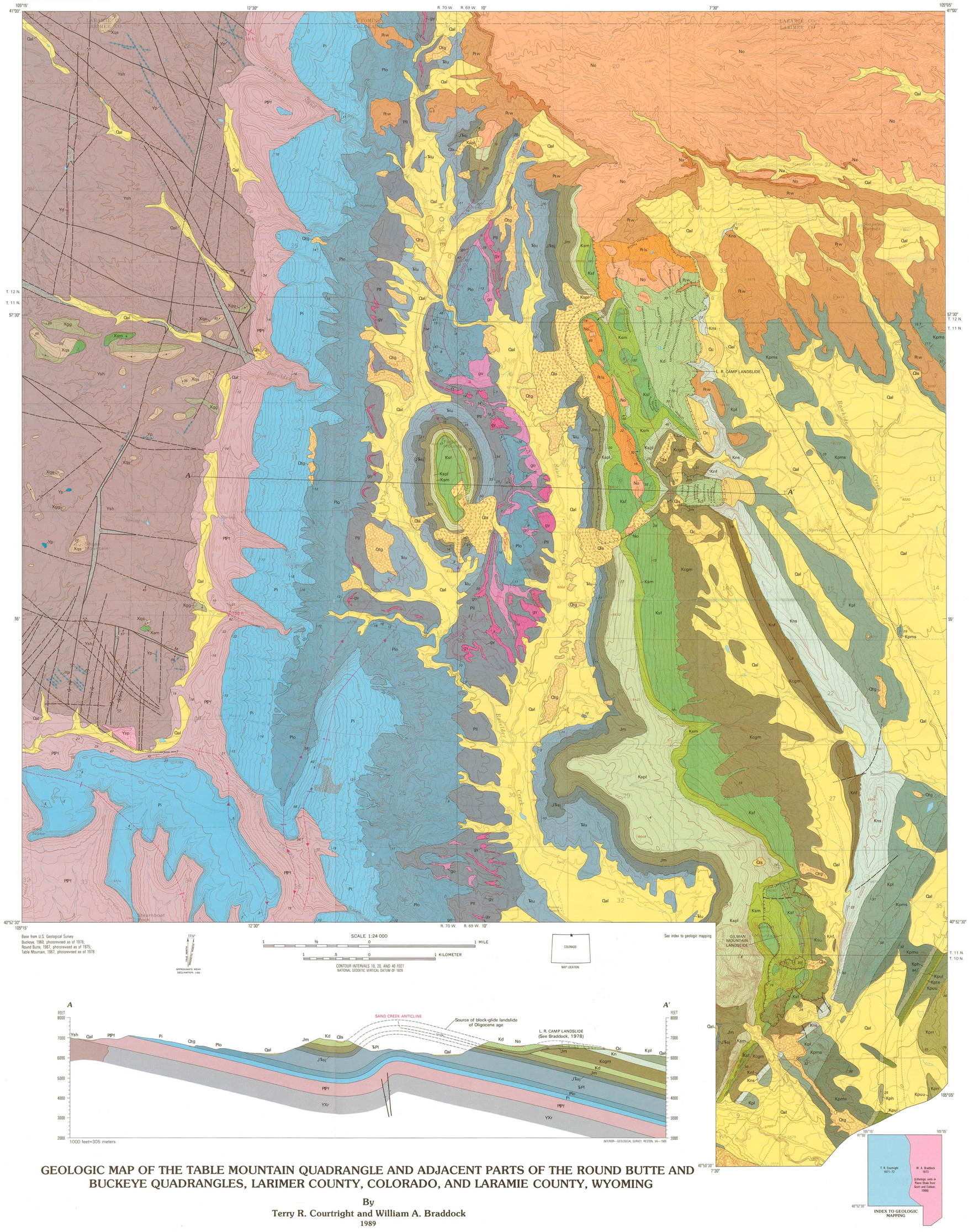
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

MISCELLANEOUS INVESTIGATIONS SERIES
MAP I–1805



GEOLOGIC MAP OF THE TABLE MOUNTAIN QUADRANGLE AND ADJACENT PARTS OF THE ROUND BUTTE AND BUCKEYE QUADRANGLES, LARIMER COUNTY, COLORADO, AND LARAMIE COUNTY, WYOMING

By
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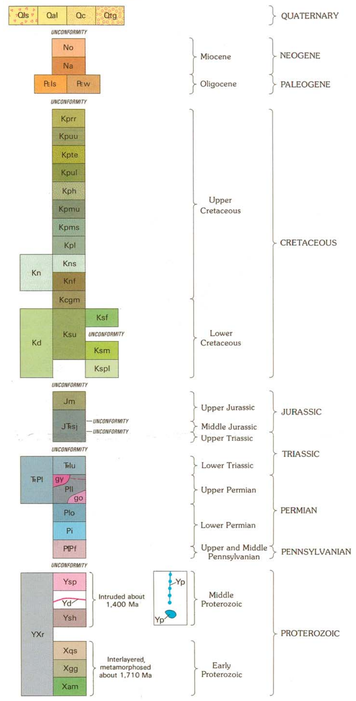
CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

[All radiometric ages quoted here have been recalculated using the IUGS decay constants (Steiger and Jäger, 1977)]

Qls **Landslide deposits (Quaternary)**—Slumps and earthflows composed of clay, silt, sand, and boulders as large as several meters in diameter

Qal **Alluvium (Quaternary)**—Unconsolidated deposits of silt, sand, and gravel; includes much colluvium along sides of valleys and at heads of tributary gullies

Qc **Colluvium (Quaternary)**—Poorly sorted deposits of silt, sand, and boulders; formed by mass wasting

Qtg **Gravel deposits on terraces and pediments (Quaternary)**—Reddish-brown or white, poorly sorted, and poorly to well-stratified gravel. Clasts are commonly of Precambrian rocks, but locally are of sedimentary rocks derived from nearby sources. Most clasts are weathered. Calcium carbonate cement is locally abundant

No **Ogallala Formation (upper Miocene)**—Reddish-brown to brown, poorly sorted, medium- to coarse-grained sandstone and conglomerate. Thickness greater than 300 ft (91 m); top not exposed

Na **Arikaree(?) Formation (Miocene)** — Light-brown or light-gray siltstone to very fine grained sandstone. Lack of fossils and lack of continuity with Miocene rocks to east makes correlation of this unit uncertain. Thickness ranges from 0 to 50 ft (0 to 15 m)

Rls **Landslide debris (Oligocene)**—Undifferentiated debris that forms part of the L. R. Camp landslide of Oligocene age (Braddock, 1978, p. 457). In secs. 5 and 8, T. 11 N., R. 69 W., composed of angular blocks of first sandstone member of South Platte Formation, and formed by collapse of first sandstone hogback either during or shortly after formation of major slide. Within secs. 32 and 33, T. 12 N., R. 69 W., composed of a mixture of blocks from both upper and lower parts of Dakota Group

Rw **White River Group, undivided (Oligocene)**—Thickness not measured
Brule Formation—White, olive-gray, or pink, massive mudstone containing thin arkose beds near top
Chadron Formation—Red, purplish-red, or gray mudstone interbedded with very coarse grained arkose and conglomerate beds; conglomerate beds have boulder-sized clasts of Paleozoic sandstone and resistant Precambrian rocks

Pierre Shale (Upper Cretaceous)—About lower two thirds of Pierre crops out in southeastern and eastern parts of map area. Subdivisions of Pierre used here and their descriptions and thicknesses are from Scott and Cobban (1986)

Kprr **Richard Sandstone Member, Larimer Sandstone Member, Rocky Ridge Sandstone Member, and intervening unnamed shale members**—Sandstone members are olive gray, greenish gray, or brown, locally glauconitic, massive, fine grained, and contain yellowish-gray to light-brown calcareous concretions as much as 6 ft (1.8 m) in diameter. Intervening shale members consist of gray, yellowish-gray, or olive-gray sandy shale or shaley sandstone containing calcareous concretions as large as 4 ft (1.2 m) in diameter. Total thickness of combined unit is about 555 ft (169 m)

Kpuu **Unnamed shale member**—Yellowish-gray to olive-gray sandstone, blocky-weathering sandy siltstone, and silty flaky-weathering shale containing large, gray, orange, or brown limestone concretions. About 360 ft (110 m) thick

Kpte **Terry Sandstone Member**—Light-gray or yellowish-gray, calcareous, fine-grained to very fine grained sandstone that weathers light to dark brown. Contains phosphatic sandstone pebbles at base. About 120 ft (36 m) thick

Kpul **Unnamed shale member**—Olive-gray sandstone, siltstone, and shale containing olive-gray limestone concretions. About 365 ft (111 m) thick

Kph **Hygiene Sandstone Member**—Yellowish-gray to rusty-brown, locally glauconitic, medium-grained sandstone. Contains phosphatic nodules at base and sparse claystone nodules at top. About 445 ft (136 m) thick

Kpmu **Mitten Black Shale Member (upper part)**—Olive-gray, blocky to fissile shale and sandy or clayey siltstone containing light-brown sideritic concretions and gray to yellowish-orange limestone concretions. About 1,350 ft (411 m) thick

Kpms **Mitten Black Shale Member (sandstone unit)**—Dusky-yellow to light-olive-gray sandstone that weathers dark yellowish brown, is thin bedded, and contains yellowish-orange sideritic ironstone or limestone concretions. About 840 ft (255 m) thick

Kpl **Mitten Black Shale Member (lower part), Sharon Springs Member, and Gammon Ferruginous Member**—Combined thickness about 400 ft (122 m)
Mitten Black Shale Member (lower part)—Olive-gray, platy to fissile, noncalcareous claystone or siltstone containing sideritic ironstone concretions, septarian limestone concretions as large as 15 ft (4.5 m), and minor limestone beds that have cone-in-cone structure
Sharon Springs Member—Dark-gray to black, hard, organic-rich, platy to papery shale containing abundant orange bentonite beds
Gammon Ferruginous Member—Calcareous to non-calcareous, dark-gray to grayish-black, hard, platy shale containing abundant orange bentonite beds and local, gray limestone concretions

Kn **Niobrara Formation (Upper Cretaceous)**—Individual members shown on map but not in cross section. Total thickness about 290 ft (86 m). Consists of two members:

Kns **Smoky Hill Shale Member**—Very fissile calcareous shale; dark gray on fresh surfaces, weathers to light-gray plates. Distinctive yellowish-brown-weathering micrite about 15 ft (5 m) thick at top; layers rich in *Pseudoperna congesta* are common near middle

Knf **Fort Hays Limestone Member**—Light-gray, thick-bedded micrite. *Inoceramus* and *Pseudoperna congesta* are abundant. About 15 ft (5 m) thick

Kcgm **Carlile Shale, Greenhorn Limestone, and Graneros Shale (Upper Cretaceous) and Mowry Shale (Lower Cretaceous)**—Total thickness about 570 ft (174 m). Unit can be subdivided as follows, but equivalent subdivisions cannot be separately mapped due to poor exposure
Carlile Shale—Olive-gray silty claystone and sandy siltstone. About 25 ft (8 m) thick
Greenhorn Limestone—Interlayered dark-gray limestone and olive-gray calcareous silty claystone and siltstone. About 285 ft (87 m) thick
Graneros Shale—Dark-gray to grayish-black siltstone and claystone. About 215 ft (66 m) thick
Mowry Shale—Siliceous shale; weathers to light-gray chips. About 45 ft (14 m) thick

Kd **Dakota Group (Lower Cretaceous)**—Subdivisions are those of Waagé (1955). Shown as group on cross section and in eastern part of L. R. camp landslide. Total thickness varies from 245 to 310 ft (75 to 94 m)
South Platte Formation:
Ksf **First sandstone member**—Gray to light-brown, well-sorted, fine- to medium-grained sandstone. About 40 ft (12 m) thick
Ksm **Middle shale member**—Dark-gray carbonaceous shale, thin bentonite, and thin gray siltstone and sandstone beds. About 75–140 ft (23–43 m) thick
Ksu **First sandstone member and middle shale member, undivided**—Shown undivided only within Gilman Mountain landslide
Kspl **Plainview Sandstone Member of the South Platte Formation, and the Lytle Formation, undivided**—The Plainview Sandstone Member is gray to light-brown, thin-bedded, fine-grained carbonaceous sandstone; thickness about 20 ft (6 m). The Lytle Formation is gray to light-brown, coarse-grained to conglomeratic sandstone and blocky-weathering, varicolored non-carbonaceous mudstone beds; thickness about 110 ft (34 m)

Jm **Morrison Formation (Upper Jurassic)**—Green, red, yellow, and white, blocky-weathering claystone and siltstone, and interbedded gray micrite and gray, fine- to medium-grained sandstone. About 330 ft (101 m) thick

JTsj **Sundance Formation (Upper and Middle Jurassic) and Jelm Formation (Upper Triassic), undivided**—Unit consists of the Sundance and Jelm Formations (Pipiringos and O'Sullivan, 1976), which have a combined thickness of 185 ft (56 m). In descending order, the Windy Hill Sandstone Member of the Sundance consists of about 14 ft (4.3 m) of flat-bedded, light-gray, fine-grained sandstone and gray clay shale. It unconformably overlies the Pine Butte Member of the Sundance, which consists of about 19 ft (5.8 m) of massive to flat-bedded, fine-grained, gray to white sandstone. The Pine Butte Member interfingers with the underlying Canyon Springs Sandstone Member of the Sundance. The Canyon Springs Sandstone Member consists of about 52 ft (15.8 m) of pink, orange-pink, or reddish-brown, fine- to medium-grained, crossbedded calcareous sandstone. It unconformably overlies the Red Draw Member of the Jelm Formation; this unconformity is marked by chert pebbles. The Red Draw Member consists of about 100 ft (30.5 m) of orange-pink or reddish-brown, fine-grained, crossbedded calcareous sandstone

TkPl **Lykins Formation (Lower Triassic and Upper Permian)**—Subdivided into two units on map based on the members defined by Broin (1957), but shown as formation on cross section. Total thickness about 800 ft (244 m)

Tklu **Upper part (Lower Triassic)**—In descending order, consists of the Red Hill Shale, Park Creek Limestone, and Stonewall Creek Shale Members of Broin (1957). The shale members are thinly laminated, ripple-laminated, and flaggy, reddish-brown, micaceous siltstone and fine-grained sandstone. The Park Creek is about 50 ft above base of Stonewall Creek and is pink to red, unlaminated, and 1–2 ft (0.3–0.6 m) thick. Total thickness about 580 ft (177 m)

Pll **Lower part (Upper Permian)**—Total thickness about 220 ft (67 m)
Poudre Limestone Member of Broin (1957)—White to gray limestone. About 5 ft (1.5 m) thick
Livermore Shale Member of Broin (1957)—Red, calcareous micaceous siltstone containing green patches and streaks. About 40 ft (12 m) thick
Forelle Limestone Member—Upper part is light-gray, unlaminated limestone; middle part is red limy siltstone containing minor gypsum; lower part is medium- to dark-gray, laminated limestone. Stromatolite structures are present. About 20–50 ft (6–15 m) thick
Glendo Shale Member of Broin (1957)—Dark-red calcareous siltstone. About 10–35 ft (3–11 m) thick

gy **Gypsum bed (younger)**—Occurs discontinuously at base of Glendo Shale Member. Shown in some areas as a single line. Leached along much of outcrop; position marked by vuggy breccia of limestone and siltstone
Falcon Tongue of the Minnekahta Limestone of Broin (1957)—Gray, gypsiferous, sandy, laminated limestone or dolomite. About 3 ft (1 m) thick
Harriman Shale Member of Broin (1957)—Red, purple, or dark-gray calcareous siltstone and flaggy sandstone. About 50–100 ft (15–30 m) thick

go **Gypsum bed (older)**—Occurs discontinuously at base of Harriman Shale Member. Leached along much of outcrop; position marked by vuggy breccia of limestone and siltstone

Plo **Lyons Sandstone and Owl Canyon Formation, undivided (Lower Permian)**
Lyons Sandstone—Fine-grained, calcareous, cross-stratified, buff-colored sandstone. North of Table Mountain, grades into dense purplish-gray dolomite. Thickness ranges from 3 to 20 ft (1 to 6 m)
Owl Canyon Formation—Red siltstone and very fine grained ripple-marked red sandstone. About 275 ft (84 m) thick

Pi **Ingleside Formation (Lower Permian)**—Pink, fine-grained quartzose sandstone, commonly well cemented with quartz or calcite, and interbedded with limestone and dolomitic limestone. About 220 ft (68 m) thick

PPPf **Fountain Formation (Lower Permian and Upper and Middle Pennsylvanian)**—Reddish-brown to purplish-gray arkosic conglomerate, medium- to coarse-grained arkosic sandstone, and dark-reddish-brown siltstone and shale. Minor thin limestone. About 650 ft (198 m) thick

INTRUSIVE IGNEOUS ROCKS (MIDDLE PROTEROZOIC)

Ysp **Silver Plume Granite**—Medium-grained, weakly porphyritic granite. Occurs only in one small body in southwest corner of map area

Yd **Mafic dikes**—Black to dark- or light-gray, fine- to medium-grained rocks of basaltic or andesitic composition that form a north- to northwest-trending dike swarm throughout much of the northern Front Range. Plagioclase forms phenocrysts in most dikes. Mineralogy and texture vary both regionally and locally; variations are due to primary magmatic factors such as bulk composition and rate of cooling, and are also due to metamorphism that has affected the dikes to varying degrees.
Because of cross-cutting relations at various places in the northern Front Range, the dike swarm is believed to be intermediate in age between the Silver Plume Granite and the Sherman Granite.
A single dike was found in sec. 33, T. 12 N., R. 70 W.

Yp **Pegmatite and aplite**—Fine grained and aplitic to very coarse grained and pegmatitic. Both Middle and Early Proterozoic pegmatites occur in adjacent quadrangles, but within this map all cut Sherman Granite and are Middle Proterozoic

Ysh **Sherman Granite**—Coarse-grained, massive, pink granite composed chiefly of quartz, microcline, and plagioclase and subordinate hornblende and biotite. Whole-rock Rb-Sr age is 1,430±20 Ma (Zielinski and others, 1981)

METASEDIMENTARY AND METAVOLCANIC UNITS (EARLY PROTEROZOIC)

The schist unit (Xqs) is a metasedimentary rock; the granitic gneiss (Xgg) and amphibolite (Xam) are probably metavolcanic rocks. All rocks have been metamorphosed to upper amphibolite facies. The metasedimentary rocks are migmatic and are characterized by the mineral assemblage sillimanite-microcline-plagioclase-quartz-biotite-magnetite. Whole-rock Rb-Sr age of time of regional metamorphism is 1,713±30 Ma (Peterman and others, 1968). Age of deposition cannot be much older, because Sm-Nd isotope analyses are consistent with a model age of 1,800 Ma for the formation of continental crust in Colorado (DePaolo, 1981)

Xqs **Quartzofeldspathic mica schist**—Biotite schist interbedded with quartzofeldspathic granofels

Xgg **Granitic gneiss**—Gray, pink, or red, fine- to medium-grained, weakly foliated rock composed of quartz and plagioclase, lesser amounts of microcline, and small amounts of biotite

Xam **Amphibolite and hornblende gneiss and schist**—Weakly to strongly layered hornblende-plagioclase gneiss or schist locally interlayered with massive amphibolite

YXr **Middle and Early Proterozoic rocks, undivided**—Shown on cross section only

32 **Contact**—Showing dip. Approximately located. Contacts of Pennsylvanian through Cretaceous formations are solid where exposed, dashed where not exposed, dotted where concealed by younger units

Boundary of block-glide landslide—Dashed where approximately located; dotted where concealed. Glide mass is stippled, and stratigraphic units are shown within glide mass

Scarp at up-dip limit of block-glide landslide or slump

60 M **Fault or fracture zone**—Showing dip where known. Dashed where approximately located; dotted where concealed; queried where inferred. M, locality where fault zone contains mylonite

Folds—Showing approximate trace of axial surface, and bearing of plunge of hinge lines where known. Dashed where inferred; dotted where concealed; queried where extension under younger units is unknown. Form of folds shown by following symbols

Anticline

Syncline

↑150 ft **Monocline**—Showing amplitude where known

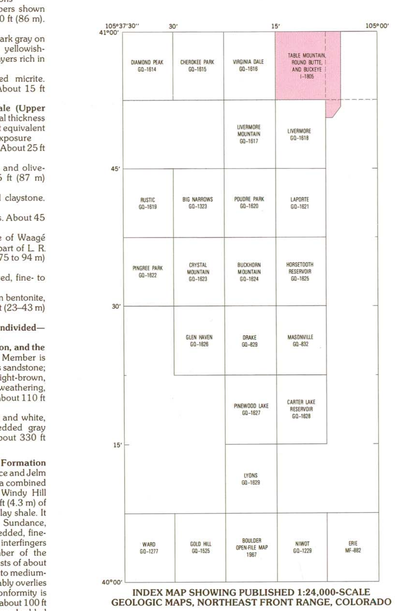
30 **Strike and dip of beds**—Queried where dip amount is uncertain

60 **Strike and dip of foliations**
Inclined
Vertical

Prospect pit

SELECTED REFERENCES

Braddock, W. A., 1978, Dakota Group rockslides, northern Front Range, Colorado, U. S. A., *in* Voight, B., ed., Rock Slides and Avalanches: New York, Elsevier Scientific Publishing Company, Inc., p. 439–480.
Broin, T. L., 1957, Stratigraphy of the Lykins Formation of eastern Colorado: Boulder, Colo., University of Colorado, Ph.D. thesis, 201 p.
Courtright, T. R., 1974, Geology of the Upper Box-Elder Creek area, Larimer County, Colorado: Boulder, Colo., University of Colorado, M.S. thesis, 98 p.
Depaolo, D. J., 1981, Neodymium isotopes in the Colorado Front Range and crust-mantle evolution in the Proterozoic: Nature, v. 291, p.193–196.
Peterman, Z. E., Hedge, C. E., and Braddock, W. A., 1968, Age of Precambrian events in the northeastern Front Range, Colorado: Journal of Geophysical Research, v. 73, no. 6, p. 2277–2296.
Pipiringos, G. N., and O'Sullivan, R. B., 1976, Stratigraphic sections of some Triassic and Jurassic rocks from Douglas, Wyoming, to Boulder, Colorado: U.S. Geological Survey Oil and Gas Investigations Chart OC–69, 1 sheet.
Scott, G. R., and Cobban, W. A., 1986, Geologic, biostratigraphic, and structure map of the Pierre Shale between Loveland and Round Butte, Colorado: U.S. Geological Survey Miscellaneous Investigations Series Map I–1700, scale 1:50,000.
Steiger, R. H., and Jäger, E., 1977, Subcommission on geochronology—Convention on the use of decay constants in geo- and cosmo-chronology: Earth and Planetary Sciences Letters, v. 3, p. 359–362.
Waagé, K. M., 1955, Dakota Group in northern Front Range foothills, Colorado: U.S. Geological Survey Professional Paper 274–B, p. 15–51.
Zielinski, R. A., Peterman, Z. E., Stuckless, J. S., Rosholt, J. N., and Nkomo, I. T., 1981, The chemical and isotopic record of rock-water interaction in the Sherman Granite, Wyoming and Colorado: Contributions to Mineralogy and Petrology, v. 78, p. 209–219.



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