GEOLOGIC MAP OF THE SIGNAL HILL QUADRANGLE, SOUTH DAKOTA

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State of South Dakota
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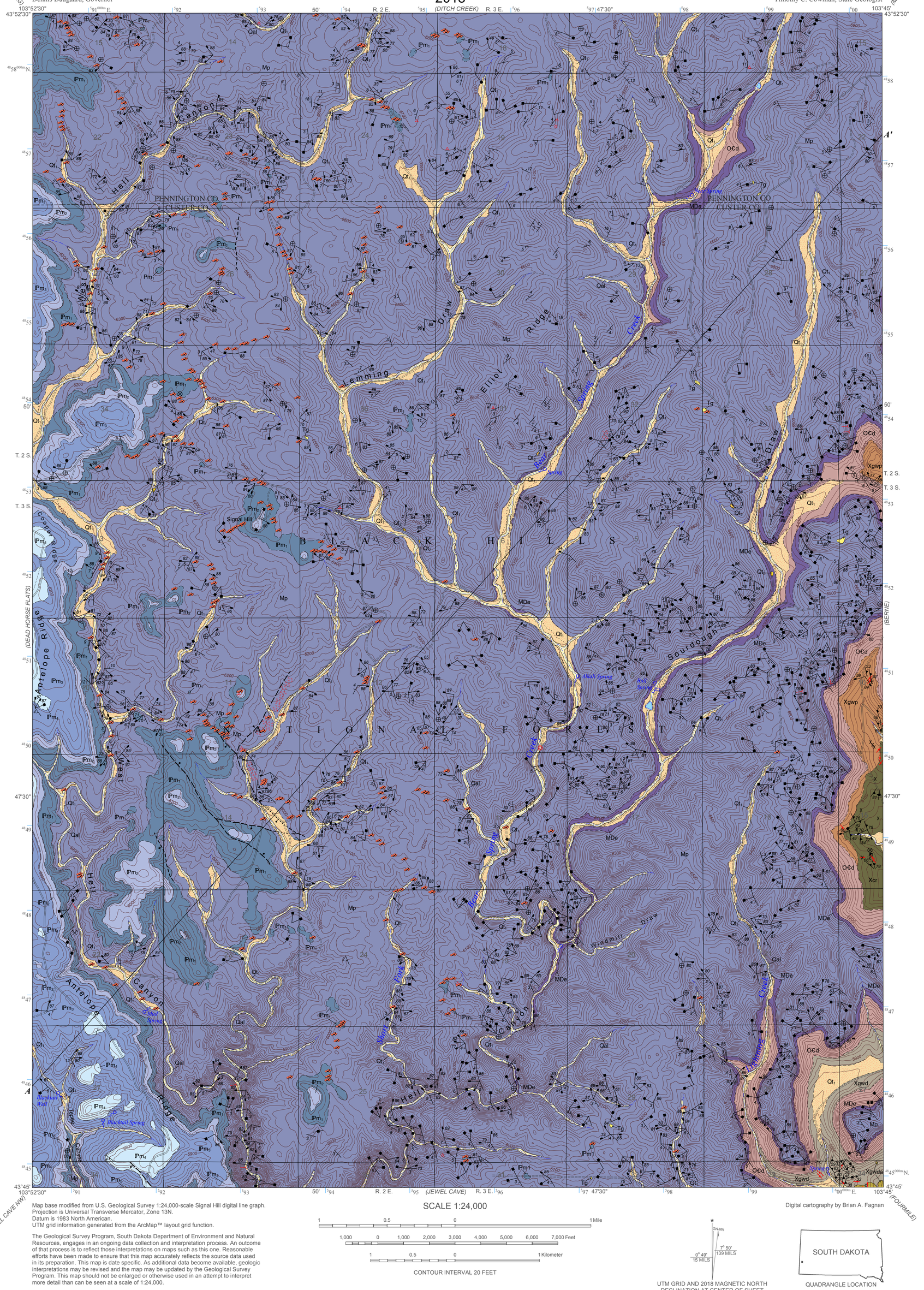
SOUTH DAKOTA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF FINANCIAL AND TECHNICAL ASSISTANCE
GEOLOGICAL SURVEY PROGRAM
7.5 MINUTE SERIES GEOLOGIC QUADRANGLE MAP 29



Map base modified from U.S. Geological Survey 1:24,000-scale Signal Hill 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, South Dakota 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

GN Mty
7° 50'
139 MILS
0° 49'
15 MILS

UTM GRID AND 2018 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SOUTH DAKOTA

QUADRANGLE LOCATION

Digital cartography by Brian A. Fagnan

EXPLANATION

QUATERNARY

- Qal — **Alluvium** - Unconsolidated to loosely consolidated, clay- to boulder-sized clasts deposited in drainages and as overbank material during floods. May include undifferentiated terrace deposits occuring 1-5 ft (0.3-1.5 m) above stream level. Indicated by brackets on cross section where too thin to show
- Qt_1 — **Terrace deposit 1** - Unconsolidated to loosely consolidated, clay- to boulder-sized clasts, sub-rounded to rounded. Deposited up to 20 ft (6.1 m) above alluvium. Indicated by brackets on cross section where too thin to show
- Qt_2 — **Terrace deposit 2** - Unconsolidated to loosely consolidated, clay- to boulder-sized clasts, sub-rounded to rounded. Deposited 20-60 ft (6.1-18.3 m) above alluvium
- Qt_3 — **Terrace deposit 3** - Unconsolidated to loosely consolidated, clay- to boulder-sized clasts, sub-rounded to rounded. Deposited 60-160 ft (18.3-48.8 m) above alluvium

TERTIARY

- Tg — **Gravel deposit** - Unconsolidated to loosely consolidated, clay- to boulder-sized clasts, sub-rounded to rounded. Deposits could be equivalent to the White River Group. Deposited 160 ft (48.8 m) above alluvium

Unconformity

PENNSYLVANIAN — Upper Pennsylvanian

- Pm_4 — **Minnelusa Formation (unit 4)** - Dolomite interbedded with sandstone and laminated limestone. Brownish- to grayish-yellow. At the base is a light-red to grayish-yellow, calcareous, medium- to coarse-grained sandstone, 1-5 ft (0.3-1.5 m) thick. Dolomitic beds commonly contain manganese oxide dendrites. Unit weathers to colluvial slopes. Exposed thickness approximately 40 ft (12.2 m)
- Pm_3 — **Minnelusa Formation (unit 3)** - Locally silicified sandstone interbedded with shale. Silicified conglomerate near base. Brownish- to grayish-yellow. Poorly exposed, except for silicified outcrops, and weathers to colluvial slopes. Estimated thickness is 80-120 ft (24.4-36.6 m)
- Pm_2 — **Minnelusa Formation (unit 2)** - Limestone, thin bedded, Yellowish-gray to light-gray. Contains distinctive red and white chert nodules, especially near the top. Limestone beds are up to 2 ft (0.6 m) thick and interbedded with sandstone and shale layers as much as 0.5 ft (0.15 m) thick. Poorly exposed. Estimated thickness is 35-50 ft (10.6-15.2 m)
- Pm_1 — **Minnelusa Formation (unit 1)** - Sandstone, grayish-yellow to moderate-red, medium- to coarse-grained, cross-bedded. Overlain by a grayish-yellow to moderate-red, fine-grained siltstone which is compensatory in thickness with the sandstone. Unit is poorly exposed and weathers to colluvial slopes. Estimated thickness is 60-80 ft (18.3-24.4 m)

Disconformity

MISSISSIPPIAN — Lower Mississippian

- Mp — **Pahasapa Limestone** - Limestone and dolomite, yellowish-gray to light-gray, with thin lenses of moderate-brown to light-gray chert. Thick- to very thick-bedded. Forms prominent cliffs that weather to dark-gray. Contains rugose corals and spiriferid brachiopods. Vuggy, with caves and solution breccia, dominantly in the upper one-third of the formation. Upper contact is an irregular paleokarst surface with a terra rossa horizon. Approximate thickness 400 ft (131.1 m)

DEVONIAN — Upper Devonian

- MDe — **Englewood Limestone** - Argillaceous limestone, dolomite, and shale. Grayish-pink, light-gray, to grayish-purple. Laminated to thin-bedded, finely to medium crystalline. Bioturbated, locally containing crinoid columnals, brachiopods, and bryozoa. Estimated thickness 35-45 ft (10.7-13.7 m)

Disconformity

ORDOVICIAN — Lower Ordovician

CAMBRIAN — Upper Cambrian

- O€d — **Deadwood Formation** - Uppermost part is composed of *Skolithos*-bearing, heavily iron-stained, quartz arenite overlying greenish- to reddish-brown, laminated to thick-bedded glauconitic sandstone, shale, limestone, and intraformational conglomerate. Local basal conglomerate. Estimated thickness 160-185 ft (48.8-56.4 m)

Nonconformity

PRECAMBRIAN — Early Proterozoic

- Xgwd / Xgwda — **Mayo Formation** - **Xgwd** - Quartz-biotite-muscovite schist. Light- to dark-gray, medium- to coarse-grained. Very thin- to thin-bedded, with thick-bedded quartzose units. Some beds have fine laminations. Garnets occur locally. Protolith is distal graywacke. **Xgwda** - Dark greenish-gray to black sills of amphibolite composed of approximately 50% hornblende and 45% plagioclase, with 5% sphene and magnetite. Sills are medium to coarsely crystalline, with hornblende phenocrysts to 5 mm in diameter, and have a speckled appearance. Protolith is gabbro intrusions
- Xcr — **Crow Formation** - Hornblende-plagioclase amphibolite, actinolite-chlorite schist, hornblende-plagioclase-calcite gneiss, diopside-hornblende-plagioclase gneiss, minor biotite-microcline schist, and a laminated quartzite typically near the top of the formation. Dark greenish-black to black. Actinolite-chlorite schists are derived from basaltic komatiite with MgO ranges between 15 and 22 weight% and normative olivine and hypersthene. Hornblende-plagioclase amphibolites are derived from basaltic komatiites and basalts, with equal abundances of olivine- and hypersthene-normative compositions. Protolith of the hornblende-plagioclase and actinolite-chlorite units is interpreted as volcanic flows, and the gneisses and biotite-mircocline schist interpreted as tuff or pyroclastic rock (Lincoln and Lincoln, 2017)
- Xgwp — **Bugtown Formation** - Quartz-mica-feldspar schist. Moderate-gray to dark brownish-gray, medium-grained. Thin- to thick-bedded with thin interbedded quartz-mica schist, and local thin meta-iron-formation. Thin, discontinuous lenses of quartz-mica-schist occur in the lower part of the formation. Calc-silicate concreations are abundant in thicker, typically Bouma A beds (Redden, 1968). Protolith is proximal graywacke
- Xu — **Undifferentiated Precambrian rocks** - Shown only in cross section

CONTACTS

Long dashed where approximately located; short dashed where inferred; dotted where concealed

FAULTS

Long dashed where approximately located; short dashed where inferred; dotted where concealed. Bar and ball on downthrown side

BEDDING

- 36 — Inclined
- Horizontal

FRACTURES

- 85 — Inclined
- Vertical
- 35 / 65 — Multiple
  Point of observation at join of strike lines

METAMORPHIC FOLIATIONS

- 85 — Inclined
- Vertical

MINERAL LINEATION

- 85 — Inclined

QUARTZ VEIN

KARST FEATURES

- Cave
- Stream loss zone
- Breccia pipe
- Breccia zone

CONCRETION

- Silicified carbonate concretions
  Pale reddish- to light-brown with banding. Size up to 2.5 ft (0.8 m) in diameter. Some contain fossil fragments, or have a moldic texture from dissolution of fossil fragments. Typically associated with the Pahasapa Limestone and Minnelusa Formation contact. Some may have been transported or are letdown deposits

OTHER FEATURES

- Quarry boundary
- Quarry
- Abandoned quarry
- Shaft
- Trench
- Group of prospect pits
- x — Prospect pit

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Historic covered cave entrance in the Pahasapa Limestone.

Silicified carbonate concretions showing fossil fragments and moldic texture.

Clast of Harney Peak Granite, approximately 3 inches across, in the basal sandstone of the Deadwood Formation.