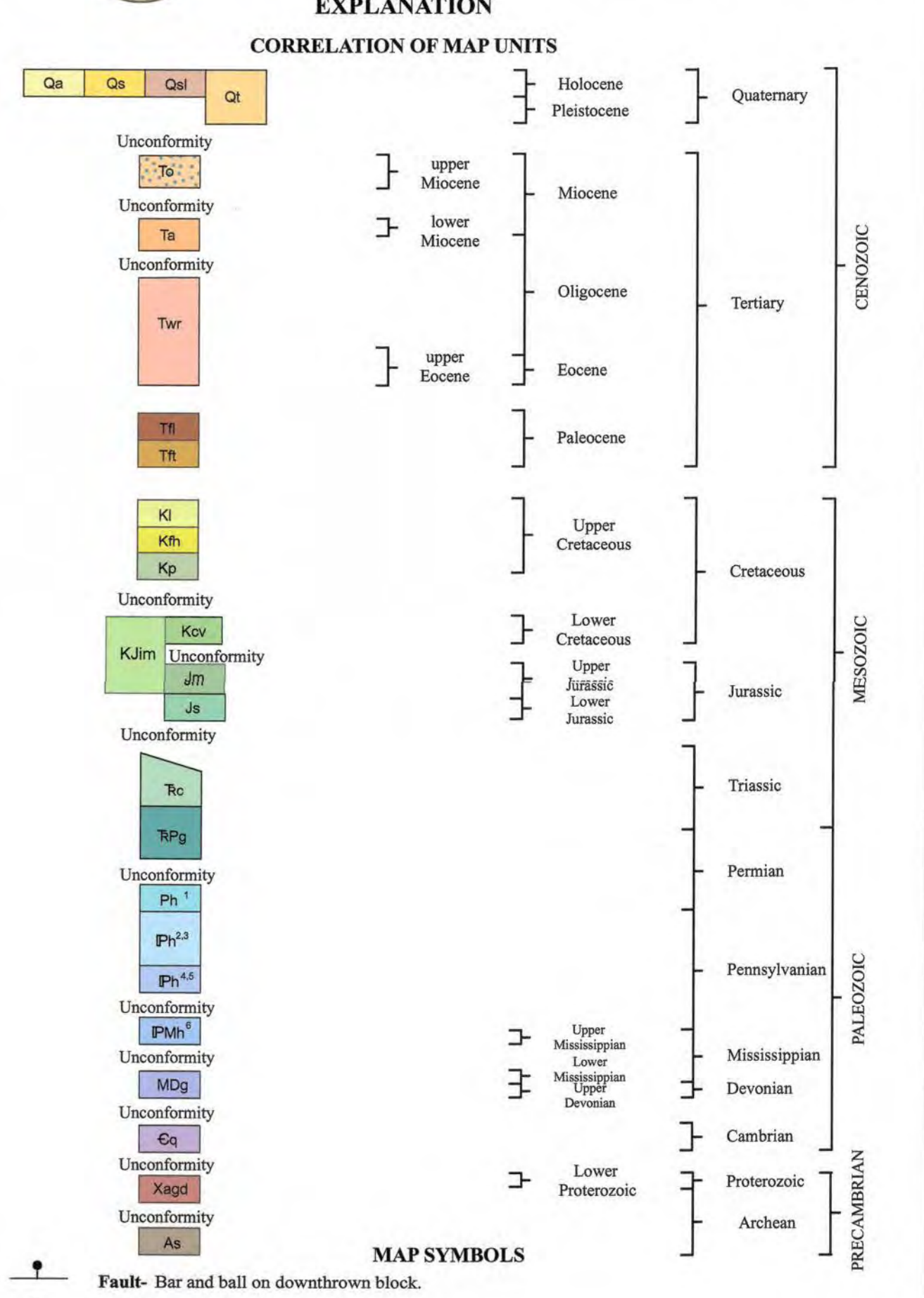
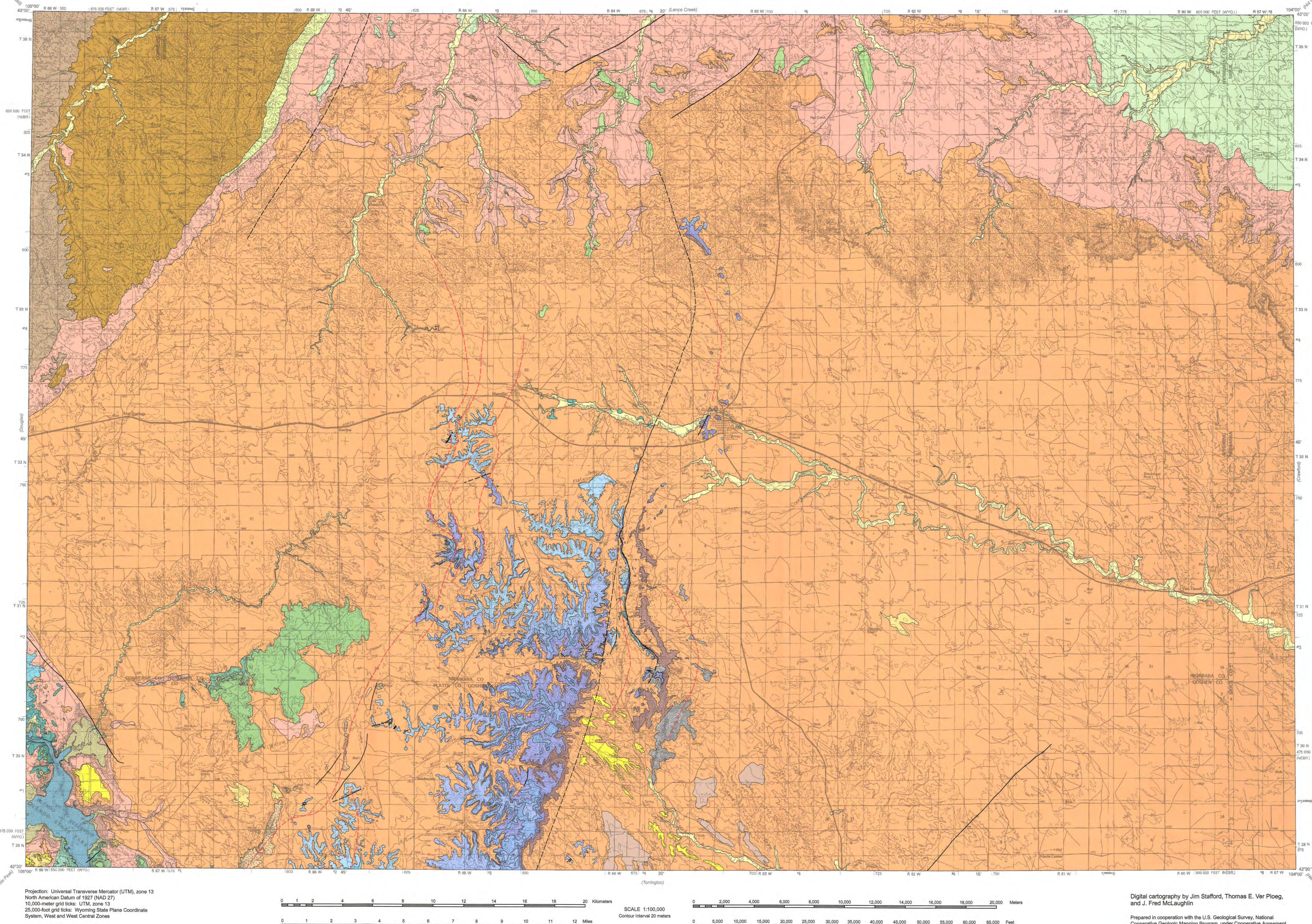




Geology - Interpreting the past to provide for the future



Prepared in cooperation with the
U.S. GEOLOGICAL SURVEY



DESCRIPTION OF MAP UNITS

- Qa** Alluvial Deposits (Holocene)—Silt, fine-grained sand, and some gravel in the present flood plains, bars, and islands of the principle streams.
- Qc** Dune Sand (Holocene)—Fine-grained, windblown sands.
- Qd** Sand and loess (Holocene)—Fine-grained residual sand and loess. Thickness from 0 to 40 feet.
- Qe** Terrace Gravels (Holocene/Pliocene)—Pebbles, cobbles and boulders deposited containing some silt, fine-grained sand, lenses of bentonitic clay, and locally some ash beds.
- Tc** Ogallala Formation (upper Miocene)—Fine to coarse-grained, light-gray to greenish-yellowish, and orange-gray sandstone interbedded and interfingering in upper part with conglomerate, claystone, and freshwater limestone; white to dark-gray vitric tuff beds near top; lower part has sand "ropy" calcareous sandstone concretions. Thickness 0 to 400 feet (0 to 120 m).
- Ta** Arikaree Formation (Miocene/Oligocene)—light-gray to buff fine-grained poorly bedded sandstone containing abundant magnetite grains; some siltstone, limestone, and tuff; lenticular conglomerate near base. Thickness 0 to 705 feet.
- Tw** White River Group (Oligocene)—White to pale pink blocky tuffaceous, bentonitic claystone and lenticular arkosic conglomerate with lenses of thin gray sandstone. Thickness 0 to 1,150 feet.
- Tt** Fort Union Formation (Paleocene)
 - Lebo Member**—Fine to coarse-grained drab to gray sandstone, finely conglomeratic in part, interbedded with drab siltstone, claystone, shale, and thin coal beds. Thickness 0 to 2,490 feet.
 - Tullock Member**—Has a drab to gray appearance and contains massive light-gray sandstones, whereas the Lebo Member is darker colored and contains more shale and claystone. Thickness 0 to 1,510 feet.
- Kp** Lance Formation (Upper Cretaceous)—Sombre shale and drab massive lenticular concretionary sandstone; many thin coal beds in lower half. Thickness 2,000 to 2,490 feet.
- Kk** Fox Hills Sandstone (Upper Cretaceous)—White to light-gray sandstone and gray sandy shale containing marine fossils. Thickness 148 to 197 feet.
- Kp** Pierre Shale (Upper Cretaceous)—Dark gray to black concretionary marine shale. Includes Red Bird Siltstone in middle part and Sharon Springs Member near base; many bentonite beds. Thickness 2,000 to 3,100 feet.
- Jm** Cloverly and Morrison formations undivided (Lower Cretaceous and Upper Jurassic)
 - Cloverly Formation (Lower Cretaceous)**—A tripartite unit consisting of a basal tan to white, coarse-grained sandstone and chert pebbled conglomerate, locally cross-bedded; variegated buff and purple claystones interbedded with this black shale beds in the middle; and an upper gray to buff to brown, fine to coarse-grained, resistant shabby sandstone and siltstone, locally referred to as the "Rusty Beds." Thickness approximately 100 to 300 feet (30 to 90 meters) (description and thickness modified from Love and others, 1979).
 - 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).
- Jk** Inyan Kara Group and Morrison Formation (Lower Cretaceous and Upper Jurassic)
 - Inyan Kara Group (Lower Cretaceous)**—Lithology and thickness similar to Cloverly Formation.
 - Morrison Formation (Upper Jurassic)**—As described above.
- Jn** Sundance Formation (Upper and Middle Jurassic)—The Sundance formation is divided into two sections. The lower Sundance is characterized by fine-grained, noncalcareous, limy sandstone, which is commonly red near the top, with persistent shaly and silty zones near the base. The shales are purple, green, and gray, and the siltstones are olive drab. Fossils collected in this layer are Jurassic in age. Thickness for the lower unit is 140 to 220 feet. The upper Sundance unit consists of glauconitic green shales and shaly sandstone, with a gray, granitic, basal sandstone which is up to 30 feet thick. Thickness of the upper unit is 50 to 120 feet.
- Tr** Chugwater Formation (Triassic)—Red shale and siltstone with some red sandstone and shale, and in the lower portion gypsum laminae and some anhydrite. The upper part is more limy than the lower part. A major unconformity marks the top of the layer. Thickness 150 to 435 feet.
- Ph** Goose Egg Formation (Triassic and Permian)—Interbedded red to other shales and siltstones, thin limestone, limestone breccias, and gypsum beds. Thickness 197 to 345 feet.
- Ph1** Hartville Formation, Division 1 (Permian)—Red, silty shale and siltstone, red aeolian sandstone, and limestone. Forms folds and folds. Thickness to 300 feet.
- Ph2** Hartville Formation, Divisions 2 and 3 (Pennsylvanian)
 - Hartville Formation, Division 2**—Consists of light-colored cherty hard dolomite and small amounts of bluish-gray limestone. This lenticular sandstone beds occur in the lower part. Thickness 0 to 225 feet. Contains recognizable gray to pink chert beds. Thickness 6 inches to 2 feet.
 - Hartville Formation, Division 3**—Consists of interbedded gray limestone, calcareous siltstone with some red shale and dolomitic mudstone near the base. The markers for Division 3 are hard vitreous, gray to pinkish-red, quartzitic sandstone 6 inches to 3 feet, and a massive, hard, ledge-forming limestone about 10 feet thick containing brown chert concretions 2 to 3 inches in diameter about 25 feet below the top.
 - Hartville Formation, Division 4 and 5 (Pennsylvanian)**—Interbedded maroon, pink, and gray siltstones and claystones, gray, brown, and buff limestone, pink dolomite, and thin gray sandstones. Forms smooth slopes with limestone ledges. Thickness 0 to 250 feet.
 - Hartville Formation, Division 6 (Pennsylvanian)**—Well indurated maroon to red orthoquartzite. Forms cliffs and rocky knolls. Deposited on a well developed karst surface, and fills sinkholes and caverns in the underlying Guernsey limestone. Thickness 0 to 120 feet.
- Mj** Guernsey Formation (Lower Mississippian and Upper Devonian)—The Guernsey formation contains an upper limestone unit of early Mississippian age and a lower unit of Devonian and Mississippian age. About four feet of pink, silty shale with abundant foliolar and white quartz grains and pebbles occurs at the base. In the southern part of the area where the Cambrian quartzite is present, the silty shale uniformly rests on the Precambrian. The dolomitic quartzite is probably Devonian. The upper limestone unit of the Guernsey formation consists of hard, gray, cherty, coarsely crystalline, coarsely bedded limestone averaging about 135 feet in thickness. The chert is a variety of colors and there are predominant dark-brown quartzite layers and nodules in this unit. The upper unit is Mississippian in age and the surface is highly irregular, with many local variations (marked, general thickening of formation towards the northwest). Total thickness (in Hartville area) is 140 to 260 feet thick. Sand and Sandberg (1987) divide this formation into the Madison Limestone, Englewood Formation, and Fremont Canyon Sandstone.
- Cg** Quartzite (Cambrian)—A hard, coarse-grained, reddish-brown conglomeratic quartzite ranging in thickness from a further edge to about 60 feet. Composed chiefly of quartz and feldspar grains and pebbles, tightly cemented, and poorly bedded.
- Xgp** Metamorphic Rocks, Granite, and Quartz Monzonite (Precambrian)—Metamorphic complex of gneisses, schists, and phyllites cut by coarse-grained granite, which is cut by white quartz dikes and veins.
- Aa** Metasedimentary and metavolcanic rocks (Archean)—Quartzite, hornblende gneiss, foliated marble, and aluminite-bearing calc-silicate rocks. Description modified from Hilliers and others (1999).

MAP SYMBOLS

- Fault**—Bar and ball on downthrown block.
- Approximated Fault**—Bar and ball on downthrown block. Dashed where approximated.
- Anticline**—Trace of axial plane and direction of plunge compiled from source mapping or by field dip measurements. Arrows point in direction of dip.
- Syncline**—Trace of axial plane and direction of plunge compiled from source mapping or by field dip measurements. Arrows point in direction of dip.

DESCRIPTION OF MAP UNITS

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, West and West Central Zones

Scale: 1:100,000
Contour interval 20 meters

Digital cartography by Jim Stafford, Thomas E. Ver Ploeg, and J. Fred McLaughlin

Prepared in cooperation with the U.S. Geological Survey, National Cooperative Geologic Mapping Program, under Cooperative Agreement Number 03HQAG0087

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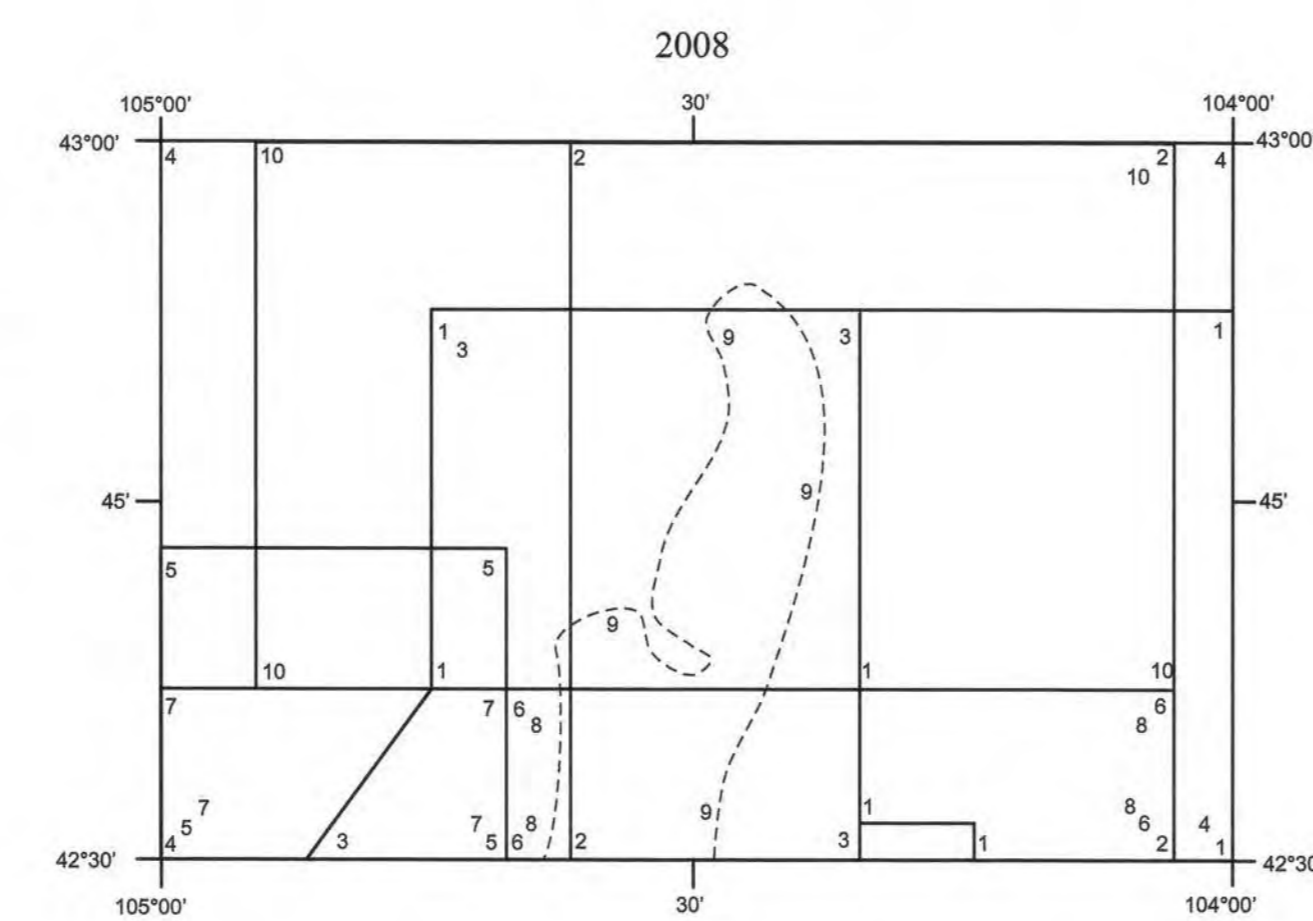
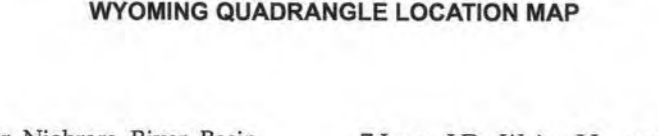
PRELIMINARY GEOLOGIC MAP OF THE LUSK 30' x 60' QUADRANGLE, NIOBRARA, GOSHEN, CONVERSE, AND PLATTE COUNTIES, WYOMING, AND WESTERN NEBRASKA

by
J. Fred McLaughlin, Jim Stafford, and Ray E. Harris, 2005

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WYOMING QUADRANGLE LOCATION MAP



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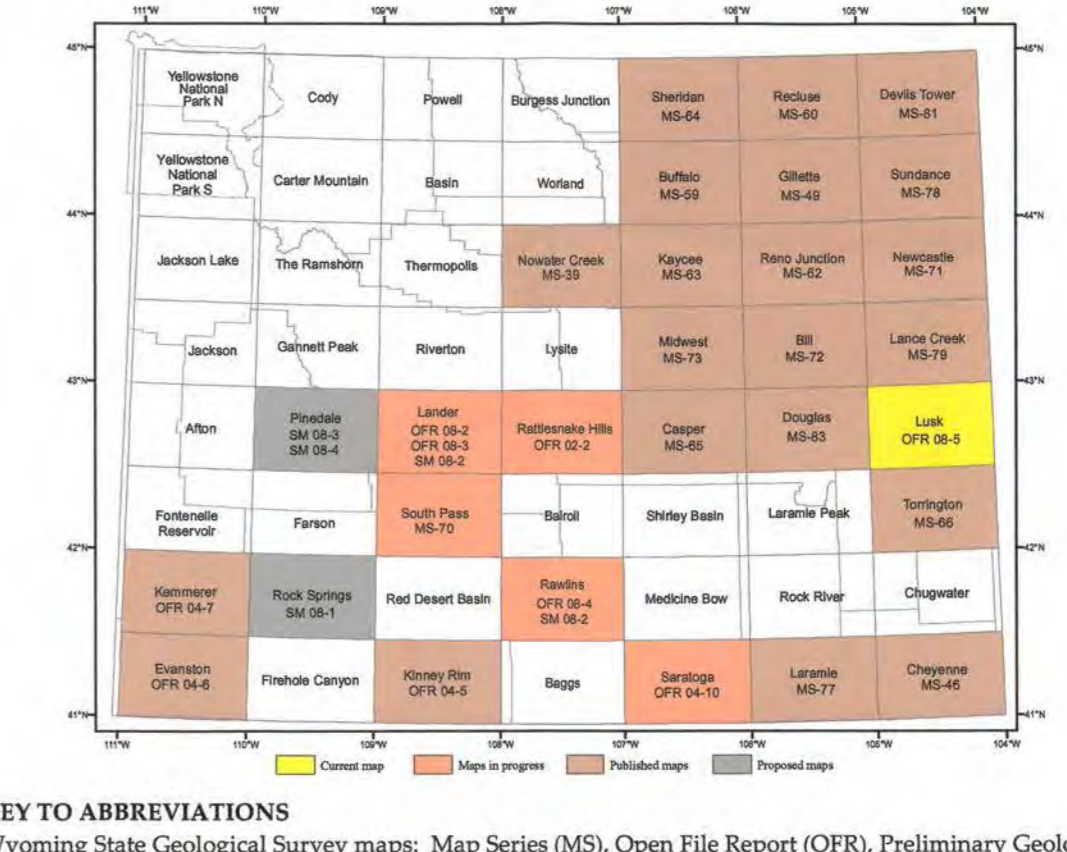
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