South Dakota Department of Environment & Natural Resources Geological Survey

Geologic Map of the Rochford Quadrangle, South Dakota

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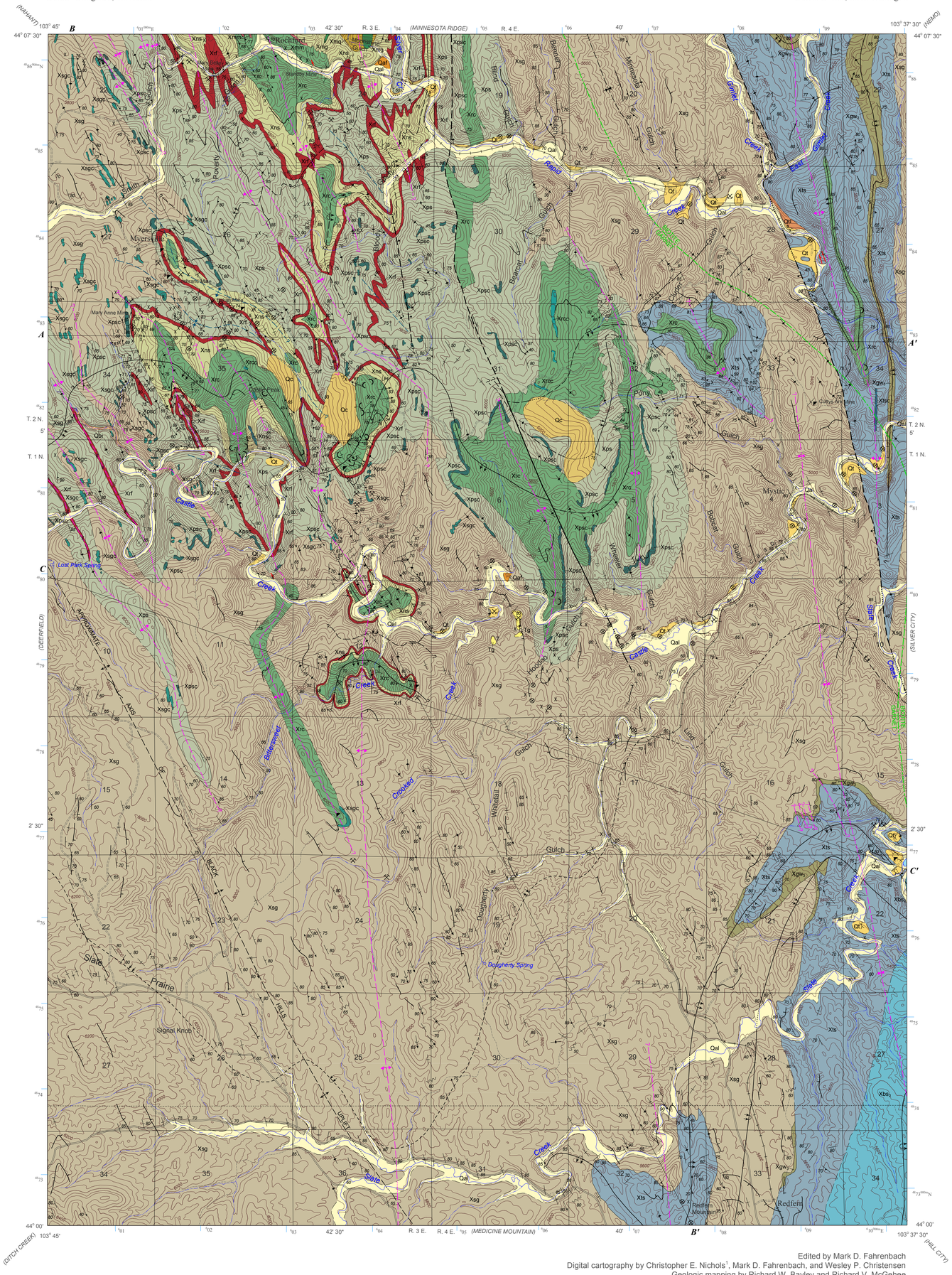
2015

State of South Dakota
Dennis Daugaard, Governor

South Dakota Geological Survey
Derric L. Iles, State Geologist



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Digital cartography by Christopher E. Nichols[1], Mark D. Fahrenbach, and Wesley P. Christensen
Geologic mapping by Richard W. Bayley and Richard V. McGehee

Map base modified from U.S. Geological Survey 1:24,000-scale Rochford 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. 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 40 Feet

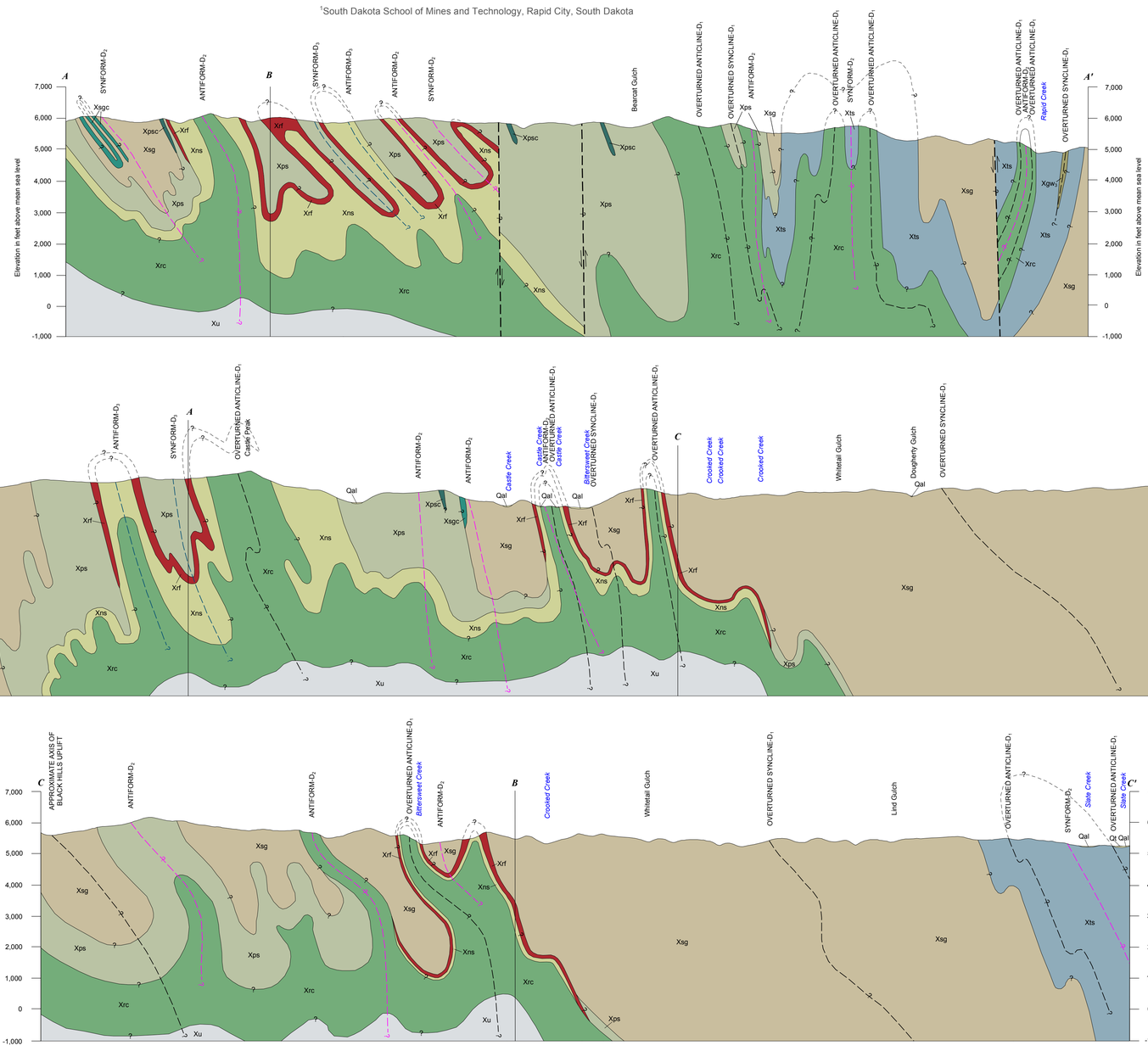
NORTH

UTM GRID AND 2014 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

South Dakota

Quadrangle location

[1]South Dakota School of Mines and Technology, Rapid City, South Dakota



Department of Environment and Natural Resources
Division of Financial and Technical Assistance
Geological Survey Program
7.5 Minute Series Geologic Quadrangle Map 25

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

EXPLANATION

Quaternary

- **Qal** — **Alluvium** - Unconsolidated to loosely consolidated; clasts to boulder-size. Deposited in present-day drainages and on flood plains
- **Qt** — **Terrace deposit** - Unconsolidated to loosely consolidated, angular to rounded, clay to boulder-size clasts. Typically less than 15 ft (4.6 m) thick
- **Qc** — **Colluvium** - Unconsolidated, poorly sorted, angular to sub-rounded rock debris with soil locally deposited along steep slopes
- **Qtl** — **Talus deposit** - Locally derived, unconsolidated, poorly sorted angular rock debris deposited along steep slopes of resistant rock units. Typically devoid of soil or vegetation
- **Qaf** — **Alluvial fan** - Unconsolidated to loosely consolidated, clay to boulder-size clasts deposited at the mouths of drainages
- **Qbi** — **Bog iron deposit** - Consolidated, angular rock debris to boulder-size cemented by iron-oxides. Typically forms from seeps and springs associated with sulphide-bearing rocks. Occurs approximately 1.5 mi (2.4 km) west of Castle Peak

Tertiary

- **Tg** — **Gravel deposit** - Unconsolidated to loosely consolidated, angular to rounded, clay to boulder-size clasts. Occurs approximately 350-400 ft (106.7-121.9 m) above present-day Castle Creek. Typically less than 10 ft (3.0 m) thick

Unconformity

Precambrian

Early Proterozoic

- **Xsg / Xsgc** — **Swede Gulch Formation** - Gray to black slate, phyllite, schist or metagraywacke. In part, garnetiferous at higher metamorphic grade. Locally carbon-rich and contains sulfide minerals. Lower graphitic portion probably grades into the Poverty Gulch Slate (Xps) (Bayley, 1972). Has well developed, thin compositional layering and schistosity with an increase in graphitic content away from amphibolite contacts (Atkinson, 1976). Xsgc - One to two beds of massive streaky ferruginous metachert interbedded with graphitic slate and schist occurring in lower portion of the formation. The Swede Gulch Formation is equivalent to the Grizzly Formation of the northern Black Hills

Unconformity

- **Xgw_3** — **Metagraywacke unit 3** - Tan to gray, thick- to thin-bedded, quartzose schist and phyllite. Calcareous and calc-silicate concretions occur locally in quartz-rich Bouma A beds. Protolith is proximal graywacke with minor shale interbeds
- **Xmg** — **Metagabbro** - Grayish-green to greenish-black amphibolite and chloritic amphibolite schist. Medium-grained except where sheared or well foliated. Composed of plagioclase, hornblende, biotite, and calcite. Protolith is gabbro
- **Xps / Xpsc / Xpsc / Xtsc / Xts** — **Poverty Gulch Slate (Xps)** - Dark-brown to black, laminated slate, phyllite, and interbedded black graphitic slate and schist. Alternate laminae commonly contain abundant small garnets. Xpsc - Ferruginous metachert. The Poverty Gulch Slate is laterally equivalent to the Tenderfoot Formation (Xts)
  Tenderfoot Formation (Xts) - Green to silver-gray, thin-bedded, phyllite and schist. Typically has accessory magnetite and ilmenite, locally with malachite-stained muscovite-rich schist and thin spessartine-bearing beds. Includes some metagraywacke beds which increase in abundance to the north, and cannot be distinguished from adjacent metagraywacke units approximately 0.6 mi (1 km) north of the quadrangle (Redden and DeWitt, 2008). Xtsc - Ferruginous metachert. Formation is equivalent to ash flow tuffs in Rochford area which have a Pb-Pb zircon age of 1.88 Ga (Redden et al, 1990). Laterally equivalent to the Poverty Gulch Slate (Xps). Protolith of formation is seafloor weathered volcanic tuff, flows, and volcaniclastic rocks
- **Xbs_2** — **Biotite schist and phyllite** - Gray, black, and tan, thin-bedded schist and phyllite with thin metagraywacke beds. Some beds may be rich in garnet, graphite, or pyrite. Unit changes facies to the southeast in the Hill City quadrangle where metagraywacke subunits are inferred to be equivalent to Metagraywacke unit 2 (Xgw_2). Equivalent to part of the Oreville Formation (Xo) (Redden and DeWitt, 2008). Protolith is black shale and pelite
- **Xrf** — **Rochford Formation** - Thin- to thick-bedded ferruginous metachert containing rosettes of cummingtonite-grunerite, chlorite, and minor garnet. Upper and lower contacts conformable (Bayley, 1972). Referred to as the "Upper Iron-Formation" by Weissenborn (1987). Frei (2008) assigns a maximum age of approximately 1,880 Ma. Lithologically similar to the Montana Mine Formation, and the Homestake Formation of the northern Black Hills
- **Xns / Xnsc** — **Nahant Schist** - Black graphitic slate and schist. Bedding inconspicuous. Intertongues with the Rapid Creek Greenstone (Xrc) (Bayley, 1972). Xnsc - Ferruginous metachert. Protolith of formation is carbonaceous black shale
- **Xmm** — **Montana Mine Formation** - Thin- to thick-bedded ferruginous metachert unit containing rosettes of cummingtonite-grunerite, chlorite, and minor garnet (Bayley, 1972). $^{207}Pb/^{206}Pb$ dating of zircon in an interbedded felsic tuff gave an age of 1,884 +/- 29 Ma (Redden and others, 1990). Lithologically similar to the Rochford Formation (Xrf)
- **Xrc / Xrcc** — **Rapid Creek Greenstone** - Green, greenish-gray, to black, massive metabasalt, schistose calcareous mafic tuff, agglomerate, and weakly foliated amphibolite with abundant actinolite. Intertongues with the Nahant Schist (Xns) (Bayley, 1972). Xrcc - Ferruginous metachert. Protolith of formation is pillowed basalt flows
- **Xmq** — **Moonshine Gulch Quartzite** - Dark-gray to nearly black, thin- to thick-bedded vitreous quartzite, and gray- and black-banded micaceous and graphitic slate. Medium- to coarse-grained, sub-rounded to rounded, moderately to poorly sorted, with silica cement. Some beds are graded. Pyrite occurs as disseminated grains. Inferred to have intertonguing with adjacent Nahant Schist (Xns). Equivalent to the Ellison Formation of the northern Black Hills (Bayley, 1972)
- **Xu** — **Early Proterozoic rocks (undifferentiated)** - Shown only in cross section

Contact

Long dashed where approximately located; short dashed where inferred; queried where uncertain

FAULTS

Fault — Long dashed where approximately located; dotted where concealed; queried where uncertain. Arrows indicate lateral movement; bar and ball on downthrown side

FOLDS (Laramide)

Anticline — Showing approximate main axis of Black Hills uplift trace of axial surface. Long dashed where approximately located; dotted where concealed

FOLDS (Early Proterozoic)

D_1 FOLDS

- **Anticline** — Showing location of trace of axial surface. Long dashed where approximately located; dotted where concealed; queried where uncertain
- **Syncline** — Showing location of trace of axial surface. Long dashed where approximately located; dotted where concealed; queried where uncertain
- **Overturned anticline** — Showing location of trace of axial surface and dip direction of limbs. Long dashed where approximately located; dotted where concealed; queried where uncertain
- **Overturned syncline** — Showing location of trace of axial surface and dip direction of limbs. Long dashed where approximately located; dotted where concealed; queried where uncertain

D_2 FOLDS

- **Antiform** — Showing location of trace of axial surface. Long dashed where approximately located; dotted where concealed; queried where uncertain
- **Synform** — Showing location of trace of axial surface. Long dashed where approximately located; dotted where concealed; queried where uncertain
- **Undifferentiated** — Showing general trace of axial surface. Long dashed where approximately located; dotted where concealed; queried where uncertain. May be anticlinal or synclinal dependent on stratigraphic sequence

D_3 FOLDS

- **Antiform** — Showing location of trace of axial surface. Long dashed where approximately located; queried where uncertain
- **Synform** — Showing location of trace of axial surface. Long dashed where approximately located; queried where uncertain
- **Undifferentiated** — Showing general trace of axial surface. Long dashed where approximately located; queried where uncertain. May be anticlinal or synclinal dependent on stratigraphic sequence

STRIKE AND DIP OF BEDDING

- Inclined
- Crenulated
- Vertical
- Overturned
- Top of bed — Shown by sedimentary structures
- Top direction of lava pillow

STRIKE AND DIP OF FOLIATION

- Inclined
- Vertical

LINEAR STRUCTURES

- **Lineation** — Showing bearing and plunge. Indicated by mineral orientation
- **Small anticline** — Showing bearing and plunge. Predominantly of D_2 age
- **Small syncline** — Showing bearing and plunge. Predominantly of D_2 age
- Quartz vein
- **Form line** — Generally inferred; based on bedding attitudes, associated folds, and aerial photo interpretation
- GARNET / BIOTITE — Metamorphic isograd
- Open pit mine or placer dredging tailings outline
- Mine tailings
- Open pit mine or glory hole
- Placer mine
- Mine shaft
- Mine adit or cave
- Trench
- Group of prospect pits
- Prospect pit

Index to sources of geologic data

(letters correspond to those listed in Selected References)

Acknowledgements

We wish to thank the West Dakota Water Development District for their financial support. Mark D. Fahrenbach and Brian A. Fagnan (Geological Survey Program, Department of Environment and Natural Resources) assisted with mapping of surficial deposits and mining excavations.

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