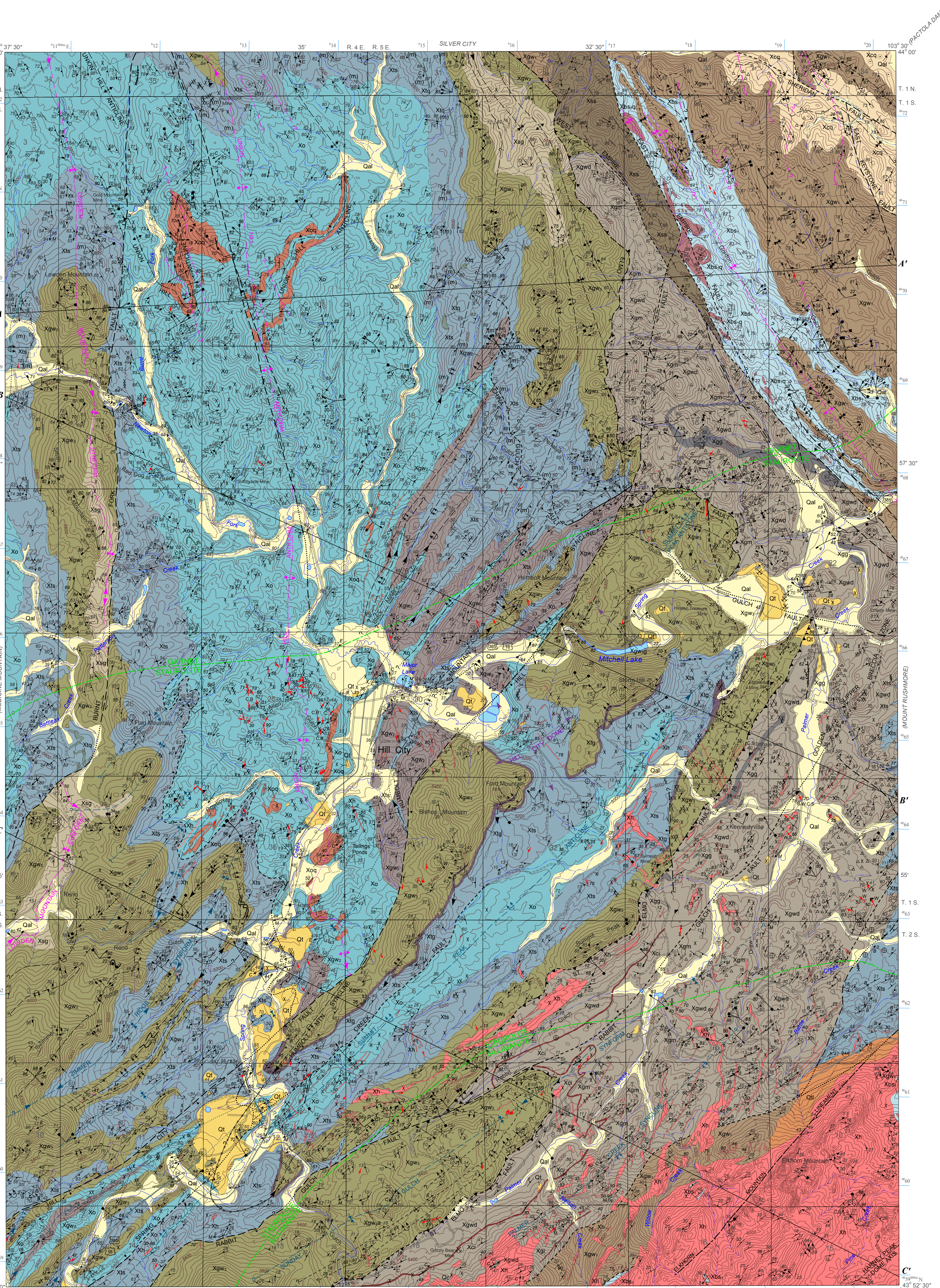


Geologic Map of the Hill City Quadrangle, South Dakota

By
J.A. Redden and N. Uzunlar
2017

State of South Dakota
D. Daugaard, Governor

South Dakota Geological Survey
Derric L. Iles, State Geologist



Geology by J.C. Ratte (1959-1962) and R.G. Wayland (1954-1957)
Digital Cartography by Emily S. Beck, M.D. Fahnenbach, and L. R. Rostand
Edited by M.D. Fahnenbach

Map base modified from U.S.G.S. 1:24,000-scale Hill City quadrangle digital line graph.
Projection is Universal Transverse Mercator, Zone 13 N.
Datum is 1983 North American.

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 the 1:24,000 scale.

SCALE 1:24,000

CONTOUR INTERVAL 40 FEET

South Dakota
Quadrangle location

EXPLANATION

Quaternary	Qal Alluvium - Unconsolidated to loosely consolidated; clasts to boulder-size. Deposited in present-day stream drainages. Estimated maximum thickness 40 ft (12.2 m)	Qt Terrace deposit - Unconsolidated to loosely consolidated; clasts to boulder-size. Deposited up to 200 ft (61.9 m) above present-day streams. Estimated maximum thickness 25 ft (7.6 m)	Qtd Talus deposit - Locally derived, large angular blocks of Harney Peak Granite. Typically devoid of soil or tree cover	
Precambrian	Xh Harney Peak Granite - Albitic-muscovite granite; locally pegmatitic. Includes fine-grained layered granitic bodies, with compositional layering common in larger masses. Age 1.715 Ga (Redden and others, 1990). Arrow indicates contact dip direction and amount. Z - zoned pegmatite. Flare minerals identified in some of the zoned pegmatites include: B-beryl, C-cassiterite, M-sheet mica, Sp-spodumene	Xsg Swede Gulch Formation - Slate and phyllite, gray, black, and greenish-tan. Thin to medium-bedded. Thin subunits are commonly graphitic and pyrrhotite-bearing. Protolith is shale	Xgwm Metagraywacke unit 3 - Quartzose schist, tan, thick-bedded. Calc-silicate concretions occur in proximal Bouma A beds. Unit pinched west and northwest of the quadrangle. Originally included as the Zimmer Ridge member of the Oreville Formation by Ratte and Wayland (1969). Protolith is proximal graywacke with minor shale interbeds. Xgwa - Thin lenses of coarse-grained amphibole- and pyroxene-bearing calc-silicate rocks, black and white banded metachert, and graphitic quartz schist less than 1 ft (3 m) thick. Protolith is dominantly carbonate facies non-foliation	
	Xtg Tenderfoot Formation - Dominantly muscovite phyllite and muscovite schist at lower metamorphic grade where magnetite octahedra (m) and pyrite metacrystals up to 0.5 in (1.25 cm) across occur in local zones as much as a few tens of feet thick. Staurolite, sillimanite, and andalusite are typically abundant at higher metamorphic grades. Xtp - Thin-bedded, quartz-biotite-garnet schist beds that occur along the upper contact of Xts and resembles the Oreville Formation. Xtz - Quartzose metagraywacke lenses and beds locally traceable for hundreds of feet. The Tenderfoot Formation (Xtg) was originally described as the mica schist unit in the Tenderfoot Gulch of the Berne quadrangle (Redden, 1985) where the unit is now mined as a source of industrial mica. Where traced into the Rockford quadrangle, the unit has volcanic tuff, flows, and volcanoclastic rocks, and is interpreted to be a part of a sea-floor weathered tuff. The unit was originally included in the Oreville Formation (Ratte and Wayland, 1969) but is here separated out and given a formal name because of its widespread stratigraphic significance	Xgwm2 Metagraywacke unit 2 - Quartzose schist and phyllite, tan to gray, thick to thin-bedded. Calciferous and calc-silicate concretions occur locally in thick quartz-rich proximal Bouma A beds. The unit lenses out to the northwest and southeast but is well exposed near Hill City where it is lithologically identical to Xgwm, and lithologically similar to Xgwm. Isolated body of Xgwm at the head of China Gulch that is nearly surrounded by Xts is interpreted to be a large slump block, but it may have been offset by unrecognized faults. Protolith is proximal to medial graywacke	Xoa Oreville Formation - Dominantly gray to nearly black, thin-bedded biotite-garnet schist, and gray to tan quartz-mica schist. Graphite- or carbon-rich beds and pyrite metacrystals are locally common at lower metamorphic grade. Equivalent to Xob, on adjacent quadrangles. Most of the unit has a protolith of black shale which grades to distal turbidites when traced into the Silver City quadrangle. Xoc - Quartzose metagraywacke schist lenses and subunits. These beds are characteristic of the original description by Ratte and Wayland (1969). Xod - Amphibole rock in beds a few inches thick. Occurs locally in the Oreville Formation throughout the quadrangle, but shown only where it outlines small folds northwest of Hill City	
	Xgwd Metagraywacke (distal) - Quartz-mica schist, quartzose schist, and aluminous schist. Includes unmapped subunits approximately 33-230 ft (10.1-70.1 m) thick of former distal to proximal graywacke, shale, and debris flow material as well as locally derived conglomerate and arkosic grit reservoir and debris flow deposits. Triangles (+) indicate local areas containing lenses of debris flow deposits. Circles (-) indicate areas of metaconglomerate interbeds. May be equivalent to unit Xoc in the northeast part of the quadrangle. Protolith is distal graywacke deposits. Xgm - Locally mapped 10-40 ft (3.0-12.2 m) thick beds of metagrit grading to pebbly metaconglomerate. Xca - Thin amphibole beds and metachert probably derived from carbonate facies iron-formation. Xgg - Graphitic or carbon-rich schist locally containing tourmaline which indicate the unit in part may represent zones of alteration	Xss Schist and phyllite - Schist and phyllite, gray to tan, thin- to medium-bedded. Protolith is shale and siltstone with lenses of distal graywacke	Xcq Metaconglomerate, quartzite, and metapelite - Schist, quartzite, and metaconglomerate of mainly quartzite clasts in a pelitic matrix. Gray, dark-gray, and tan, typically thin- to thick-bedded. Includes subunits of metagraywacke which increase in abundance in a general northerly direction and quartzite decrease. May be equivalent to part of unit Xgwm in the northeast part of the quadrangle. Protolith is debris flow deposits	
	Xgw Metagraywacke unit 1 - Quartzose schist to mica schist, tan to gray. Proximal portions are dominantly thick Bouma A beds. The Xgw, adjacent to the Harney Peak Granite in the southeast portion of the quadrangle, as well as on the Mount Rushmore quadrangle, may be equivalent to Xgwm. Protolith is proximal to medial graywacke	Xbs Biotite-garnet schist and biotite schist - Biotite-rich schist with more massive quartzose beds. Thin-bedded, fine- to medium-grained, locally graphitic. Also occurs as inliers in the Harney Peak Granite. Xbs - Quartzose metagraywacke schist lenses. Formation may be equivalent to the Loues Formation at Bear Mountain on the Medicine Mountain quadrangle, and the Reausaw Slate of Bayley (1972). Protolith is black shale	FAULTS Contact: Long dashed where approximately located; short dashed where inferred; dotted where concealed or where projected above land surface in cross section; queried where uncertain. Arrow indicates dip direction and amount. Form line: Triangles indicate dip direction of beds. Fault: Long dashed where approximately located; short dashed where inferred; dotted where concealed or where projected above land surface in cross section; queried where uncertain. Bar and ball on downthrown side. Arrows indicate block movement. Triangles indicate dip direction and amount. Thrust Fault: Long dashed where approximately located; short dashed where inferred; dotted where concealed or where projected above land surface in cross section; queried where uncertain. Sawtooth on overthrusting plate. Lineament or probable fault: Marked by topographic lineament on map and on aerial photograph.	FOLDS (Early Proterozoic) D ₁ Folds: Initial plunge angles are believed to be low but were locally modified to much steeper angles by later folding which may also wipe the fold. The values larger D ₁ folds shown in Xgwm along the northeast part of the Summit Peak anticline have not been field checked but are inferred to exist. Large D ₁ folds likely exist in other sizeable areas unvisited by Xgwm. Anticline: Showing generalized trace of the axial plane and approximate direction of plunge. Long dashed where approximately located; short dashed where inferred; dotted where concealed; queried where uncertain. Syncline: Showing generalized trace of the axial plane and approximate direction of plunge. Long dashed where approximately located; short dashed where inferred; dotted where concealed; queried where uncertain. Overturned anticline: Showing generalized trace of the axial plane and dominant dip direction of limbs. Long dashed where approximately located; short dashed where inferred; dotted where concealed; queried where uncertain. Overturned syncline: Showing generalized trace of the axial plane and dominant dip direction of limbs. Long dashed where approximately located; short dashed where inferred; dotted where concealed; queried where uncertain. D ₂ Folds: North-northeast-trending folds reformed by folding of D ₁ structures during earliest metamorphism and prior to emplacement of Harney Peak Granite. Northeast of the East Empire fault, D ₂ folds trending northeast-southwest may be younger than other D ₂ folds. Minor D ₂ folds have clearly reformed earlier D ₁ folds but the relative age of larger structures is uncertain. Trends of D ₂ folds may be modified by younger northeast-trending folds which are not shown separately. Antiform: Showing generalized trace of the axial plane and direction of plunge. Long dashed where approximately located; short dashed where inferred; dotted where concealed; queried where uncertain. Synform: Showing generalized trace of the axial plane and direction of plunge. Long dashed where approximately located; short dashed where inferred; dotted where concealed; queried where uncertain. Undifferentiated fold: Showing generalized trace of the axial plane and direction of plunge. Long dashed where approximately located; short dashed where inferred; dotted where concealed; queried where uncertain. D ₃ Folds: Minor, largely northerly-trending cross folds in the southwest portion of the quadrangle which deform D ₂ and earlier folds. A small domal structure occurs approximately 1 mile (1.7 km) east of Hill City. The dome and the D ₃ cross folds are believed to be related to the emplacement of the Harney Peak Granite, but at a somewhat younger age than the larger D ₂ folds. Cross fold: Showing generalized trace of the axial plane and direction of plunge. Long dashed where approximately located; short dashed where inferred; dotted where concealed; queried where uncertain. Dome: Long dashed where approximately located; dotted where concealed.

STRIKE AND DIP OF BEDDING

— 30°	Inclined
— 45°	Inclined
— 60°	Inclined
— 75°	Inclined
— 90°	Vertical
— 105°	Vertical
— 120°	Vertical
— 135°	Vertical
— 150°	Vertical
— 165°	Vertical
— 180°	Horizontal
— 195°	Horizontal
— 210°	Horizontal
— 225°	Horizontal
— 240°	Horizontal
— 255°	Horizontal
— 270°	Horizontal
— 285°	Horizontal
— 300°	Horizontal
— 315°	Horizontal
— 330°	Horizontal
— 345°	Horizontal
— 360°	Horizontal

STRIKE AND DIP OF FOLIATION

— 30°	Inclined
— 45°	Inclined
— 60°	Inclined
— 75°	Inclined
— 90°	Vertical
— 105°	Vertical
— 120°	Vertical
— 135°	Vertical
— 150°	Vertical
— 165°	Vertical
— 180°	Horizontal
— 195°	Horizontal
— 210°	Horizontal
— 225°	Horizontal
— 240°	Horizontal
— 255°	Horizontal
— 270°	Horizontal
— 285°	Horizontal
— 300°	Horizontal
— 315°	Horizontal
— 330°	Horizontal
— 345°	Horizontal
— 360°	Horizontal

STRIKE AND DIP OF LAYERING IN HARNEY PEAK GRANITE

— 30°	Inclined
— 45°	Inclined
— 60°	Inclined
— 75°	Inclined
— 90°	Vertical
— 105°	Vertical
— 120°	Vertical
— 135°	Vertical
— 150°	Vertical
— 165°	Vertical
— 180°	Horizontal
— 195°	Horizontal
— 210°	Horizontal
— 225°	Horizontal
— 240°	Horizontal
— 255°	Horizontal
— 270°	Horizontal
— 285°	Horizontal
— 300°	Horizontal
— 315°	Horizontal
— 330°	Horizontal
— 345°	Horizontal
— 360°	Horizontal

STRIKE AND DIP OF FRACTURES

— 30°	Inclined
— 45°	Inclined
— 60°	Inclined
— 75°	Inclined
— 90°	Vertical
— 105°	Vertical
— 120°	Vertical
— 135°	Vertical
— 150°	Vertical
— 165°	Vertical
— 180°	Horizontal
— 195°	Horizontal
— 210°	Horizontal
— 225°	Horizontal
— 240°	Horizontal
— 255°	Horizontal
— 270°	Horizontal
— 285°	Horizontal
— 300°	Horizontal
— 315°	Horizontal
— 330°	Horizontal
— 345°	Horizontal
— 360°	Horizontal

LINEAR STRUCTURES

Lineation:
B - intersection of bedding and other S planes
C - axis of strike or very small fold
F - folding or major structure in massive rocks
M - material orientation or stretching
O - fold or other structure in bedding or fault
W - trend wip in bedding or foliation

Minor folds:
Small anticline: Showing bearing and plunge
Small syncline: Showing bearing and plunge
Right rotation: Showing bearing and plunge
Left rotation: Showing bearing and plunge
Horizontal: Showing bearing

Strike and dip of axial planes of minor folds:
Inclined: Showing type, bearing, and plunge
Horizontal: Showing type and bearing
Vertical: Showing type and bearing
Multiple: Multiple orientations at one locality

Quartz Vein: Veins range from virtually pure quartz veins to those having a generalized selvage containing muscovite, cassiterite, and beryl. Some veins probably predate Harney Peak Granite and are related to the regional metamorphism. Arrow indicates dip direction and amount; tri indicates vertical dip. Associated minerals include:
A - andalusite
B - beryl
C - cassiterite
S - sulfide
W - tungsten minerals

Metamorphic isograd:
Breccia zone: Areas of interlayered competent and incompetent metamorphic rocks where the competent layers have been sheared into breccia and pseudoconglomerate. Associated with the Golden Slipper breccia zone.
Silicified zone: Associated with the Golden Slipper breccia zone.

Open pit mine or glory hole
Placer pit
Mine shaft and tailings
Mine adit
Trench
Prospect pit

Publication Date: June 30, 2017

Acknowledgements
Original geologic mapping was done by J.C. Ratte and R.G. Wayland (1969) of the U.S. Geological Survey, who initially determined the division of rock units, contacts, geologic attitudes, as well as some of the major folds and faults. J.A. Redden of the South Dakota School of Mines and Technology revised the stratigraphic sequence, determined relative fold ages, and modified geologic contacts in many areas. Additional fracture data and geologic attitudes are from N. Uzunlar, also from the South Dakota School of Mines and Technology. The West Dakota Water Development District, Rapid City, South Dakota, and the South Dakota Geological Survey provided some financial support for current mapping. We would like to thank the many South Dakota landowners who have allowed access to their properties.

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