WYOMING STATE GEOLOGICAL SURVEY
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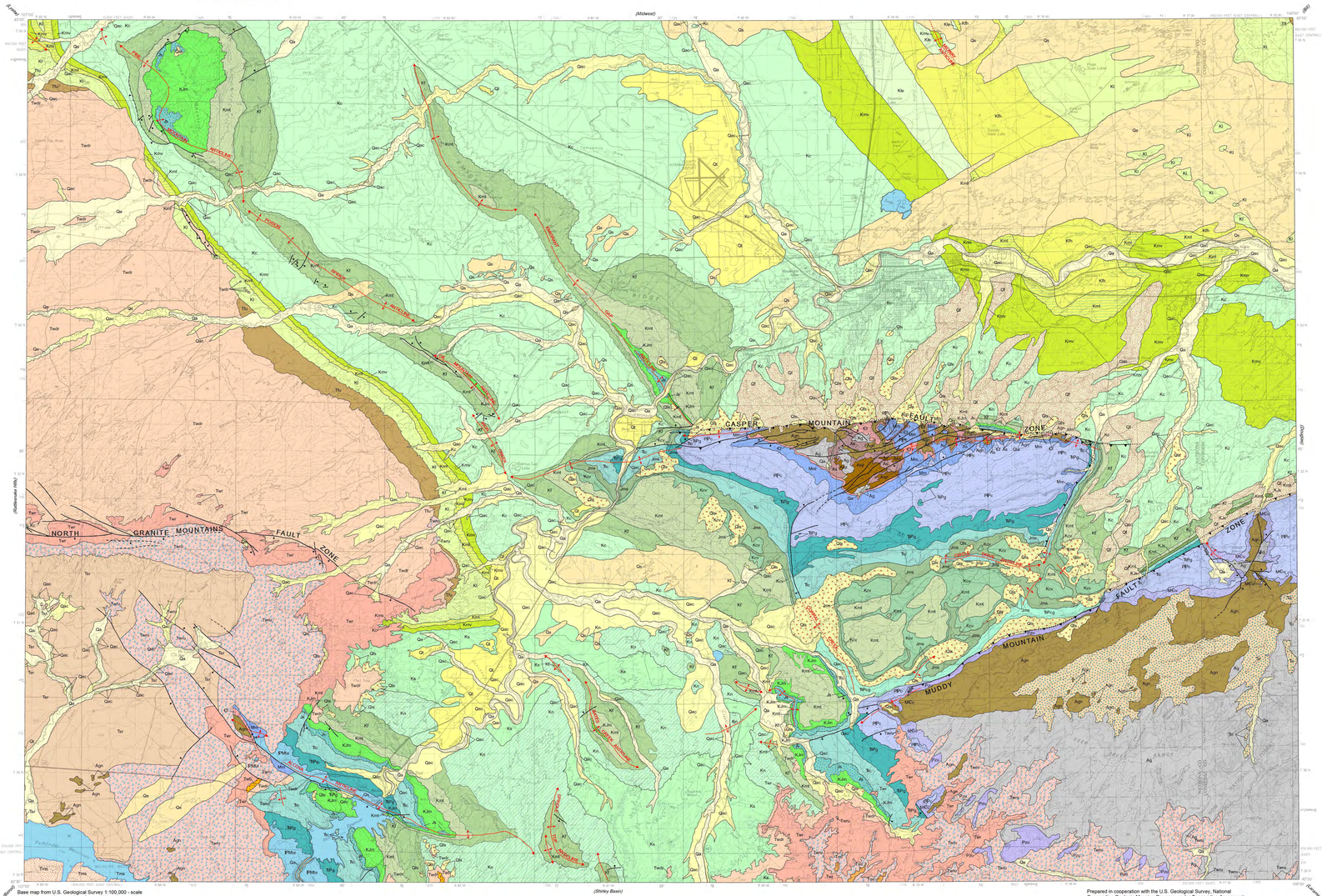
Geology - Interpreting the past to provide for the future

Prepared in cooperation with the
U.S. GEOLOGICAL SURVEY

MAP SERIES 65
Casper 1:100,000 - scale Geologic Map



Base map from U.S. Geological Survey 1:100,000 - scale metric topographic map of the Casper, Wyoming 30' x 60' Quadrangle, 1978

Projection: Universal Transverse Mercator (UTM), zone 13
North American Datum of 1927 (NAD 27)
10,000-meter grid ticks: UTM, zone 13
25,000-foot grid ticks: Wyoming State Plane Coordinate System, east central and east zones

MN (GN) 10° 15' MILS — VOIT 18 MILS — 14° 249 MILS

UTM GRID CONVERGENCE (GN)
1979 MAGNETIC DECLINATION (MN) AT CENTER OF SHEET
DIAGRAM IS APPROXIMATE

SCALE 1:100,000
Contour Interval 20 meters

0 1 2 4 6 8 10 12 14 16 18 20 Kilometers
0 1 2 3 4 5 6 7 8 9 10 11 12 Miles
0 2,000 4,000 6,000 8,000 10,000 12,000 14,000 16,000 18,000 20,000 Meters
0 5,000 10,000 15,000 20,000 25,000 30,000 35,000 40,000 45,000 50,000 55,000 60,000 65,000 Feet

GEOLOGIC MAP OF THE CASPER 30' x 60' QUADRANGLE, NATRONA AND CONVERSE COUNTIES, CENTRAL WYOMING

Compiled and mapped by
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2005

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Digital cartography by Alice J. Vogelmann

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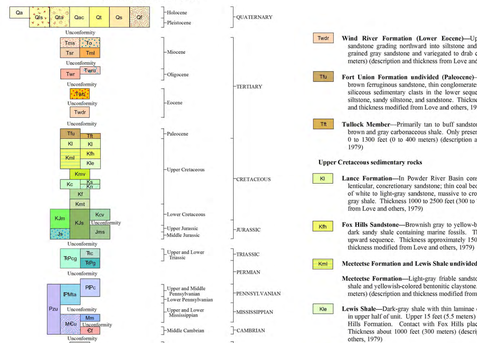
EXPLANATION
CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

Surficial deposits

Qa **Alluvial deposits (Holocene)**—Unconsolidated and poorly consolidated clay, silt, sand, and gravel, mainly in channel or meander belt of creeks and rivers. Includes lowest level terrace deposits in many of the stream valleys

Qls **Landslide deposits (Holocene/Pleistocene)**—Blocks of bedrock, surficial materials, or loose slope debris that have fallen, slumped, or flowed down moderate to steep slopes, especially those weakened by water and undercutting. May contain glacially derived material on northern and western slopes of Casper Mountain (Anderson and others, 2004). Includes large blocks of the Cloverly and Morrison formations which detached at a shale contact within the lower Morrison and underlying Sundance Formation and slid down the dip slope on the southwestern flank of Casper Mountain

Qsc **Talus deposits (Holocene/Pleistocene)**—Unconsolidated masses of angular rock fragments and larger blocks of bedrock; interbedded with nonsorted to poorly sorted sand, silt, clay, sparse gravel; derived locally through mass wasting. Only largest and thickest masses of talus on the steep north facing slope of the east end of Casper Mountain are shown

Qac **Mixed alluvium and colluvium (Holocene/Pleistocene)**—Sand, silt, clay, and gravel deposited mainly along intermittent streams and rivers; includes slope wash and smaller alluvial fan deposits that coalesce with alluvium and youngest low level terrace deposits

Qt **Terrace deposits (Holocene/Pleistocene)**—Unconsolidated (partially consolidated locally) beds of pebble and cobble gravels and lenses of silt and sand. Consist of uncorrelated terraces which occur along present drainages, a few feet to over hundred feet above modern flood plains

Qs **Windblown sand (Holocene/Pleistocene)**—Primarily gray quartz sand; includes active and inactive (stabilized) sand dunes trending southwest to northeast, especially in the area northeast of Casper

Qf **Alluvial fan deposits (Holocene/Pleistocene)**—Boulder gravels in a coarse matrix; subrounded and rounded pebbles, cobbles, and boulders of igneous, metamorphic, and resistant sedimentary rocks, interbedded with lenses of sand and silt spreading out from mouths of ravines and canyons or at the base of steep slopes. Glacially derived boulder deposits on ridges and terrace surfaces on northern and western slopes of Casper Mountain (Anderson and others, 2004). These fan deposits are most common on the northern and eastern flanks of Casper Mountain and are often down slope from landslides

Tertiary sedimentary rocks

Tmg **Moonstone Formation (Upper Miocene)**—Light-gray, pale-green, and brown tuff and tuffaceous sandstone; radiocarbon white shale and algal limestone, and in the lower part, thick beds of arkose; abundant chalcedony layers and pebbles and small silicified algal heads. Thickness 0 to 1350 feet (0 to 410 meters) (description and thickness from Love and others, 1979)

Tgd **Ogallala Formation (Upper Miocene)**—Heterogeneous sequence of white soft tuffaceous sandstone with frosted rounded quartz grains and abundant magnetite, and limestone, pumicite beds, and lesser amounts of claystone and conglomerate. Thickness 0 to 1650 feet (0 to 500 meters) (description and thickness from Love and others, 1979)

Tsr **Split Rock Formation (Lower Miocene)**—Divided into ; 1) an upper sequence of white to tan, fine- to coarse-grained sandstone, rounded frosted grains, soft, porous; includes conglomerate containing chalcedony pebbles; contains several algal reefs, pumicite, and limestone beds; contains diatom, pollen, and vertebrate fossils; 2) a sequence of gray to tan sandstone, fine- to coarse-grained, rounded grains, soft, porous with silty matrix; contains vertebrate fossils; 3) a sequence of gray, very soft sandstone with rounded quartz grains embedded in white clayey matrix; some siltstone and claystone; and 4) a lower sequence including a gray, hard, arkosic conglomerate intertonguing with and overlain by gray, soft, porous sandstone; contains vertebrate and mollusk fossils. This unit is equivalent to the upper White River, Arikaree, and lower Ogallala Formation of Denson (1965). Thickness 0 to 2400 feet (0 to 732 meters) (description and thickness from Love, 1961)

Tmi **Lower Miocene rocks undivided (Lower Miocene)**—Mainly white to light-gray tuffaceous sandstone, eolian in part, composed of frosted rounded quartz grains and abundant magnetite; sparse lenticular white limestones. Base intertongues with conglomerate and may be partly Oligocene. Thickness 0 to 400 feet (0 to 120 meters) (description and thickness from Love and others, 1979)

TaWr **Upper White River conglomerate (Miocene? and upper Oligocene?)**— Gray, brown, and pink arkosic conglomerate interbedded with gray and pink blocky tuffaceous claystone in some areas and gray, soft sandstone with frosted rounded quartz grains and abundant magnetite in others. Thickness 0 to 600 feet (0 to180 meters) (description and thickness from Love and others, 1979)

Twr **White River Formation (Oligocene)**—White, pink, brown, and green tuffaceous claystone and siltstone; thin beds of pumice and limestone; lenticular conglomerates near base. Thickness 0 to 600 feet (0 to 180 meters). K-Ar ages of pumice beds range from 35.2 Ma (mega-annum or million years before present) in the lower part to 31.6 Ma near the top (Evernden and others, 1964). Thickness 0 to 850 feet (0 to 260 meters) (description and thickness from Love and others, 1979)

Twa **Wagon Bed Formation (Upper and middle Eocene)**—Pale-green to dully variegated, tuffaceous, siliceous claystone underlain by giant granite boulders. Only occurs on southern edge of map southeast of Alcova Reservoir and in a small outcrop northwest of the reservoir. Thickness 0 to 160 feet (0 to 50 meters) (description and thickness from Love and others, 1979)

Twdr **Wind River Formation (Lower Eocene)**—Upper sequence is arkosic conglomerate and sandstone grading northward into siltstone and claystone; lower sequence is generally fine-grained gray sandstone and variegated to drab claystone. Thickness 0 to 1500 feet (0 to 460 meters) (description and thickness from Love and others, 1979)

Tfu **Fort Union Formation undivided (Paleocene)**—Contains thin discontinuous layers of dark-brown ferruginous sandstone, thin conglomerates with granite clasts in the upper sequence and siliceous sedimentary clasts in the lower sequence, and thin to thick beds of gray to white siltstone, sandy siltstone, and sandstone. Thickness 0 to 3000 feet (0 to 915 meters) (description and thickness modified from Love and others, 1979)

Tft **Tullock Member**—Primarily tan to buff sandstone, with minor interbedded siltstone and dark brown and gray carbonaceous shale. Only present in northeastern corner of the map. Thickness 0 to 1300 feet (0 to 400 meters) (description and thickness modified from Love and others, 1979)

Upper Cretaceous sedimentary rocks

Kl **Lance Formation**—In Powder River Basin consists of gray shale and drab brown, massive lenticular, concretionary sandstone; thin coal beds in lower half. In Wind River Basin consists of white to light-gray sandstone, massive to cross-bedded, and thin beds of carbonaceous and gray shale. Thickness 1000 to 2500 feet (300 to 760 meters (description and thickness modified from Love and others, 1979)

Kth **Fox Hills Sandstone**—Brownish gray to yellow-brown sandstone interbedded with siltstone and dark sandy shale containing marine fossils. The sandstone is characterized as a coarsening upward sequence. Thickness approximately 150 to 200 feet (45 to 60 meters) (description and thickness modified from Love and others, 1979)

Knd **Meeteetse Formation and Lewis Shale undivided**

Meeteetse Formation—Light-gray friable sandstone interbedded with dark-gray carbonaceous shale and yellowish-colored bentonitic claystone. Thickness about 400 to 600 feet (120 to 180 meters) (description and thickness modified from Love and others, 1979)

Kle **Lewis Shale**—Dark-gray shale with thin laminae of light-gray siltstone; fine-grained sandstone in upper half of unit. Upper 15 feet (5.5 meters) grades into light-colored sandstone of the Fox Hills Formation. Contact with Fox Hills placed at 6-inch (15 cm)-thick bentonite layer. Thickness about 1000 feet (300 meters) (description and thickness modified from Love and others, 1979)

Kmv **Mesaverde Formation**—Teapot Sandstone Member, white, at top; underlain by unnamed gray sandstone, shale, and coal member; nonmarine gray Parkman Sandstone Member at base. Parkman Sandstone commonly contains brown-weathering calcareous concretions. Thickness about 600 to 1200 feet (180 to 365 meters) (description and thickness modified from Love and others, 1979)

Kc **Cody Shale**—Dark-gray calcareous, fossiliferous marine shale interbedded with light-gray fine-grained sandstone, with numerous bentonite beds in the upper two-thirds of the formation. Septarian concretions common throughout the shale units. An upper, glauconitic, fine-grained shaly sandstone (Shannon Sandstone Member) occurs about 1000 feet (300 meters) below the top of the formation. The Sussex Sandstone Member occurs approximately 400 feet (120 meters) above the Shannon. Thickness about 500 to 4500 feet (915 to 1370 meters) (description and thickness modified from Gable and others (1988)

Ks **Steele Shale**—Dark-gray, soft marine shale containing thin beds of gray limestone, white bentonite, and very fine-grained, lenticular, hard sandstone. Equivalent to the upper Cody Shale and used in the area southwest of Casper Mountain and south and east of the North Platte River. Thickness about 2400 feet (730 meters) (description and thickness modified from Love and others, 1979)

Kn **Niobrara Formation**—Dark-gray to yellowish-buff marine shale and chalky, soft, white limestone; highly selenitferous. Equivalent to the lower Cody Shale and used in the area southwest of Casper Mountain and south and east of the North Platte River. Thickness about 700 feet (205 meters) (description and thickness modified from Love and others, 1979)

Kf **Frontier Formation**—Gray, fine- to coarse-grained quartz sandstone interbedded with gray to black siltstone and shale; glauconitic in part. White to yellow bentonite, white to gray porcellanite, and thin impure coal beds present in lower part. Contact with the underlying Mowry Shale is at the base of a 4- to 6-foot (1.2 to 1.8 meters) bentonite bed, locally referred to as the "Clay Spur Bentonite." Thickness about 600 feet (180 meters) (description and thickness modified from Love and others, 1979)

Upper and Lower Cretaceous sedimentary rocks

Knt **Mowry Shale, Muddy Sandstone, and Thermopolis Shale undivided**

Mowry Shale (Upper Cretaceous)—Hard, dark-gray, siliceous shale that weathers silver-gray and contains thin bentonite beds and abundant fish scales. Lower unit is dark-gray to black, nonresistant shale with thin, interbedded white fine-grained lodge-forming sandstone near the base, grading into the underlying Muddy Sandstone. Thickness approximately 100 to 300 feet (30 to 90 meters) (description and thickness modified from Love and others, 1979)

Muddy Sandstone (Lower Cretaceous)—Tan to gray, fine- to medium-grained, friable to well-lithified sandstone. Easily identified by its drab color and grains of black minerals (salt and pepper). Thickness approximately 50 to 100 feet (15 to 30 meters) (description and thickness modified from Love and others, 1979)

Thermopolis Shale (Lower Cretaceous)—Dark-gray to black, soft fissile shale with some interbedded bentonite layers. Ironstone concretions appear in the lower part of the formation. Thickness approximately 100 to 200 feet (30 to 60 meters) (description and thickness modified from Love and others, 1979)

Lower Cretaceous and Jurassic sedimentary rocks

KJn **Cloverly and Morrison formations undivided**

KJk **Cloverly, Morrison, and Sundance formations undivided**

Kcv **Cloverly Formation (Lower Cretaceous)**—A triparitie unit consisting of an upper gray to buff to brown, fine- to coarse-grained, resistant slabby sandstone and siltstone, locally referred to as the "Rusty Beds;" variegated buff and purple claystones interbedded with thin black shale beds in the middle; and a basal tan to white, coarse-grained sandstone and chert pebble conglomerate, locally cross-bedded. Thickness approximately 100 to 300 feet (30 to 90 meters) (description and thickness modified from Love and others, 1979)

Jms **Morrison and Sundance formations undivided**

Morrison Formation (Upper Jurassic)—Pale-green, olive-green, blue-green to maroon and chalky, white, variegated calcareous and bentonitic claystones interbedded with light-gray, fine-grained, friable, cross-bedded silty sandstones. Dinosaur bones and bone fragments are common in the upper part of the section. Thickness approximately 100 to 300 feet (30 to 90 meters) (description and thickness modified from Love and others, 1979)

Js **Sundance Formation (Upper and Middle Jurassic)**—Upper part is gray to greenish-gray glauconitic shale with an upper layer consisting of slabby shale and calcareous sandstone that weathers brown and is slightly glauconitic. Middle part is red and gray nonglauconitic sandstone and shale and thin gypsum and limestone beds. Lower part is thick-bedded gray to pink sandstone. Thickness approximately 550 feet (170 meters) (description and thickness modified from Love and others, 1979)

Triassic and Permian sedimentary rocks

TRgu **Chugwater and Goose Egg formations undivided**

TRc **Chugwater Group (Upper and Lower Triassic)**—Includes, from top to bottom, Popo Agie Formation, Crow Mountain Sandstone, Alcova Limestone, and Red Peak Formation. Popo Agie includes lower limestone unit with upper ocher and purple mudstones; Crow Mountain is reddish-orange sandstone, locally referred to as the Jelm Formation; Alcova is purplish-gray slabby algal limestone; Red Peak is red shale, siltstone, and fine-grained sandstone. Thickness approximately 300 to 1000 feet (90 to 305 meters) (description and thickness modified from Love and others, 1979)

TRg **Goose Egg Formation (Triassic and Permian)**—Dark-red to reddish-orange shale and siltstone with interbedded gypsum, algal limestone, and dolomite, mainly in the lower part. Thickness approximately 200 to 300 feet (60 to 90 meters) (description and thickness modified from Love and others, 1979)

Permian, Pennsylvanian, Mississippian, and Cambrian sedimentary rocks

Pzu **Paleozoic rocks undivided**—Includes Casper, Madison, and Flathead formations in the southeastern corner of the map

PIPc **Casper Formation (Lower Permian and Upper and Middle Pennsylvanian)**—Alternating thicker red and white sandstone and thinner gray to pink, hard, persistent limestone, with red shale and siltstone. The sandstone is highly cross-bedded with festoon cross-bedding common. The limestone is fossiliferous with brachiopods and fusilinids. Thickness approximately 600 to 1100 feet (180 to 335 meters) (thickness from Love and others, 1979)

PIMu **Tensleep and Amsden formations undivided**

Tensleep Sandstone (Pennsylvanian)—White to buff, medium- to fine-grained, massive sandstone; interbedded with thin cherty limestone and dolomite beds, especially toward the base. Upper and middle sandstones are usually characterized by large-scale cross-beds. Thickness approximately 220 to 330 feet (67 to 100 meters) (thicknesses from Love and others, 1979 and Allen, 2003)

Amsden Formation (Pennsylvanian and Upper Mississippian)—Includes from top to bottom, gray to purplish limestone and dolomite, interbedded with shale, siltstone, and sandstone; reddish-brown to maroon shale and siltstone with thin beds of sandstone and carbonates; and gray to buff, fine- to medium-grained, cross-bedded sandstone. Persistent sandstone at base is probably Upper Mississippian Darwin Sandstone Member. Thickness approximately 125 to 330 feet (38 to 100 meters) (thickness from Love and others, 1979)

MCu **Madison Limestone and Cambrian rocks undivided**— Sando and Sandberg (1987) revised the age and terminology of the Cambrian sequence to Mississippian and Devonian Englewood Formation and Devonian Fremont Canyon Sandstone

Mm **Madison Limestone (Upper and Lower Mississippian)**—Alternating units of light-tan to gray cherty limestone and dolomite. Upper part bluish-gray limestone with karst surface at the top. Lower part mainly dolomite and dolomitic limestone. The entire formation is fossiliferous; spiriferoid brachiopods and solitary tetracorals are the most common. Sando and Sandberg (1987) included the lowermost part of the Madison Limestone in their Mississippian and Devonian Englewood Formation. Thickness ranges from 100 to 400 feet (30 to 120 meters), thinning toward the south (thickness modified from Love and others, 1979)

Cf **Flathead Sandstone (Middle Cambrian)**—Reddish-gray, tan, and light-brown, medium to coarse-grained quartz sandstone in beds, locally conglomeratic and cross-bedded. Thin interbeds of green, maroon, and tan siltstone, mainly in the upper part; arkosic conglomerate in the lower part. Sando and Sandberg (1987) divided this sequence into Mississippian and Devonian Englewood Formation and Devonian Fremont Canyon Sandstone. Thickness 15 to 200 feet (5 to 60 meters) (description and thickness modified from Gable and others, 1988, and Sando and Sandberg, 1987)

ARCHEAN ROCKS

Ag **Granite intrusive rocks (Archean)**—Leucocratic, buff- to light-gray or white, medium-grained to very coarse-grained, nonfoliated, muscovite-bearing granite containing traces of biotite and magnetite. Description modified from Gable and others (1988)

Agn **Gneissic granite intrusive rocks (Archean)**—Very coarse-grained, generally pinkish granite, consisting of biotite, microcline, plagioclase, and quartz. Description modified from Gable and others (1988)

As **Serpentinite intrusive rocks (Archean)**—Serpentinite intrusives occurring on Casper Mountain. Description modified from Gable and others (1988)

As **Metasedimentary rocks (Archean)**—Biotite-quartz-plagioclase gneiss and biotite-microcline-plagioclase-quartz gneiss. Occurs on Casper Mountain. Description modified from Gable and others (1988)

MAP SYMBOLS

Formation contact

Fault—Bar and ball on downthrown block; arrows indicate relative direction of oblique-slip movement. No indication on fault trace indicates undetermined motion. Dashed where approximately located and dotted where concealed

Thrust fault—Sawteeth on upthrown block. Dashed where approximately located and dotted where concealed

Anticline—Trace of axial plane and direction of plunge compiled from source mapping or determined by field dip measurements and by photo interpretation. Dotted where axis is concealed by surficial deposits. Asymmetric anticlines are shown by shorter arrow on steeper limb

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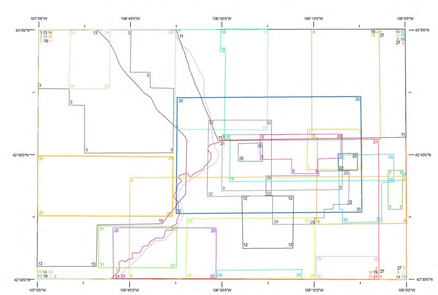
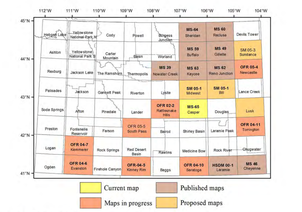
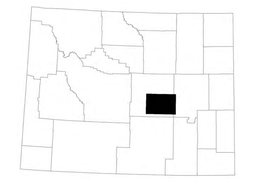


INDEX TO GEOLOGIC MAPPING
(numbers are those listed in the sources of geologic data)



KEY TO ABBREVIATIONS
Wyoming State Geological Survey maps: Map Series (MS), Open File Report (OFR), Hazards Section Digital Map (HSDM), and unpublished STATEMAP project (SMP).

INDEX TO 1:100,000-SCALE BEDROCK GEOLOGIC MAPS OF WYOMING



QUADRANGLE LOCATION

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