WYOMING STATE GEOLOGICAL SURVEY
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MAP SERIES 47
Wyoming
industrial minerals and
construction materials map

INDUSTRIAL MINERALS AND CONSTRUCTION MATERIALS MAP OF WYOMING

by

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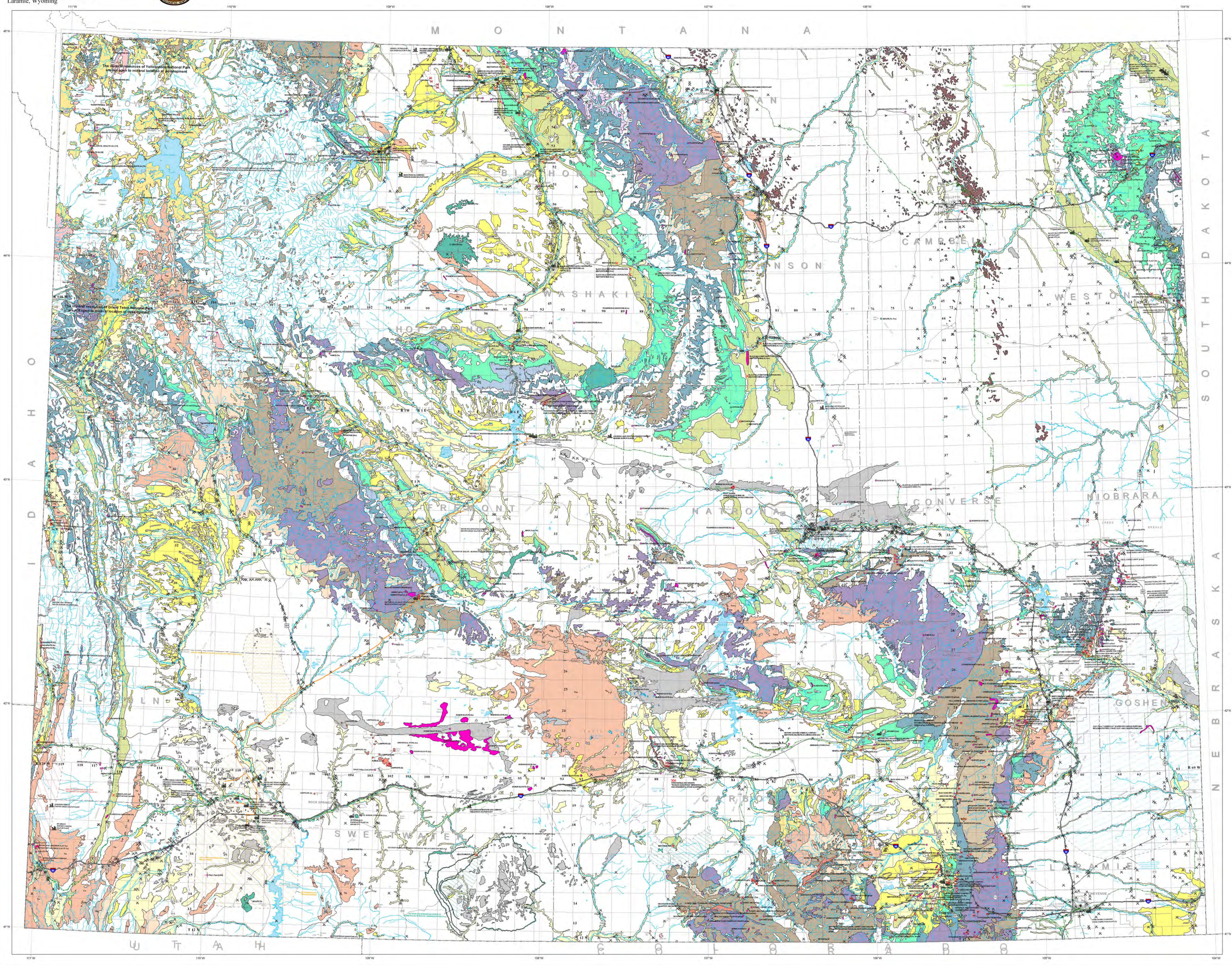
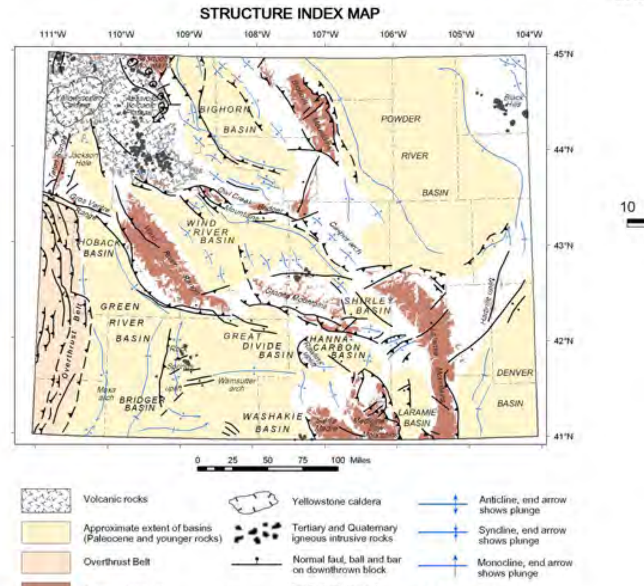


SCALE 1:500,000
1 inch equals approximately 8 miles (13 kilometers).
1 centimeter equals approximately 5 kilometers (3 miles).

10 5 0 10 20 30 40 Miles
9 4.5 0 9 18 27 36 Kilometers

STRUCTURE INDEX MAP



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EXPLANATION

INDUSTRIAL MINERALS

DEPOSITS AT THE SURFACE

Outcrop area of zeolite-bearing strata. Includes the zeolite-bearing beds of the Eocene Washakie and Green River formations in the Washakie Basin, the Eocene Wagon Bed Formation along the western Beaver Rim and on Lysite Mountain, the Eocene Tatman Formation in the Bighorn Basin, the Miocene rocks north of the Sierra Madre (samples contain as much as 98 percent clinoptilolite, a potassium-rich zeolite mineral), and the Pleistocene(?)-Pliocene Bug Formation in the Granite Mountains. Zeolites are a group of chemical compounds characterized by a silicate ring structure and a high cation-exchange capacity. The naturally occurring zeolite minerals are formed by alteration of volcanic tuffs.

Outcrop area of bentonite-bearing strata. Includes the Cretaceous Mowry, Thermopolis, Belle Fourche, Hilliard, and Aspen shales; the Newcastle Sandstone; the Frontier Formation; and parts of the Cody and Steele shales. Bentonite is an authigenic clay formed by the alteration of volcanic ash.

Outcrop area of gypsum-bearing strata. Includes the Permian Goose Egg Formation, Forelle Limestone, and Satanka Shale; the Triassic Spearfish and Chugwater formations; the Jurassic Gypsum Spring Formation; and part of the Jurassic Sundance Formation. Locally may include Triassic to Permian (undivided) formations. Gypsum is an evaporite deposit.

Outcrop area of phosphate-bearing strata. Includes phosphate-bearing rocks of the Permian Phosphoria Formation. The phosphate is a chemical precipitate.

Outcrop area of limestone-bearing strata. Includes the Mississippian-Devonian Guernsey Limestone; the Mississippian Madison and Pahasapa limestones, the predominately carbonate portion of the Pennsylvanian Casper Formation, the Pennsylvanian-Permian Hartville Formation, and the Permian Minnekahta Limestone. Limestone is a calcareous chemical precipitate.

Outcrop of dolomite-bearing strata. Includes the Ordovician Bighorn Dolomite where mapped separately. Dolomitic strata are also present in portions of the Mississippian Madison Limestone, the Pennsylvanian Casper Formation, and the Pennsylvanian-Permian Hartville Formation. Dolomitic marble is present in Precambrian rocks. Dolomite is a chemical precipitate or a diagenetically altered limestone.

DEPOSITS IN THE SUBSURFACE

Area underlain by bedded trona. Bedded trona occurs in the Wilkins Peak Member of the Eocene Green River Formation. Single crosshatch indicates the approximate subsurface area for which trona resources were calculated by the U.S. Geological Survey (Known Trona Resource Area). Double crosshatch shows the area underlain by minable beds (includes trona beds 8 feet thick or greater within 2000 feet of the surface). Data from the Wyoming State Geological Survey, U.S. Geological Survey, U.S. Bureau of Mines, and the Union Pacific Railroad, Minerals Division (now Anadarko Petroleum Company). Trona is natural sodium carbonate-bicarbonate classified as an evaporite mineral.

Area underlain by possible occurrence of black trona water. Dana and Smith (1973) reported several zones of black trona water under artesian pressure in at least 18 shallow wells drilled into oil shales of the Wilkins Peak Member of the Eocene Green River Formation. Several water wells drilled in the area since these first wells have also encountered the black trona water. Black trona water is an organic-rich groundwater solution containing primarily dissolved trona (sodium carbonate-bicarbonate).

Area underlain by zeolite-bearing beds. Includes the area of the Washakie Basin underlain by the zeolite-bearing robins-egg-blue tuff bed of the Adobe Town Member of the Eocene Washakie Formation.

Area underlain by bedded halite. Includes subsurface portions of the Jurassic Preuss Formation where halite has been reported at depth. Halite (native salt, NaCl) is an evaporite mineral.

Area underlain by bedded potash. Includes an area in the subsurface reported by the U.S. Geological Survey and the Wyoming State Geological Survey to contain bedded potash (potassium carbonate) in Pennsylvanian rocks. Potash is an evaporite deposit.

STONE
(Also see limestone and dolomite, above)

Outcrop area of baked and fused rocks. Rocks baked or partially melted by recent, naturally-ignited coal fires; sometimes called clinker or scoria. Hosted by coal-bearing rocks of Cretaceous, Paleocene, and Eocene age. Used as decorative aggregate. Locally suitable for light-duty construction aggregate in areas lacking other sources of durable rocks.

Outcrop area of basalt. Locally suitable for dimension stone and crushed aggregate. Found in and immediately south of Yellowstone National Park, the northern Wind River Range, and west of the Sierra Madre. Includes basalt of Tertiary and Quaternary age.

Outcrop area of "granite." Locally suitable for decorative and dimension stone and decorative and construction aggregate. These rocks are called granite by the dimensional stone industry, based on finishing characteristics (hardness, durability, resistance to acid, etc.). Includes rock types not geologically defined as granite, such as monzonite, granodiorite, syenite, and others. Includes rocks of Precambrian age plus selected Tertiary igneous rocks in the Black Hills area; Cretaceous igneous intrusive rocks in the Beartooth Mountain; Eocene alkaline, dacite, and quartz latite intrusive and extrusive rocks of the Rattlesnake Hills; and late Tertiary intrusive and extrusive rocks south of Jackson Hole.

Outcrop area of anorthosite and syenite of the Laramie Mountains. Locally suitable for decorative and dimension stone and construction and decorative aggregate. Includes only rocks of Precambrian age.

Outcrop area of other dimension, decorative, and ornamental stone. Includes marble, quartzite, sandstone, travertine, and leucite-bearing lamprophyric igneous rocks. Includes Precambrian and younger rocks.

Other outcrop areas with decorative and dimension stone potential. Includes rock types such as marble, amphibolite, gneiss, and others. Locally suitable for construction aggregate, especially railroad ballast. Includes all other areas of Precambrian rocks plus Tertiary igneous intrusive rocks not included in other categories of stone.

AGGREGATE RAW MATERIALS (EXCLUDING CRUSHABLE STONE)*

Outcrop area of windblown sand. Recent stabilized and unstabilized windblown sand deposits.

Outcrop area of alluvial sand and gravel. Recent stream deposits containing varying proportions of subrounded to subangular clasts of gravel, sand, silt, and clay.

Outcrop area of glacial sand and gravel. Pleistocene glacial moraine, outwash, and related deposits sometimes containing a high proportion of coarse material.

Outcrop area of terrace sand and gravel. Quaternary terrace gravels containing a variable proportion of finer material.

Outcrop area of older sand and gravel. Includes selected areas of poorly consolidated to consolidated gravels and conglomerates in rocks of Upper Cretaceous to Pleistocene age. Symbol indicates conglomerate or conglomerate-bearing formations (see list of **FORMATION NAMES AND/OR ROCK TYPES**, below). In many cases, only those parts of formations that contain mapped conglomerates or gravels are shown. Some of the areas depicted may be overlain by thin surficial deposits.

Outcrop area of sand and gravel of various origins. Undifferentiated sand and gravel deposits of various origins, mapped in and near Yellowstone National Park and locally in other areas.

"Alluvial, glacial, terrace, older sand and gravel deposits, and sand and gravel of various origins are generally referred to as "river rock."

OTHER SYMBOLS

POTASSIUM FELDSPAR (pЄgg) — **Surface occurrence of specialty or miscellaneous industrial minerals or construction materials not described above.** Name of host formation(s) or rock type(s) in parentheses (see list of **FORMATION NAMES AND/OR ROCK TYPES**, below).

HIGH-CALCIUM LIMESTONE (Mlg) — **Surface occurrence of industrial minerals or construction materials of small areal extent.** Circle denotes area of small extent (not to scale); color denotes type of material as described above. Name of host formation(s) or rock type(s) in parentheses (see list of **FORMATION NAMES AND/OR ROCK TYPES**, below).

TALC (Tgs-[1,800]) — **Subsurface occurrence of specialty or miscellaneous industrial minerals not described above.** Name of host formation(s) or rock type(s) in parentheses (see list of **FORMATION NAMES AND/OR ROCK TYPES**, below). Numbers in brackets refer to depth of occurrence, in feet.

RINKER STONE COMPANY QUARTZITE QUARRY (Cd) — **Active surface mine or quarry.** Mine operator, mine name (where appropriate), type of material mined or quarried, proposed mines or quarries (P) or mines or quarries under development (U), and formation name(s) or rock type(s) in parentheses (see list of **FORMATION NAMES AND/OR ROCK TYPES**, below). Numerous mines operated by one or more companies in some areas are not labeled. Symbol may indicate more than one mine or quarry in areas of closely spaced mines or quarries.

SUGAR ROCK (LIMESTONE) (PPh) — **Inactive surface mine or quarry.** Includes type of material mined or quarried, and formation name(s) or rock type(s) in parentheses (see list of **FORMATION NAMES AND/OR ROCK TYPES**, below). Symbol may indicate more than one mine or quarry in areas of closely spaced mines or quarries.

OCI BIG ISLAND TRONA MINE (Tgw) — **Active underground mine.** Mine operator, mine name (where appropriate), type of material mined or quarried, and formation name(s) or rock type(s) in parentheses (see list of **FORMATION NAMES AND/OR ROCK TYPES**, below). Includes proposed mines (P).

FMC WYOMING GRANGER TRONA MINE (Tgw) — **Inactive underground mine.** Includes type of material mined and formation name(s) or rock type(s) in parentheses (see list of **FORMATION NAMES AND/OR ROCK TYPES**, below).

Pit or quarry for sand, gravel, or unspecified aggregate. Symbol may indicate more than one pit or quarry in areas of closely spaced pits or quarries.

WYOMING LIME PRODUCERS FRANNIE LIMESTONE PLANT (500 TPD) — **Mill or plant.** Plant operator/owner, plant name, status (A = active, Ab = abandoned, I = inactive, P = proposed, or U = under construction or development), and capacity (TPY = short tons of product per year, TPD = short tons of product per day).

HOWELL PETROLEUM ELK BASIN SULFUR PLANT — **Sulfur plant.** Natural gas processing plant that produces elemental sulfur as a by-product from hydrogen sulfide (H_2S) in the gas. Includes plant operator and plant name; (I) indicates inactive.

Railroad. Ownership of trackage:

BNSF	Burlington Northern Santa Fe Railroad.
BNSF & UP	Jointly-owned line shared by BNSF and UP between Shawnee Junction and the Caballo mine spur.
PP & L	Pacific Power and Light Company, private rail line.
UP	Union Pacific Railroad Company.

Highway. Route of the Bonneville Transloaders, Incorporated (BTI) trona hauling operation from trona mines in the Green River Basin to the Bonneville loading facility north of Shoshoni.

FORMATION NAMES AND/OR ROCK TYPES
(Arranged in approximate order of age)

CENOZOIC ERA

Qal	Alluvium (Quaternary)
Qg	Glacial deposits (Quaternary)
Qhs	Hot spring deposits (Quaternary)
Qi	Intrusive rocks (Quaternary)
Ql	Lake deposits (Quaternary)
Qr	Rhyolite (Quaternary)
Qt	Terrace deposits (Quaternary)
Qu	Quaternary rocks, undivided
Qv	Quaternary volcanic rocks
QTg	Terrace gravel (Pleistocene and/or Pliocene)
QTc	Unnamed conglomerate in Jackson Hole (Pleistocene or Pliocene), Medicine Bow Mountains, and east of the Laramie Mountains (Pleistocene to Miocene)
QTb	Bug Formation (Pleistocene or Pliocene)
Tu	Tertiary rocks, undivided
Thl	Heart Lake Conglomerate (Pliocene)
Tsi	Shooting Iron Formation (Pliocene)
Tsl	Salt Lake Formation (Pliocene and Miocene)
Tm	Miocene rocks, undivided
Tr	Red conglomerate on top of Hoback and Wyoming Ranges (Miocene?)
Tcd	Camp Davis Formation (Miocene)
Tte	Teewinot Formation (Miocene)
Tnp	North Park Formation (Miocene)
Tbp	Browns Park Formation (Miocene)
Tmo	Ogallala Formation (Miocene)
Tbi	Bishop Conglomerate (Miocene)
Tsr	Split Rock Formation (Miocene)
Twru	Upper conglomerate member of the White River Formation (Oligocene)
Twrc	Chadron Member of White River Formation (Oligocene)
Tf	Fowkes Formation (Pliocene(?) and Eocene)
Twi	Wiggins Formation (Eocene)
Ttt	Tepee Trail Formation (Eocene)
Ta	Aycross Formation (Eocene)
Tip	Ice Point Conglomerate (Eocene)
Twa	Washakie Formation (Eocene)
Twb	Wagon Bed Formation (Eocene)
Tb	Bridger Formation (Eocene)
Tcg	Crooks Gap Conglomerate (Eocene)
Tgc	Granitic conglomerate above or in the upper part of the Wasatch Formation (Eocene)
Tg	Green River Formation (Eocene)
Tgl	Laney Member (Eocene)
Tgw	Wilkins Peak Member (Eocene)
Tgt	Tipton Shale Member (Eocene)
Tw	Wasatch Formation (Eocene)
Twmo	Moncrief Member (Eocene)
Twk	Kingsbury Member (Eocene)
Twdr	Wind River Formation (Eocene)
Tta	Tatman Formation (Eocene)
Tp	Pass Peak Formation (Eocene)
Twl	Willwood Formation (Eocene and Paleocene)
Tcr	Crandall Conglomerate (Eocene)
Tbs	Battle Spring Formation (Eocene and Paleocene)
Tcs	Conglomerate of Sublette Range (Eocene and Paleocene)
Tep	Conglomerate of Roaring Creek (Eocene and Paleocene)
Tha	Hanna Formation (Eocene and Paleocene)
Tfw	Early Tertiary conglomerate at Clarks Fork Canyon (Eocene(?) and Paleocene)
Tfe	Ferris Formation (Paleocene)
Tfu	Fort Union Formation (Paleocene)
Tv	Tertiary volcanics, undivided
Ti	Tertiary intrusives, undivided
TKp	Pinyon Conglomerate (Paleocene and Upper Cretaceous)

MESOZOIC ERA

Kha	Harebell Formation (Upper Cretaceous)
Kle	Lewis Shale (Upper Cretaceous)
Kp	Pierre Shale (Upper Cretaceous)
Kav	Adaville Formation (Upper Cretaceous)
Ke	Ericson Sandstone of Mesaverde Group (Upper Cretaceous)
Kmv	Mesaverde Group or Formation (Upper Cretaceous)
Ks	Steele Shale (Upper Cretaceous)
Kc	Cody Shale (Upper Cretaceous)
Kba	Baxter Shale (Upper Cretaceous)
Kn	Niobrara Formation (Upper Cretaceous)
Kh	Hilliard Shale (Upper Cretaceous)
Kf	Frontier Formation (Upper Cretaceous)
Kbf	Belle Fourche Shale (Upper Cretaceous)
Kg	Greenhorn Formation (Upper Cretaceous)
Kmr	Mowry Formation (Upper Cretaceous)
Ka	Aspen Shale (Upper Cretaceous)
Knc	Newcastle Sandstone (Lower Cretaceous)
Ksc	Skull Creek Shale (Lower Cretaceous)
Km	Muddy Sandstone (Lower Cretaceous)
Kt	Thermopolis Shale (Lower Cretaceous)
Kbr	Bear River Formation (Lower Cretaceous)
Kcv	Cloverly Formation (Lower Cretaceous)
Kik	Inyan Kara Group (Lower Cretaceous)
Jm	Morrison Formation (Jurassic)
Js	Sundance Formation (Jurassic)
Jst	Stump Formation (Jurassic)
Jp	Preuss Formation (Jurassic)
Jg	Gypsum Spring Formation (Jurassic)
Ꞧa	Alcova Limestone (Triassic)
Ꞧc	Chugwater Formation (Triassic)
ꞦPs	Spearfish Formation (Triassic and Permian)
ꞦPg	Goose Egg Formation (Triassic and Permian)

PALEOZOIC ERA

Pp	Phosphoria Formation (Permian)
Pf	Forelle Limestone (Permian)
Ps	Satanka Shale (Permian)
Pm	Minnekahta Limestone (Permian)
PPc	Casper Formation (Permian and Pennsylvanian)
PPh	Hartville Formation (Permian and Pennsylvanian)
PPw	Wells Formation (Permian and Pennsylvanian)
PPm	Minnelusa Formation (Permian and Pennsylvanian)
Pt	Tensleep Formation (Pennsylvanian)
Pa	Amsden Formation (Pennsylvanian)
Mm	Madison Limestone (Mississippian)
Mp	Pahasapa Limestone (Mississippian)
MDg	Guernsey Limestone (Mississippian and Devonian)
Ob	Bighorn Dolomite (Ordovician)
Єu	Cambrian rocks, undivided
Єd	Deadwood Formation (Cambrian)
Єf	Flathead Sandstone (Cambrian)

PRECAMBRIAN

pЄu	Precambrian rocks, undivided
pЄam	Amphibolite
pЄan	Anorthosite
pЄex	Exsolution bodies of magnetite-ilmenite and associated minerals
pЄgn	Gneiss
pЄgr	Granite
pЄif	Iron formation
pЄmb	Marble
pЄmi	Mafic rocks
pЄmk	Mafic dikes
pЄms	Metasedimentary rocks, undivided
pЄmu	Mafic and ultramafic rocks
pЄpg	Pegmatite
pЄqz	Metaquartzite
pЄum	Ultramafic rocks

GEOLOGY AND INDUSTRIAL MINERAL COVERAGES

Geologic formation boundaries: Love and Christiansen (1985)
Structural index map: De Bruin (2002)
Industrial mineral locations: Harris (1996)

BASE MAP COVERAGES

County boundaries: Spatial Data Visualization Center, University of Wyoming (1997).
City locations: Wyoming Water Resources Center GIS Lab, University of Wyoming (1994).
Federal boundaries: Spatial Data Visualization Center, University of Wyoming (1996).
Latitude, Longitude: Wyoming State Geological Survey (2002).
Public Land Survey System (PLSS): Wyoming Water Resources Center GIS Lab, University of Wyoming (1994).
Railroads: U.S. Census TIGER files (1995).
Highways and roads: Wyoming State Geological Survey (2002); U.S. Census TIGER files (1997).
State boundaries: Wyoming State Geological Survey (2002); Spatial Data Visualization Center, University of Wyoming (1993).
Streams: Environmental Systems Research Institute (ESRI) 2000, ESRI, Redlands, CA, USA.
Lakes: Spatial Data Visualization Center, University of Wyoming (1996).

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Harris, R.E., 1996, Industrial minerals and construction materials map of Wyoming: Wyoming State Geological Survey Map Series 47, scale 1:500,000, color.
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Love, J.D., and Christiansen, A.C., 1985, Geologic map of Wyoming: U.S. Geological Survey, scale 1:500,000.
Wyoming State Geological Survey published and unpublished mineral commodity reports (see Wyoming State Geological Survey List of Publications for released published commodity reports).
Wyoming Department of Transportation published and unpublished sand and gravel inventory reports.

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