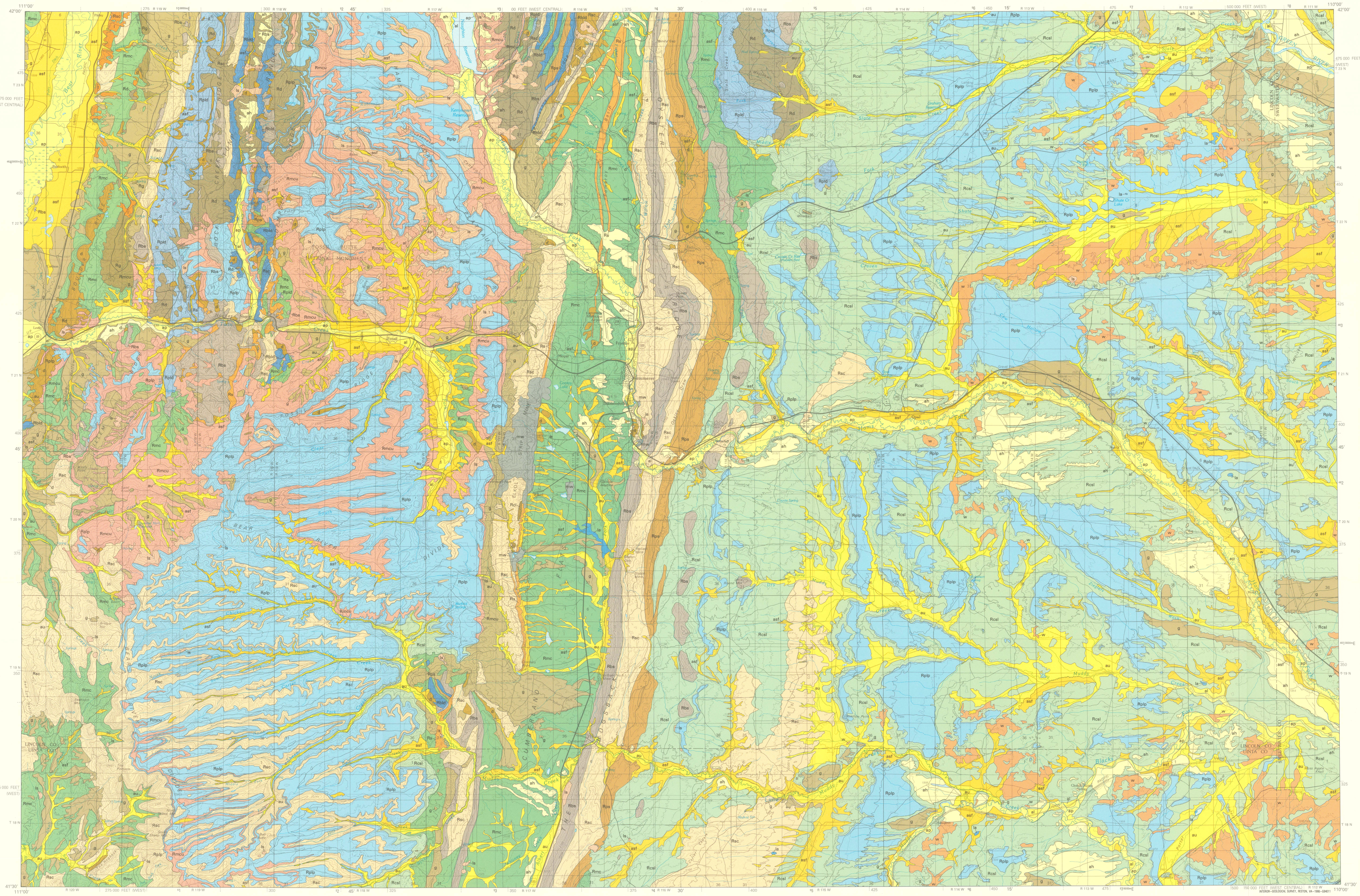
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

COAL INVESTIGATIONS
MAP C-102



Base from U.S. Geological Survey, 1:24 000 and 1:62 500, 1954-69
25,000-foot grid based on Wyoming coordinate system, west to west central zones
10,000-meter Universal Transverse Mercator gird ticks, zone 12

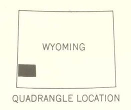
APPROXIMATE MEAN DECLINATION, 1986

SCALE 1:100 000

5 0 5 10 15 KILOMETERS

5 0 5 MILES

CONTOUR INTERVAL 20 METERS
NATIONAL GEODETIC VERTICAL DATUM OF 1929



QUADRANGLE LOCATION

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA—1986—G84011

Compiled and field checked in 1977-78

CORRELATION OF MAP UNITS

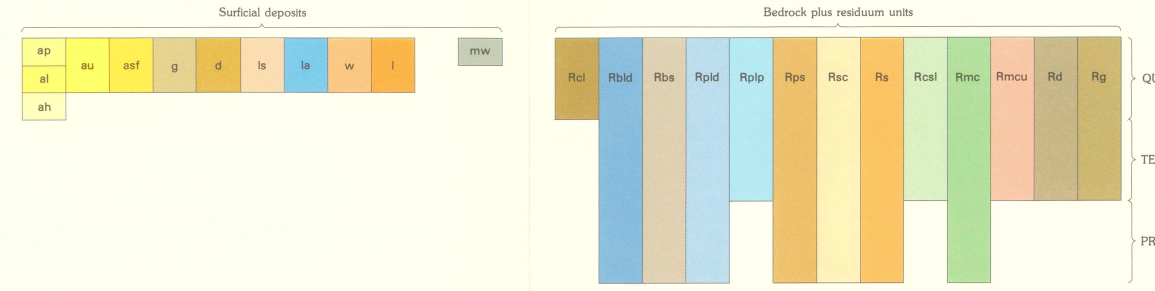


Table 1.—*Characteristics of map units*

General Characteristics						Practical Characteristics										Stratigraphic unit or units corresponding to bedrock plus residuum unit[1,2]	
Symbol	Name of unit	Materials	Origin of surficial deposit or residuum	Typical position in landscape	Common thickness of deposit or residuum (feet)	Good for road metal or aggregate	Possible source of sand	Subject to flooding or high water table	Forms deep mud when wet	Forms rough terrain	Best land for hay and grain	Subject to gully erosion	Steep slopes likely to be unstable	Subject to wind erosion if disturbed	Difficult to excavate	Name	Age
ALLUVIAL DEPOSITS																	
ap	Alluvium, flood plain	Silt, clay, sand, and gravel. Variably bedded and sorted. Silt and clay mostly at top; sand and gravel near base. Gravel mostly quartzite, well rounded, as much as 10 in. in diameter. Little soil formation or dissection in unit. Granite pebbles and cobbles along Green River.	Channel, point bar, and overbank deposition.	Flood plains of perennial and intermittent streams.	0–40?	Material present, but high water table and high land values discourage use.	Sand present, but high water table and high land values discourage use.	Everywhere	In some places	Rarely	Generally	Rarely	Rarely	In some places	No	Unnamed	Quaternary
al	Alluvium, low terrace	Silt, clay, sand, and gravel. Variably bedded and sorted. Silt and clay mostly at top; sand and gravel near base. Gravel, mostly quartzite, well rounded, as much as 10 in. in diameter. Granite pebbles and cobbles along Green River. Commonly oxidized in upper 3 ft.	Channel, point bar, and overbank deposition.	Terraces 5–15 ft above flood plains of perennial and intermittent streams.	0–40?	Material present, but high water table and high land values discourage use.	Sand present, high water table and high land values may discourage use.	In some places	In some places	Rarely	Generally	Rarely	Rarely	In some places	No		
ah	Alluvium, high terrace	Dominantly gravel and sand. Gravel mostly quartzite, well rounded, as much as 10 in. in diameter. Granite pebbles and cobbles along Green River. Surface soil is oxidized sand and silt, 6–12 in. thick above 3–6 ft of sand and gravel that are variably cemented by white calcite.	Channel, point bar, and overbank deposition.	Terraces that bevel bluffs along perennial and intermittent streams.	0–20	Generally	Generally	No	In some places	In some places	In some places	Rarely	Rarely	In some places	Rarely	Unnamed	Quaternary and Tertiary
au	Alluvium, undifferentiated	Mostly silt, clay, and sand; locally gravelly. Interfingers upslope with unit asf.	Channel, point bar, and overbank deposition.	Channels, flood plains, and low terraces of mostly, intermittent streams.	0–15+	Rarely	In some places	Axial areas of valleys sometimes flooded	In some places	Rarely	In some places	Generally	Rarely	In some places	No	Unnamed	Quaternary
asf	Alluvium of side slopes, fans, and minor tributary streams	Silt, clay, sand, and gravel as available from local sources. Coarse material commonly shows little wear. Grades upslope into rock debris. May be very thick at margins of Bear River valley.	Deposition by ephemeral streams and sheet floods.	Minor valleys and low areas marginal to main valleys.	0–15	Rarely	In some places	In some places	In some places	In some places	In some places	Generally	Rarely	In some places	No		
g	Gravel	Mostly well-rounded quartzite, as much as 14 in. in diameter. Minor silt and sand are present, but do not form continuous upper layer. As mapped unit includes accumulations directly overlying bedrock source.	Deposition mainly by sheet floods and shifting ephemeral streams, partly by subaerial rolling and slumping.	High, sloping, irregular surfaces.	0–20	In some places. Deposit too thin to work in many places.	In some places. Deposit too thin to work in many places.	No	No	Generally	No	Rarely	In some places	Rarely	In some places		
MASS-WASTING DEPOSITS																	
d	Rock debris	Angular to subangular blocks .5 in.–10 ft or more across with sparse to abundant clay, silt, and sand. Includes much active talus as well as stabilized material.	Emplacement by rock fall, talus creep, and minor rockslides.	Lower parts of steep valley walls.	0–25	In some places	Rarely	Rarely	Rarely	Generally	No	Rarely	In some places	Rarely	In some places. Large blocks may require special handling.	Unnamed	Quaternary
ls	Landslide deposits	Mostly silt and clay; locally includes blocks of porous limestone. Surface commonly marked by closed depressions holding water through the year. Landslide deposits from east wall of Rock Creek are made up of blocks of dense limestone and quartzite as much as 10 ft across.	Emplacement mostly by rotational slumps, in lesser part by mudflows.	On or below steep, high slopes.	0–100	Rarely	Rarely	In some places	In some places	Generally	Rarely	Generally	Generally	In some places	In some places		
OTHER DEPOSITS																	
la	Lake deposits	Silt and clay, minor sand and gravel. Frequent flooding.	Deposition in ephemeral lakes by bottom currents and by infall of wind-blown dust.	Edges of broad alluviated areas.	0–5	No	Rarely	Generally	Generally	No	Rarely	In some places	No	Generally	No	Unnamed	Quaternary
w	Windblown sand	Mostly fine, well-sorted sand, some silt and coarse sand. Forms dunes as much as 12 ft high, mostly stabilized by vegetation. As mapped, unit includes areas of bedrock and of alluvium as much as several hundred feet across. Some dune fields include deflation hollows with as much as 4 ft of closure.	Wind transport and winnowing downwind from major streams and outcrops of soft, sandy bedrock.	Slopes to north and east of alluviated areas.	0–20	No	Generally	Rarely	No	In some places	Rarely	Rarely	Generally	Generally	No		
l	Loess	Silt and very fine sand. Forms discontinuous mantle on bedrock near west edge of area. Mostly adjacent to Bear River valley. Topographic expression slight. Commonly mixed with other surficial materials.	Wind transport and winnowing.	Slopes and uplands east of Bear River valley.	0–10	No	Rarely	Rarely	Rarely	In some places	Rarely	In some places	Rarely	Generally	No		
mw	Strip-mine waste	Transported shale, carbonaceous shale, and minor sandstone debris.	Mining	Artificial terraces, as much as 80 ft high, built eastward into valley of North Fork of Little Muddy Creek.	0–80	No	Rarely	Rarely	In some places	In some places	No	Generally	Generally	In some places	No		
BEDROCK PLUS RESIDUUM UNITS																	
Rcl	Rock, clinker, and residuum	Shale and sandstone variably baked and fused, commonly oxidized to red or pink. Residuum of blocks, plates, or chips from several feet to .25 in. across.	Burning of underlying coal bed.	Ridges east and west of Cumberland Flat-Pomeroy Flat lowland.	0–50?	Rarely	No	Rarely	No	In some places	No	Rarely	Rarely	No	In some places	Unnamed	Quaternary and Tertiary?
Rbld	Rock, blocky weathering, limestone, dense, plus residuum	Mostly massive limestone; dolomite or dolomitic limestone dominant in a few areas. Rock in part cherty. Large areas of colluvial material stabilized by vegetation. Considerable coarse active talus. Bedrock outcrop, estimated at 20–25 percent of the unit area, mostly much fractured.	Mechanical weathering and solution in place. Downslope transport by rockfall, talus creep, rockslides, and sheet and rill wash.	Steep canyon walls	0–25	Generally	No	Rarely	Rarely	Generally	Rarely	Rarely	In some places	Rarely	Generally	Thaynes Limestone Phosphoria Formation Wells Formation, upper part, gray limestone Amsden Formation Darby Formation Bighorn Dolomite Gallatin Limestone	Early Triassic Permian Permian Pennsylvanian and Mississippian Mississippian and Devonian Late and Middle Ordovician Late Cambrian
Rbs	Rock, blocky weathering, siliceous, plus residuum	Hard sandstone, siliceous or partly siliceous, and siliceous conglomerate. Common coarse, active talus. Abundant colluvium variably stabilized by vegetation. Bedrock outcrop, estimated at 20 percent of unit area, much fractured but coherent blocks are as much as 5 ft across.	Mostly mechanical weathering in place. Downslope transport by rockfall, talus creep, rockslides, and sheet and rill wash.	Crestal areas of ridges.	0–25	In some places	Rarely	Rarely	No	Generally	No	Rarely	In some places	Rarely	Generally	Frontier Formation, middle unit Bear River Formation, basal sandstone Ephraim Conglomerate Nugget Sandstone Wells Formation	Late Cretaceous Early Cretaceous Early Cretaceous Jurassic(?) and Triassic(?) Permian and Pennsylvanian
Rpld	Rock, platy weathering, limestone, dense, plus residuum	Limestone argillaceous. Abundant active talus, mostly of plates, chips, and spindles less than 5 in. in greatest dimension. Outcrop estimated about 10 percent of unit area, closely fractured, crumbly.	Mostly mechanical weathering in place. Downslope transport by rockfall, talus creep, rockslides, and sheet and rill wash.	Uplands and rugged canyon walls.	0–35	In some places	No	Rarely	In some places	In some places	No	In some places	In some places	Rarely	In some places	Twin Creek Limestone Twin Creek Limestone Gypsum Spring Member	Middle Jurassic Middle Jurassic
Rplp	Rock, platy weathering, limestone, porous, plus residuum	Limestone impure, marly, siliceous in some areas, with interbedded shale and siltstone. Platy to chippy fragments conspicuous only near topographic rims. Back from rims unit forms soil with light-brown powdery surface layer 12–18 in. thick grading down into as much as 60 in. of soil and weathered rock containing abundant white calcite. In eastern part of area, beds are as much as 2 ft thick; in western part of area, beds are as much as 5 ft thick, in part blocky weathering.	Mechanical and solutional weathering in place. Downslope transport commonly initiated by sapping in underlying rock, followed by talus creep, rockslides, and sheet and rill wash.	Caprock of mesas and gently dipping benches.	0–7	Rarely	No	Rarely	Generally	In some places	Rarely	In some places	Rarely	In some places	In some places. Thick limestones, present in west half of area, may be difficult.	Bridger Formation Green River Formation Green River Formation, Angelo Member Green River Formation, Fossil Butte Member Green River Formation, Laney Member Green River Formation, Fontenelle Tongue	Eocene Eocene Eocene Eocene Eocene Eocene
Rps	Rock, platy weathering, siliceous, plus residuum	Ridges in central part of area are hard, silicic sandstone and shale called "porcellanite", and yield coarsely platy and some blocky residuum. Hills in northwest part of area are fairly hard, silicic siltstone, and yield finely platy residuum.	Mostly mechanical weathering in place. Downslope transport by talus creep, rockslides, and sheet and rill wash.	Steeply sloping hills and ridges.	0–15	In some places	No	Rarely	Rarely	In some places	No	In some places	Rarely	In some places	In some places	Aspen Shale Dinwoody Formation	Early Cretaceous Early Triassic
Rsc	Rock, sandy and clayey, plus residuum	Coherent to friable sandstone interbedded with shale and locally with limestone. Residuum mostly sandy, locally contains boulders as much as 3 ft across. Little soil development.	Mechanical weathering and solution in place. Downslope transport by sheet and rill wash, talus creep, and rockslides on upper parts of slopes.	Moderate slopes alternating with sharp bluffs.	0–10	Rarely	Generally	Rarely	Rarely	In some places	Rarely	In some places	Rarely	In some places	In some places. Limestone beds, where present, may be difficult	Fowkes Formation, Bulldog Hollow Member Wasatch Formation, Bullpen Member Wasatch Formation, sandstone tongue Wasatch Formation, New Fork Tongue Adaville Formation Hilliard Shale, Shurtliff Sandstone Member Frontier Formation, upper unit Frontier Formation, lower unit Cokeville Formation Thomas Fork Formation Smiths Formation Stump Sandstone and Preuss Red Beds Ankareh Red Beds	Eocene Eocene Eocene Eocene Late Cretaceous Late Cretaceous Late Cretaceous Late Cretaceous Early Cretaceous Early Cretaceous Early Cretaceous Late and Middle Jurassic Late and Early Triassic
Rs	Rock, sandy, plus residuum	Fairly well consolidated sandstone and sandstone conglomerate. Residuum almost pure sand, soil development slight.	Mechanical weathering and solution in place. Downslope transport mainly by sheet and rill wash.	Mostly moderate slopes; steep scarps in some places.	0–10	Rarely	Generally	Rarely	No	In some places	Rarely	Rarely	Rarely	In some places	In some places	Wasatch Formation, basal conglomerate member Adaville Formation, Lazeart Sandstone Member	Eocene Late Cretaceous
Rcsl	Rock, clayey, sandy, and limey, plus residuum	Lightly consolidated siltstone and shale with fairly common sandstone and porous limestone. Residuum dominantly fine grained. Soil development variable, mostly fairly slight.	Mechanical weathering and solution in place. Downslope transport by sheet and rill wash and by rockfall, talus creep, and rockslides, mainly at heads of slopes.	Moderate slopes.	0–15	Rarely	Rarely	In some places	In some places	In some places	Rarely	Generally	In some places	Generally	Rarely	Bridger Formation Green River Formation, Laney Member Green River Formation, Fontenelle Tongue Wasatch Formation Wasatch Formation, New Fork Tongue	Eocene Eocene Eocene Eocene Eocene
Rmc	Rock, silty and clayey, plus residuum	Siltstone and shale, lightly to fairly well consolidated, with minor, mostly dirty, sandstone. Residuum fine grained. Soil development mostly slight.	Mechanical and chemical weathering in place. Downslope transport mainly by sheet and rill wash.	Lowlands.	0–10	Rarely	Rarely	In some places	Generally	In some places	Rarely	Generally	In some places	In some places	Rarely	Fowkes Formation, Sillem Member Evanston Formation Evanston Formation, lower member Hilliard Shale Sage Junction Formation Bear River Formation Gannett Group Gannett Group, upper part Woodside Red Beds	Eocene Paleocene and Late Cretaceous Late Cretaceous Late Cretaceous Early Cretaceous Early Cretaceous Early Cretaceous Early Cretaceous Early Triassic
Rmcu	Rock, silty and clayey, unstable, plus residuum	Siltstone and shale, moderately consolidated. Associated sandstones generally thin, dirty, discontinuous. Local lenses of conglomerate. Residuum silty and clayey. Soil development mostly slight.	Mechanical and chemical weathering in place. Downslope transport on low slopes by sheet wash and rill wash. Downslope transport on slopes steeper than 15 degrees (27 percent) commonly by landsliding	Steep lower walls of valleys.	0–10	Rarely	Rarely	In some places	Generally	In some places	Rarely	Generally	Generally	In some places	Rarely	Wasatch Formation Wasatch Formation, Bullpen Member Wasatch Formation, mudstone tongue Wasatch Formation, lower member	Eocene Eocene Eocene Eocene
Rd	Rock, debris rich, plus residuum	Blocks, commonly of hard, siliceous sandstone or conglomerate and commonly as much as 6 ft in diameter in a matrix of poorly sorted, soft shale or siltstone. Residuum, bouldery clay, or silt. Soil development variable.	Mechanical and chemical weathering in place. Downslope transport of fine matrix material by sheet wash and rill wash. Downslope transport of larger blocks by rolling and slumping as fine supporting material is washed out.	On and adjacent to major ridges.	0–15	Rarely	Rarely	Rarely	In some places	In some places	Rarely	In some places	In some places	In some places	In some places. Large blocks may require special handling.	Wasatch Formation Wasatch Formation, Tunp Member	Eocene Eocene
Rg	Rock, gravelly, plus residuum	Conglomerate with chunks of hard rock as much as 4 in. in diameter in a coherent matrix of limy siltstone and sandstone. Residuum of gravel, silt, and sand. Soil development variable.	Mechanical and solutional weathering in place. Downslope transport mostly by sheet wash and rill wash.	Moderately steep, fairly low hills.	0–10	Rarely	Rarely	Rarely	Rarely	In some places	Rarely	Rarely	Rarely	Rarely	In some places	Fowkes Formation, Gooseberry Member	Pliocene(?) or Miocene(?)

1. Usage in western part of quadrangle is that of Rubey and others, 1975. Usage in eastern part of quadrangle is that of Bradley, 1964.
2. Some stratigraphic units correspond to more than one bedrock plus residuum unit because they show strong changes in rock type from one bed to another or from one area to another.

PREPARATION AND USE OF THIS MAP

This map was prepared by compiling data from published and unpublished mapping, aerial-photograph interpretation (scale of 1:62,500), and field checking.

Where different kinds of bedrock are present at or near the surface, as in much of the western part of the study area, lateral change in the bedrock is generally accompanied by changes in the character of the surficial materials. Thus, previously mapped contacts that separate bedrock units of contrasting physical characteristics are commonly used on this map as contacts between areas of differing surficial materials. Surficial materials that are parts of a complex that is identified with a particular underlying bedrock unit are considered residuum in this report and are described with the parent bedrock unit in table 1.

The map shows the distribution of materials that typically make up the upper 3-15 ft of the ground. Because surficial materials form the part of the earth that we live on and use most, a knowledge of their distribution and properties is necessary for making decisions about land-use. The bedrock of the mapped area is varied and produces surficial materials that differ in many ways. These differences are related not only to the bedrock from which the materials formed but also to processes of weathering, and to erosion and redeposition by wind, water, and gravity. Descriptions of the surficial materials and the processes that formed them appear in table 1.

When using this map, it is important to note that the processes that produced the surficial materials at a given site may not be the dominant processes at that site today. For example, some areas of windblown sand may be areas where sediment transport today is almost entirely by running water.

ALLUVIAL VALLEY FLOORS

The Surface Mining Control and Reclamation Act (U.S. Congress, 1977) defines "alluvial valley floors" for the purposes of the Act as: "the unconsolidated stream-laid deposits holding streams where water availability is sufficient for subirrigation or flood irrigation agricultural activities but does not include upland areas which are generally overlain by a thin veneer of colluvial deposits composed chiefly of debris from sheet erosion, deposits by unconcentrated runoff or slope wash, together with talus, other mass movement accumulation and windblown deposits."

On this map, the flood-plain alluvium (**ap**) is usually within this definition of alluvial valley floor, as is most of the low-terrace alluvium (**al**). Along major streams, some of the alluvium of side slopes, fans, and minor tributary streams (**asf**) and some undifferentiated alluvium (**au**) are also included in the definition. The presence of any of these units along a major stream indicates the need for further detailed study to delineate the "alluvial valley floors" in that area.

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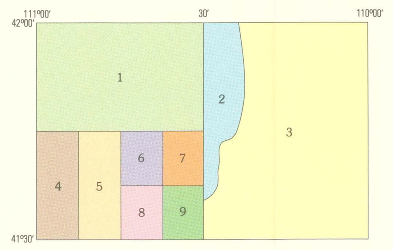


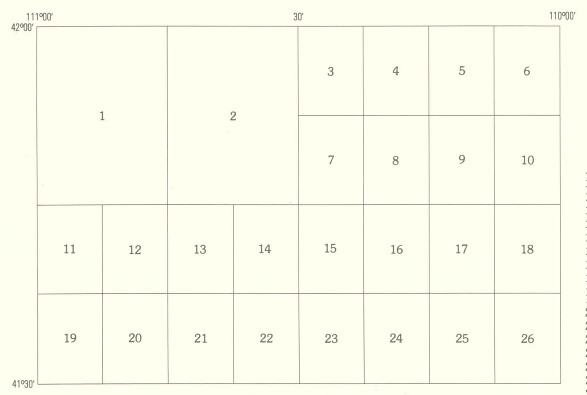
INDEX SHOWING SOURCES OF GEOLOGIC DATA

GEOLOGIC SOURCES

1. Rubey, W. W., Oriel, S. S., and Tracey, J. I., Jr., 1975
2. Veatch, A. C., 1907
3. Bradley, W. H., 1964
4. Dover, J. H., 1979
5. M'Gonigle, John, 1980
6. _______, 1979b
7. _______, 1979a
8. Schroeder, M. L., 1977
9. Schroeder, M. L., and Lunceford, R. A., 1979

CONVERSION FACTORS FOR METRIC EQUIVALENTS

To convert ENGLISH UNIT	Multiply by	To obtain METRIC UNIT
Foot Inch	.3048 2.54	Meter Centimeter



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SURFICIAL MATERIALS MAP OF THE KEMMERER 30' x 60' QUADRANGLE, LINCOLN, UINTA, AND SWEETWATER COUNTIES, WYOMING

By
A. B. Gibbons

1986

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