial surface and direction of plunge. Long dashed where approximately located; dotted where concealed
- Syncline — Location of trace axial surface and direction of plunge. Dotted where concealed
- Monocline, anticlinal bend — Location of trace axial surface and direction of plunge. Shorter arrow indicates steeper beds. Dotted where concealed
- Monocline, synclinal bend — Location of trace axial surface and direction of plunge. Shorter arrow indicates steeper beds. Dotted where concealed

STRIKE AND DIP OF BEDDING

- Inclined

STRIKE AND DIP OF FRACTURES

- Inclined
- Vertical

DIP OF CONTACT

- Dip of clastic dike

OTHER FEATURES

- af — Artificial fill — Compacted earth, indicated only where extensive
- sg — Quarry — Hachure lines indicates pit outline; sg - sand and gravel
- Petroleum, ground water or uranium drill hole — Number corresponds to the drill hole name given below. Asterisk(*) indicates uranium exploration hole.
  1 Continental Oil Co. No.1 Larsen
  2 *Kerr-McGee 22-1
  3 U.S. Army Corps of Engineers
  4 U.S. Army Corps of Engineers
  5 *Rexcon BH-19
  6 *Rexcon BH-56
  Drill hole numbers 2,3,5, and 6 are shown in the cross section and are indicated with the symbol to the left