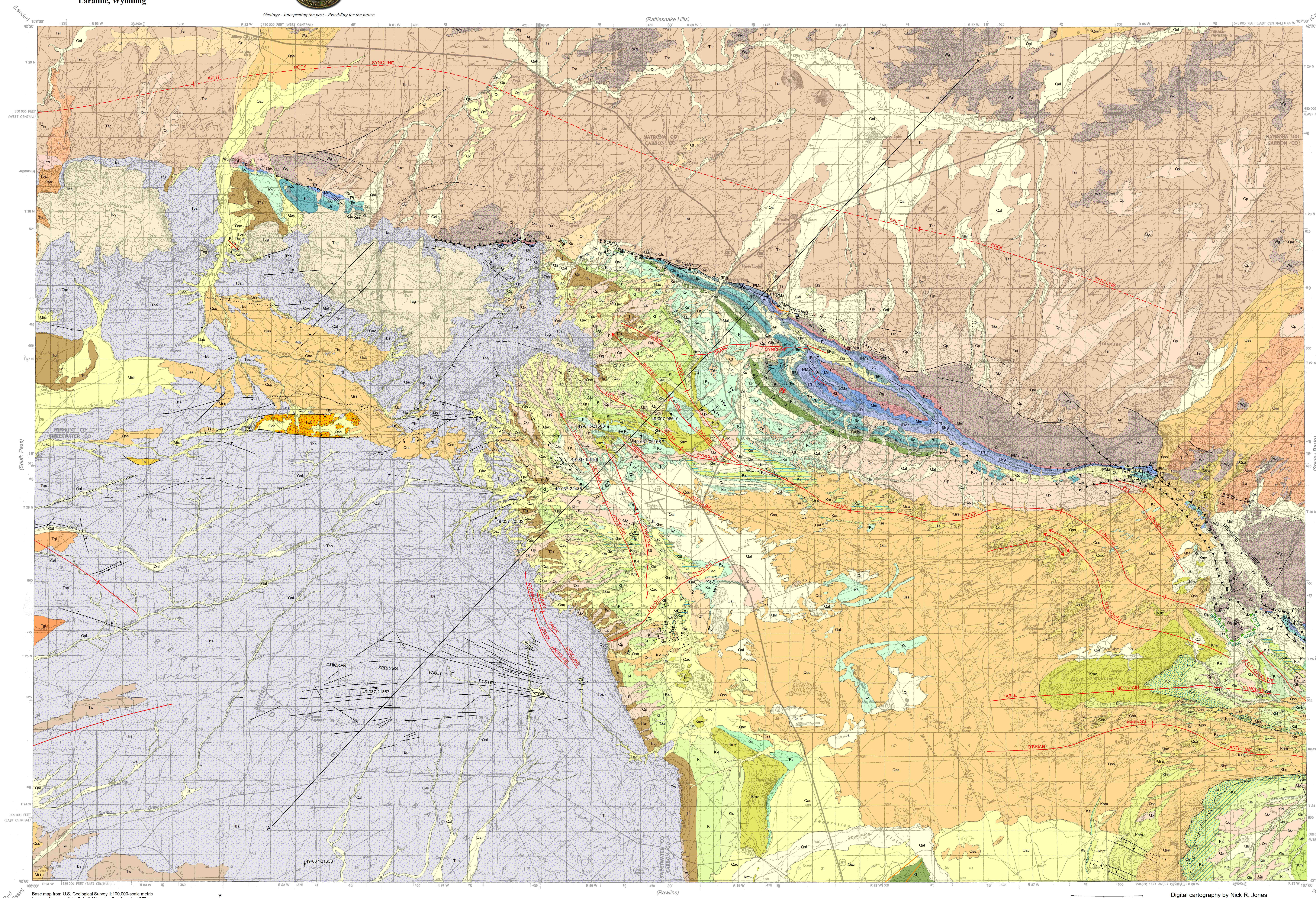
WYOMING STATE GEOLOGICAL SURVEY
Wallace L. Ulrich, Director and State Geologist
Laramie, Wyoming

Geology - Interpreting the past - Providing for the future

Prepared in cooperation with the U.S. GEOLOGICAL SURVEY

MAP SERIES 86
Bairoil 1:100,000 - scale
Bedrock Geologic Map



Base map from U.S. Geological Survey 1:100,000-scale metric topographic map of the Bairoil, Wyoming Quadrangle, 1979

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 west central zones
National Geodetic Vertical Datum of 1929

A digital version of this map is also available on CD-ROM.

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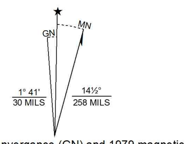
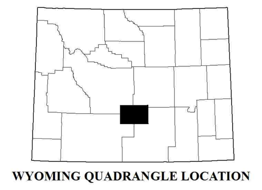


UTM grid convergance (GN) and 1979 magnetic declination (MN) at center of map
Diagram is approximate

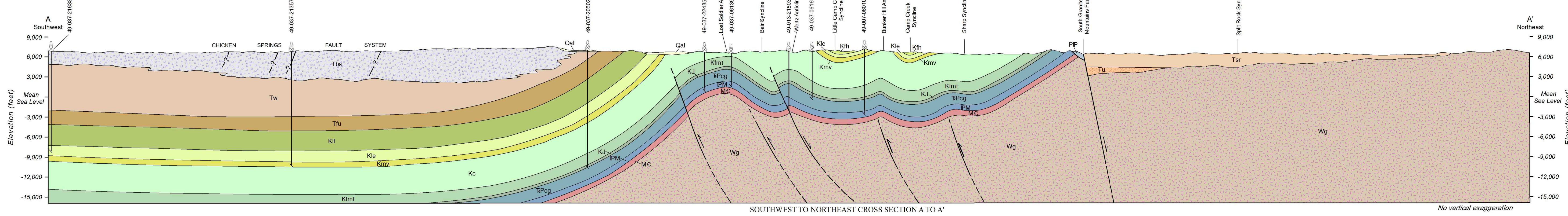
SCALE 1:100,000
Contour Interval 20 meters

Digital cartography by Nick R. Jones
Map layout and design by Thomas E. Ver Ploeg
Map editing by Suzanne C. Luhr

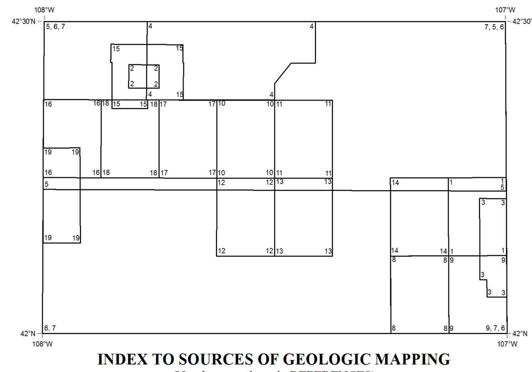
Prepared in cooperation with and research supported by the U.S. Geological Survey, National Cooperative Geologic Mapping Program, under USGS award number G10AC00416. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government.



WYOMING QUADRANGLE LOCATION



SOUTHWEST TO NORTHEAST CROSS SECTION A TO A'



INDEX TO SOURCES OF GEOLOGIC MAPPING
(Numbers are those in REFERENCES)

GEOLOGIC MAP OF THE BAIROIL 30' x 60' QUADRANGLE, CARBON, SWEETWATER, FREMONT, AND NATRONA COUNTIES, WYOMING

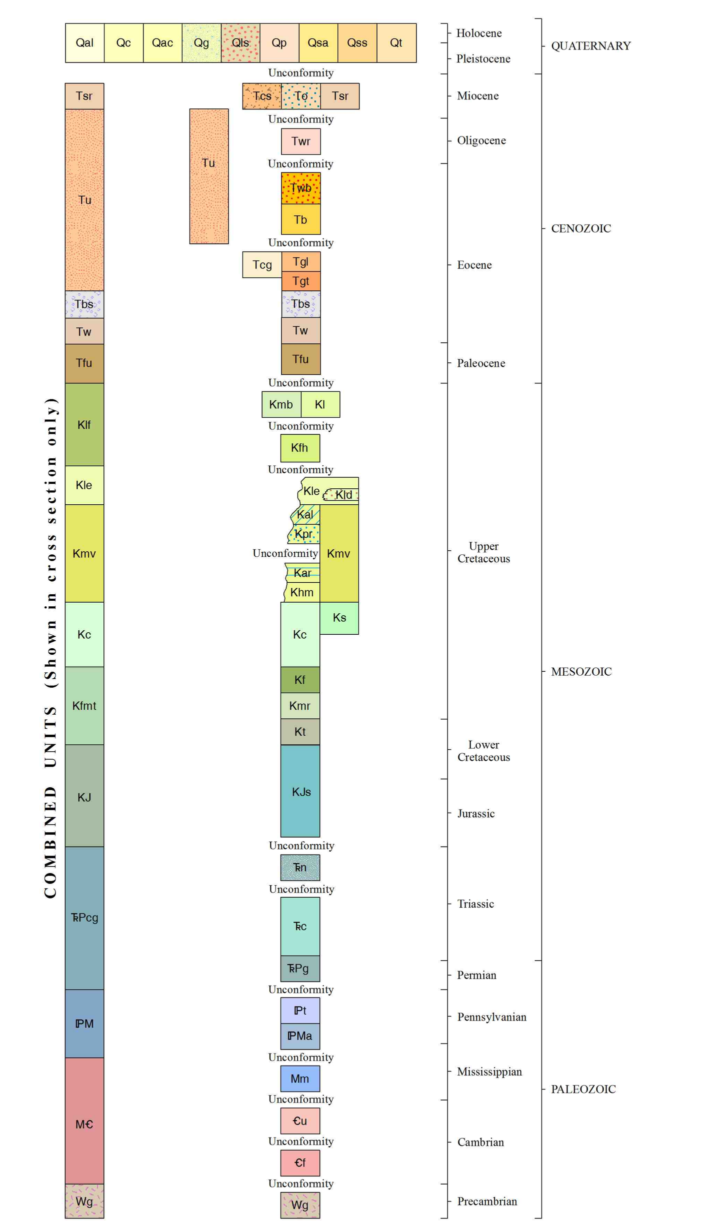
Compiled and mapped by

Nick R. Jones, Robert W. Gregory, and J. Fred McLaughlin

2011

EXPLANATION

CORRELATION OF UNITS



MAP SYMBOLS

- **Formation contact**
- **Fault**—Displacement unknown; dashed where approximately located
- **Normal fault**—Dashed where approximately located, dotted where concealed; ball and bar on downthrown block
- **Thrust fault**—Dotted where concealed; sawteeth on upper (tectonically higher) plate
- **Anticline**—Arrow on end or along axis indicates direction of plunge
- **Syncline**—Dashed where approximately located; arrow on end indicates direction of plunge
- **Bradley Peak gravity slide mass**—Sawteeth on overriding block
- **Unknown linear feature**
- A—A' **Line of cross section**
- 49-007-06010 **Drill hole**—With API number of well; well logs used to construct cross section; all wells projected to line of cross section

DESCRIPTION OF MAP UNITS

Quaternary surficial deposits

Qal **Alluvial deposits (Holocene)**—Gravel, sand, silt, and clay, largely unconsolidated and poorly sorted; occurring in flood plains and low-lying terraces. Varying in thickness, up to approximately 25 feet (8 m)

Qc **Colluvium (Holocene/Pleistocene)**—Weathered bedrock, slope wash, and soil, at base of, and on slopes of variable thicknesses; transported mostly by gravity

Qac **Alluvium and colluvium undivided**—Gravel, sand, silt, clay, weathered bedrock, and soil, deposited along recent and older flood plains; includes slope wash, weathered bedrock, and smaller alluvial fan deposits that coalesce with alluvium

Qg **Boulder gravel**—Precambrian and Phanerozoic boulders, cobbles, and sand, in colluvium and lag deposits. Precambrian boulders include granite and mafic dike material derived from the Granite Mountains; Phanerozoic rock fragments include unconsolidated and poorly sorted boulders derived from Cambrian quartzite and Paleozoic chert. Thickness can reach 170 feet (52 m)

Qls **Landslide deposits**—Angular blocks of bedrock and finer loose slope debris; largely unconsolidated and poorly sorted, with hummocky topography

Qp **Pediment deposits**—Boulders, cobbles, and pebbles in a sand and silt matrix; forms broad, gently sloping surfaces between drainages; unconsolidated, poorly sorted, and weakly stratified

Qsa **Eolian sand (active)**—Active wind-blown dunes and dune forms; fine- to medium-grained with scattered coarser material; unconsolidated, moderately sorted; mostly barren of vegetation other than sparse grass at margins

Qss **Eolian sand (stabilized)**—Stabilized wind-blown dunes and dune forms; fine- to medium-grained with scattered coarser material; unconsolidated, moderately sorted; most supports annual vegetation

Qt **Terrace gravel**—Cobbles, pebbles, sand, and silt, of fluvial origin; unconsolidated, poorly sorted, and largely unstratified; forms broad, near flat to gently sloping surfaces between drainages

Tertiary sedimentary rocks

Tu **Tertiary rocks, undifferentiated**—Boulders, cobbles, pebbles, conglomerate, arkosic sandstone, and minor siltstone. Precambrian boulders of granite, and scattered diabase; Phanerozoic fragments of quartzite, limestone, and chert, as large as 2-3 feet (1 m) in diameter; conglomerate consists of fragments of Precambrian and Phanerozoic rocks, gray, light-yellow, and grayish-white; arkosic and quartz sandstone is commonly glauconitic; siltstone and mudstone is olive, buff, and reddish; poorly to firmly indurated. Thicknesses over 900 feet (274 m)

Tcs **Tertiary conglomerate and sandstone**—Precambrian and Phanerozoic cobbles, pebbles, conglomerate, and primarily arkosic sandstone, comprised mainly of granite, diabase, quartzite, limestone, and chert; gray, light-yellow, and grayish-white; sandstone is commonly glauconitic. Can reach several hundred feet in thickness (±100 m)

To **Ogallala Formation**—Pale-orange to pink and yellow-gray to white, poorly sorted, weakly to firmly consolidated conglomerate, crossbedded sandstone, and minor siltstone with local concretionary limestone; boulders, cobbles, and pebbles of Precambrian and Phanerozoic age; locally tuffaceous, crossbedded, poorly sorted, and weakly to firmly consolidated

Tsr **Split Rock Formation**—This formation consists of four units (Love, 1970). From youngest to oldest, they are: Upper unit: porous sandstone: conglomeratic at base along with medium- to coarse-grained, gray to buff, crossbedded sandstone; forms broad dip slopes; contains subrounded, frosted Sweetwater moss agates, mostly less than 1 in. (3 cm) diameter, moderately radioactive; abundant very fine grained (0.1 mm in diameter) magnetite grains; this unit also contains common thin, chalky, white, soft, fine-grained, sandy limestone beds; up to 1000 feet (305 m) thick. Upper middle unit: silty sandstone, fine- to coarse-grained, light-gray sandstone with silty matrix; tuffaceous beds are common along with abundant glass shards, and very fine grained magnetite; 300-600 feet (91-183 m) thick. Lower middle unit: clayey sandstone: gray, fine- to medium-grained, soft matrix; abundant frosted quartz grains; abundant glass shards and very fine grained magnetite; commonly includes gray to tan siltstone; local bentonitic clayey sandstone beds; 100-300 feet (30-91 m) thick. Basal unit: porous sandstone: coarsest and most widespread of the 4 units; forms cliffs and steep slopes (eg., Beaver Divide); boulders, cobbles, pebbles of Precambrian granite and mafic igneous rocks; matrix is gray, coarse-grained, poorly sorted sandstone with abundant frosted quartz grains and interbedded with conglomerate beds; sandstone and conglomerate beds contain abundant very fine grained magnetite and glass shards; 100-400 feet (30-122 m) thick

Twr **White River Formation**—Fluvial tuffaceous siltstone, shale, arkosic sandstone, and conglomerate; white to grayish-orange, light-pink, yellow; poorly to well-indurated; local bentonitic mudstone beds. Thicknesses up to 650 feet (198 m)

Twb **Wagon Bed Formation**—Consists of as many as five depositional units, generally comprised of mudstone, claystone, arkose and sandstone; colors range from dull-gray to pale shades of blue, green, and yellow to tan; volcanic debris, more abundant in the upper three units, is common in the form of tuff and tuffaceous sandstone, mudstone and claystone; most of this material was derived from the Yellowstone-Absaroka region to the northwest and the Rattlesnake Hills area to the northeast. Thicknesses range from 50-300 feet (15-91 m)

Tb **Bridger Formation**—Siliceous, bentonitic claystone and shale, green, pale-green to blue-green, light-yellow, with thin limestone containing ostracods and algae; base of formation within this area contains white tuff and arkose. Thicknesses can reach over 500 feet (152 m), although erosion has removed much of the formation in the mapped area

Tcg **Crooks Gap Conglomerate**—Very large, subrounded granitic boulders, up to 40 feet (12 m) across in a pink and gray siltstone and arkosic sandstone matrix; abundant iron oxide stained rinds on most boulders; occurs largely as remnants of fan deposits shed by the Granite Mountains. Thicknesses of up to 1,500 feet (475 m)

Tgl **Laney Member of the Green River Formation**—Brown oil shale; green shale containing ostracods; local, sandy limestone with mollusks; limey sandstone; arkosic sandstone; and conglomerate. Thickness ranges from 200-300 feet (61-91 m)

Tgt **Tipton Shale Member of the Green River Formation**—Gray and dark-brown marlstone and oil shale, interbedded with thin algal limestone and tan-brown dolomite; thin grayish tuffs, and thin fossiliferous sandstone; interbedded with carbonaceous shale near base. Thickness ranges from 100-200 feet (30-61 m)

Tbs **Battle Spring Formation**—Light-gray, brown, yellowish-tan, medium-grained to very coarse grained, pebbly arkosic sandstone and conglomerate, with local greenish-gray, sandy mudstone; brownish, carbonaceous mudstone and claystone; yellowish-gray conglomerate interbedded with very coarse conglomerate; poorly indurated, with local well-indurated lenses and paleo-channels, cemented with calcite cement; scattered cobbles and boulders over one foot (0.3 m) in diameter with some boulders up to several feet across which may be remnants of Crooks Gap Conglomerate; numerous iron-rich irregular and spheroidal concretions. The Battle Spring Formation is host to economic uranium deposits in many areas of the Great Divide Basin. Thickness varies considerably but generally increases basinward from approximately 1,000-3,500 feet (305-1,067 m)

Tw **Wasatch Formation**—Drab to variegated claystone, siltstone and sandstone, carbonaceous shale and coal; locally interfingers with conglomerates around basin margin; interfingers primarily through changes in depositional environments with members and tongues of the Green River Formation

Tfu **Fort Union Formation**—Complexly interbedded, commonly lenticular or discontinuous sequence of beds; sandstone, light-brown to gray, argillaceous, very fine to medium-grained, commonly contains ferruginous concretions; siltstone, light-brown to orange, commonly ferruginous, and argillaceous; shale, light- to dark-gray, locally maroon, locally contains numerous vertebrate and common invertebrate fossils, and plant fossils; coal beds are generally thin and discontinuous with lenticular thickenings to as much as 9 feet (3 m). Thickness approximately 1,500 feet (475 m)

Cretaceous sedimentary rocks

Kmb **Medicine Bow Formation**—Sandstone, very fine to fine-grained, silty, friable to well-indurated, with plant fossils common; siltstone, slightly carbonaceous, irregular-bedded to laminar, crossbedded, with plant fossils; shale, carbonaceous; local coal beds

Kl **Lance Formation**—Shale, tan to medium-gray to grayish-black, partly silty, and partly carbonaceous; siltstone, light-gray to grayish-black, partly sandy, and partly carbonaceous; sandstone, light-gray, very fine to fine-grained, and partly silty; coal; formation commonly contains dolomite and iron concretions. Thickness ranges from 1,000 to nearly 4,000 feet (305-1,219 m)

Kfh **Fox Hills Sandstone**—Sandstone, pale-gray to light-orange, very fine to fine-grained, well-sorted, thinly bedded, and slightly calcareous; siltstone, medium-gray, sandy; shale, light-greenish to gray, with local thin coal beds; intertongues with Lewis Shale and Lance Formation. Thickness ranges from 200-800 feet (61-244 m)

Kle **Lewis Shale**—Shale, marine, gray to greenish, sandy, and slightly calcareous; sandstone, gray, very fine to fine-grained, friable, silty, calcareous, concretionary, with abundant fossils of foraminifera, oyster shells, pelecypods, and fossil burrows. Thicknesses up to 700 feet (213 m)

Kld **Dad Sandstone Member of the Lewis Shale**—Thinly bedded sandstone, very fine to fine-grained, loosely consolidated, silty, calcareous, and locally concretionary; siltstone, gray, sandy and platy; shale, medium- to dark-gray, and silty

Kmv **Mesaverde Formation (includes Teapot Sandstone)**—The Mesaverde Formation is a sequence of mostly non-marine light-gray, tan, and brown, fine- to medium-grained, crossbedded sandstone interbedded with shale, carbonaceous shale, and coal. Thickness ranges from 800-1,200 feet (244-366 m). Includes the following units in the mapped area:

Kal **Almond Formation**—Shale, gray to dark-gray, silty, and partly carbonaceous; siltstone, gray, sandy, partly carbonaceous, with trace fossils; sandstone, gray, very fine to fine-grained, slightly carbonaceous, irregular-bedded, with plant fossils

Kpr **Pine Ridge Sandstone**—Sandstone, gray, very fine to fine-grained, slightly carbonaceous, irregular-bedded, and containing plant and wood fossils; siltstone, gray, sandy, and partly carbonaceous; shale, carbonaceous; local thin coal beds

Kar **Allen Ridge Formation**—Shale, gray to black, partly silty and carbonaceous; siltstone, light- to dark-gray, partly argillaceous and sandy, laminated to irregular-bedded; sandstone, gray, very fine to fine-grained, slightly carbonaceous, slightly friable, and partly crossbedded; local thin coal beds

Khm **Haystack Mountains Formation**—The formation is a series of interbedded shales, siltstones, and sandstones; shales, medium- to dark-gray, partly silty, mostly carbonaceous, with local concretions; siltstones, light- to dark-gray, partly sandy, and locally glauconitic; sandstones, light- to medium-gray, very fine to fine-grained, mostly silty, and crossbedded; locally calcareous to carbonaceous, fossil-bearing, glauconitic, with local bentonite beds

Ks **Steele Shale**—Marine shale, medium- to dark-gray, olive-gray, and silty; siltstone, light- to dark-gray, locally sandy or argillaceous, slightly calcareous, and locally bentonitic; sandstone, gray to orangish-gray, very fine grained, silty, and partly glauconitic

Kc **Cody Shale**—Marine shale, soft, gray to olive-gray, numerous bentonitic shales and siltstones, partly sandy, with limestone concretions; sandstone, very fine to fine-grained, gray to orangish-gray, glauconitic, thin-bedded, with trace fossils; lower part of Cody Formation is equivalent to the Niobrara Formation (not present): shale, gray to dark-gray, laminated, and calcareous; fossil-rich chalk beds near top, light-tan to buff, and laminated. Formation thickness ranges from 4,000-6,000 feet (1,219-1,829 m)

Kf **Frontier Formation**—Upper part of formation is sandstone, light-gray to grayish-orange, fine-grained, partly silty, calcareous, and glauconitic, with numerous fossils including ammonites, pelecypods, rare shark teeth, and burrows; forms prominent ledges and dip slopes (known as Wall Creek Sandstone in many areas); near the base is marine shale, gray, olive to dark-gray, fissile, and platy, with thin olive-gray, fine-grained sandstone beds, and discontinuous thin bentonite beds. Thickness ranges from 800-1,000 feet (244-305 m)

Kmr **Mowry Shale**—Gray to dark-gray dense siliceous, locally tuffaceous shale; contains abundant fish scales and numerous bentonite beds. Weathers to flaky and blocky, white to silver-gray, with rusty staining along fracture surfaces. Thickness approximately 350 feet (107 m)

Kt **Thermopolis Shale**—Shale in upper part, dark- to medium-gray, soft, silty, and contains carbonaceous thinly bedded siltstone; middle part is also known as the Muddy sandstone, light-gray to grayish-orange, very fine to fine-grained, crossbedded to massive, locally calcareous or carbonaceous, with scattered trace fossils; forms ledges and dip slopes. Thickness ranges from 120-250 feet (37-76 m)

Cretaceous and Jurassic sedimentary rocks

KJs **Cloverly, Morrison, and Sundance Formations undivided**

Cloverly Formation (lower Cretaceous)—Upper part of formation is gray to brown, fine- to coarse-grained sandstone; main formation is sandstone, tan, yellowish-gray, pale-orange, fine- to coarse-grained, with pebbles of quartz, chert, shale, and sandstone, in a matrix of fine- to medium-grained sandstone; it is well-indurated, locally siliceous, crossbedded, and slabby, with interbedded variegated shale, claystone, and carbonaceous shale; forms prominent ledges and dip slopes; conglomeratic at base. Thickness ranges from 75-100 feet (23-30 m)

Morrison Formation (upper Jurassic)—Pale-green, blue-green, maroon, buff to brown, chalky white, interbedded mudstones and sandstones; mudstones, olive-green, gray, maroon, blocky, loosely consolidated to competent beds, with scattered chert and carbonate nodules, and local bentonite and ash beds; sandstone, gray, grayish-yellow to grayish-orange, and thinly bedded; local dark-gray to black, discontinuous chert beds; local thin drab limestone beds with scattered chert nodule inclusions. Variable thickness between 150 and 300 feet (46-91 m)

Sundance Formation (upper and middle Jurassic)—Interbedded sandstone, siltstone, limestone, and shale. Sandstone, grayish-yellow to tan, calcareous, slightly glauconitic, and platy; siltstone, olive-gray, glauconitic, with numerous marine fossils; shale, greenish to maroon; limestone, brown, with abundant marine fossils of pelecypods and cephalopods. Thickness ranges from 200-250 feet (61-76 m)

Triassic sedimentary rocks

Ten **Nugget Sandstone (includes Bell Springs Member)**—Sandstone and siltstone interbedded. Sandstone, light-brown, tan to buff, reddish-pink, massive, crossbedded, fine- to medium-grained, and friable to moderately well cemented; typically forms ledges. Thickness ranges from 0-250 feet (76 m)

Tec **Chugwater Group**—Red and gray shale and siltstone with interbedded red to salmon to buff, fine-grained sandstone. Not listed is the Alcova Limestone, a thin fossiliferous, ridge-forming limestone within the Chugwater Group. Units within the Chugwater Group are as follows:

Popo Agie Formation—Mudstone, reddish-brown to maroon, with scattered yellow to orange pebbles near base, blocky, and locally calcareous. Thickness approximately 30-50 feet (9-15 m)

Jelm Formation—Interbedded sandstone and siltstone, very fine to coarse-grained, scattered thin mudstone layers, and locally calcareous. Thickness approximately 350 feet (107 m)

Red Peak Formation—Sandstone, very fine grained, silty, grading into siltstone, and partly calcareous; siltstone, laminated, platy, with common ripple marks. Thickness approximately 900 feet (274 m)

Triassic and Permian sedimentary rocks

TePg **Goose Egg Formation**—Reddish-brown, pale-red, and tan shale and siltstone, interbedded with gray to light-purple limestone and cherty dolomite; abundant chert nodules. Thickness approximately 300 feet (91 m)

Pennsylvanian sedimentary rocks

IPt **Tensleep Formation**—Tan, gray to buff sandstone, fine- to medium-grained, well-sorted, with prominent crossbeds, and calcareous cement; basal portion commonly contains light-gray to buff, finely crystalline, locally cherty limestone and dolomite beds. Thickness approximately 400-500 feet (122-152 m)

Pennsylvanian and Mississippian sedimentary rocks

IPMa **Amsden Formation**—Pale-red to reddish-brown, grayish-red siltstone and mudstone, interbedded with thin limestone and silty limestone beds; local sandstone, reddish-brown to orange, very fine to fine-grained with scattered medium-sized grains. Thickness ranges from 150-200 feet (46-61 m)

Mississippian sedimentary rocks

Mm **Madison Limestone**—Gray, buff, finely crystalline tan limestone, and tan to brown dolomite; basal portion commonly contains chert nodules and chert fracture-fillings; upper portion commonly forms a karst-like dissolution surface. Thickness ranges from 250-300 feet (76-91 m)

Cambrian sedimentary rocks

Cu **Cambrian rocks, undifferentiated**—Blue-gray, reddish, yellow limestone interbedded with greenish, glauconitic shale and very fine grained, silty, laminated sandstone; siltstone is glauconitic, platy, and locally fossiliferous. Thickness approximately 500-600 feet (152-183 m)

Cf **Flathead Sandstone**—Reddish-brown, pale-red, purple, crossbedded, fine- to coarse-grained sandstone; extensive hematite staining, locally limonitic and glauconitic; conglomeratic near base, containing granitic and quartzitic pebbles up to several inches in diameter. Thickness ranges from 200-300 feet (61-91 m)

Precambrian crystalline rocks

Wg **Precambrian, undifferentiated**—Includes Granite Mountain batholith, in the Granite Mountains; Spanish Mine metamorphic suite, Turkey Creek metaplutonic suite, Ferris Mountains plutonic suite, and the Bear Mountain granitic pluton in the Ferris Mountains (Bowers and Chamberlain, 2006); intrusive igneous rocks, Seminoe greenstone belt metasedimentary and metaigneous rocks, Bradley Peak ultramafics, and the Sunday Morning Creek metavolcanics in the Seminoe Mountains (Hausel, 1994)

Granite Mountains

Granite Mountain batholith—Massive, coarse, leucocratic granite that contains both ilmenite and magnetite phases. The Granite Mountain batholith intruded Meso- and Paleoarchean country rock at 2.62 Ga (Chamberlain, K. unpublished zircon date)

Ferris Mountains

Bear Mountain granitic pluton—Buff-colored medium- to coarse-grained biotite granite with large (up to 1 in. [3 cm]) potassium feldspar crystals

Spanish Mine metamorphic suite—Metasedimentary and ultramafic metavolcanic supracrustal rocks, intruded by numerous mafic dikes; main assemblages include quartzite, pelitic schist, andalusite-garnet-biotite schist, mafic paragneiss, and garnet-talc-tremolite schist

Ferris Mountains plutonic suite—Massive pink to light-gray, porphyritic granite

Turkey Creek metaplutonic suite—Predominantly fine-grained granodioritic orthogneiss, with lesser tonalite and pink, fine-grained granite

Seminoe Mountains

Seminoe Mountains intrusive igneous rocks—Incudes granodiorite, granodiorite dikes, foliated felsic gneiss, porphyritic metagabbro ("leopard rock"), and diabase

Seminoe greenstone belt metasedimentary and metaigneous rocks—Includes volcaniclastic and intermediate to felsic metavolcanics, metasediments, banded iron formation, mafic metavolcanics, and ultramafic schists

Bradley Peak ultramafics—Includes metagabro with spinifex and subophitic texture, and basaltic affinities; mafic and ultramafic rocks including serpentinite, metaperidotite, schist and amphibolite

Sunday Morning Creek metavolcanics—Includes mafic metavolcanics and volcaniclastics, amphibolite, mica schist, metabasalt, serpentinite, and chlorite-actinolite schist

REFERENCES AND SOURCES OF GEOLOGIC MAPPING
(Numbers refer to INDEX TO SOURCES OF GEOLOGIC MAPPING)

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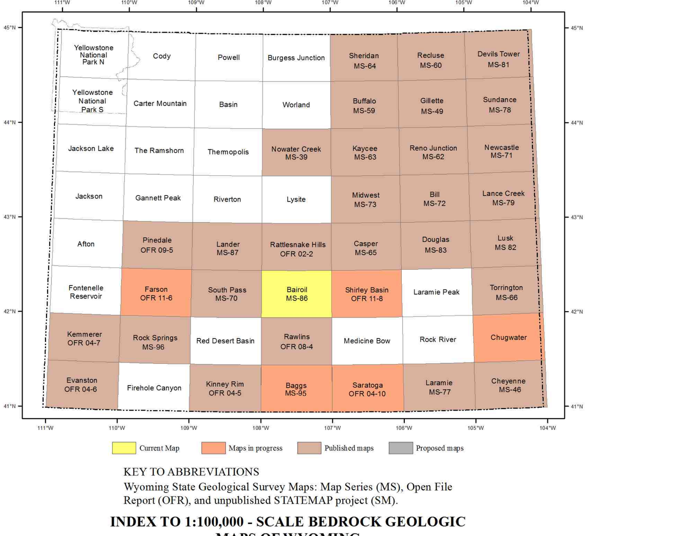

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