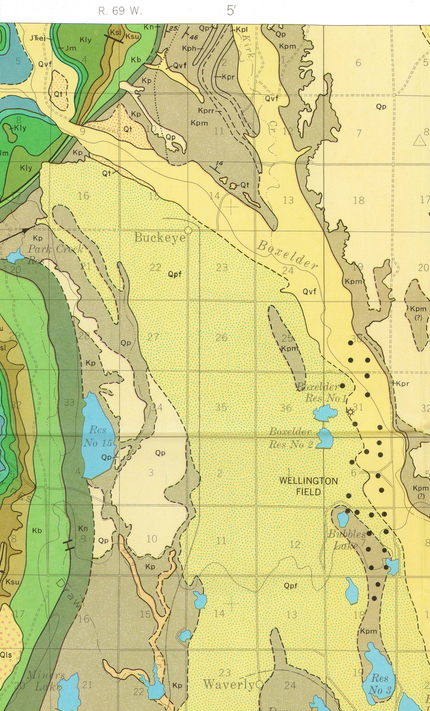
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
U.S. BUREAU OF RECLAMATION

MISCELLANEOUS GEOLOGIC INVESTIGATIONS
MAP I-687

Base modified from U.S. Geological Survey
Greeley, 1:250,000, 1954

Geology of the unconsolidated Quaternary deposits mapped by L. A. Hershey and P. A. Schneider, Jr., 1960



EXPLANATION

QUATERNARY

Holocene

Qw — Windblown sand
Sand and some silt. Generally not a source of water to wells

Qls — Landslide deposits
Mainly blocks and boulders of sandstone and sandy shale of the South Platte Formation. Generally not a source of water to wells

Pleistocene and Holocene

Qvf / **Qf** / **Qt** — Valley-fill deposits
Qvf, *valley-fill deposits undifferentiated. Principal source of water for irrigation wells. Yields as much as 2,000 gpm (gallons per minute) to wells*
Qf, *flood-plain deposits, sand, silt, and clay*
Qt, *terrace deposits, arkosic gravel and sand; contains some loosely cemented sand and gravel*

Pleistocene

Qpf — Pediment and fan deposits undifferentiated
Arkosic gravel, sand, and red clay. Yields 1 to 600 gpm to wells

Qp — Pediment deposits
Arkosic sand and gravel with minor amounts of red clay. Yield 2 to 5 gpm to wells

TERTIARY

Oligocene

Twr — White River Formation
Arkosic sand and gravel conglomerate. Yields no water to wells

CRETACEOUS

Upper Cretaceous

Kl — Laramie Formation
Olive-gray silty shale; contains lenticular beds of sandstone, clay, and seams of coal. Lower 200 feet contains beds of subbituminous coal, ferruginous concretionary beds and variegated shale. Yields water to domestic and stock wells tapping sandstone beds

CRETACEOUS

Upper Cretaceous

Kfm / **Kfh** — Fox Hills Sandstone
Kfh, *Fox Hills Sandstone undifferentiated*
Kfm, *Milliken Sandstone Member, buff to pale yellow, massive, silty fine-grained sandstone; contains thin lenticular black shale partings*
Kfl, *lower member, interbedded light gray silty sandstone and medium to dark gray sandy shale. Yields water to stock and domestic wells*

Kptz / **Kpr** / **Kpl** / **Kpm** / **Kprr** / **Kpt** / **Kph** / **Kp** — Pierre Shale
Kptz, *transition zone, interbedded sandstone and shale; contains hard sandstone ledges. Most permeable about 600 feet below the base of the Fox Hills Sandstone. Yields 5 to 15 gpm to wells. Water has high sulfate content*
Kpm, *middle zone; consists of 5 members separated by 100 to 200 feet of sandy shale. Upper 4 members are olive-gray, massive fossiliferous fine-grained, tightly cemented sandstone that contains concretions; each as shown on map includes the underlying unnamed sandy shale*
Kpr, *Richard Sandstone Member*
Kpl, *Larimer Sandstone Member*
Kprr, *Rocky Ridge Sandstone Member*
Kpt, *Terry Sandstone Member*
Kph, *Hygiene Sandstone Member, thin-bedded, medium- to coarse-grained permeable sandstone. Yields 2 to 50 gpm to wells tapping sandstone. Water has high sulfate content*
Kp, *lower zone, bentonitic, dark-gray shale, contains some ferruginous concretions. Yields no water to wells*

Kn — Niobrara Formation
Calcareous, chalky shale, contains thick marl beds and a persistent basal chalky limestone bed. Yields 5 to 10 gpm of highly mineralized water to wells where fractured

Kb — Benton Shale
Dark gray to black fissile shale; contains thin interbedded, fossiliferous chalky limestone and bentonite beds. The upper 10 to 15 feet consists of shaly to clean sandstone considered to be the lithologic-equivalent of the Codell Sandstone Member of the Carlile Shale. The sandstone is commonly capped by 2 to 5 inches of dark-gray, brown-weathering calcarenite. May yield 2 to 10 gpm to wells

Lower Cretaceous

Ksu / **Ksl** — South Platte Formation
Ksu, *upper sandstone, white to light gray, thick-bedded locally quartzitic, fine-grained sandstone. Yields 1 to 2 gpm to springs along the outcrop*
Ksl, *lower shale, predominantly gray to black shale, silty shale and siltstone; contains thin beds of bentonite and fossiliferous, brown, crystalline limestone, and a persistent thin-bedded argillaceous fine- to medium-grained sandstone, the Plainview Sandstone Member at its base. Not known to yield water to wells*

Kly — Lytle Formation
Light gray to white sandstone, conglomeratic sandstone, and variegated claystone. Not known to yield water to wells

JURASSIC

Upper Jurassic

Jm — Morrison Formation
Variegated shale and siltstone, thick-bedded limestone and lenticular medium- to coarse-grained sandstone above the base. Yields 1 to 20 gpm to wells tapping lenticular sandstones. Other units yield no water to wells

JURASSIC AND TRIASSIC

JTej — Entrada Sandstone and Jelm Formation
Upper Jurassic Entrada Sandstone, 25 to 50 feet thick, consists of gray to pink, massive, cross-bedded, fine- to medium-grained sandstone. Yields 5 to 10 gpm to wells. Upper Triassic Jelm Formation, 70 feet thick, consists of reddish-orange, crossbedded, fine- to medium-grained sandstone. Yields 5 to 10 gpm to wells

PERMIAN TRIASSIC(?)

TrPl — Lykins Formation
Dark-red thin bedded silty sandstone and sandy shale, becomes massive at the top. Not known to yield water to wells

PERMIAN

Pf — Forelle Limestone
Gray to pink thin bedded, cherty limestone. Yields no water to wells

Psu — Upper part of Satanka Shale
Sandy red shale and siltstone, contains anhydrite and gypsiferous shale near the base. Yields no water to wells

Pl — Lyons Sandstone
Light gray to yellowish-gray, crossbedded quartzose sandstone. May yield 5 to 10 gpm to wells

Psl — Lower part of Satanka Shale
Brick-red sandy shale, sandstone, and siltstone. Not known to yield water to wells

Pi — Ingleside Formation
Reddish-orange and pink, fine to very fine sandstone, and interbedded light gray to grayish-pink dense limestone and dolomite. Not known to yield water to wells

PENNSYLVANIAN AND PERMIAN

PPf — Fountain Formation
Red arkosic micaceous conglomerate, sandstone, siltstone and shale. Cross-bedding and cut and fill structures common. May yield 1 to 5 gpm to wells tapping fracture zones

PRECAMBRIAN

pCg — Gneiss
Quartzite, phyllite, mica schist and gneiss. Yields 2 to 5 gpm to wells tapping fracture

LOCATION OF MAP

SELECTED REFERENCES

Chronic, B. J. Jr., 1957, No. 1, Owl Creek measured section, *in* Rocky Mtn. Assoc. Geologists, Colorado measured sections—a symposium: Denver, Colo., p. 9–14.

Maughan, E. K., and Wilson, R. F., 1960, Pennsylvanian and Permian Strata in southern Wyoming and northern Colorado, *in* Rocky Mtn. Assoc. Geologists, Guide to the geology of Colorado: Denver, Colo., p. 34–42.

Moore, F. E., 1960, Summary of Cenozoic history, southern Laramie Range, Wyoming and Colorado, *in* Rocky Mtn. Assoc. Geologists, Guide to the geology of Colorado: Denver, Colo. p. 217–222.

Scott, G. R., and Cobban, W. A., 1959, So-called Hygiene group of northeastern Colorado [and Wyo.], *in* Rocky Mtn. Assoc. Geologists, Symposium on Cretaceous rocks of Colorado and adjacent areas, 11th field conference, 1959: Denver, Colo., p. 124–131.

Waage, K. M., 1955, Dakota Group in northern Front Range foothills, Colorado: U.S. Geol. Survey Prof. Paper 274-B, p. 15–51.

SOURCES OF GEOLOGIC DATA

This map based on geology mapped by the authors in 1960 and the following source material:

1. Baker, V. R., 1948, Geology of the foothills of the Front Range between Masonville and Bellvue, Colorado: Boulder, Colorado Univ., unpub. M.S. thesis.
2. Broin, T. L., 1962, Geology of the Owl Canyon-Bellvue area, Larimer County, Colorado: Boulder, Colorado Univ., unpub. M.S. thesis.
3. Cavender, W. S., 1951, Structural geology of the Livermore area, Larimer County, Colorado: Boulder, Colorado Univ., unpub. M.S. thesis.
4. Hunter, Z. M., 1955, Geology of the foothills of the Front Range in northern Colorado: Rocky Mtn. Assoc. Geologists Map, scale 1:48,000, 2 sheets [Petroleum Inf. Corp., Denver, Colo.].
5. Mather, K. F., Gilluly, James, and Lusk, R. G. 1928, Geology and oil and gas prospects in northeastern Colorado: U.S. Geol. Survey Bull. 796, p. 65–124.

SCALE 1:62 500

1 ½ 0 1 2 3 4 MILES

1 .5 0 1 2 3 4 KILOMETERS

DATUM IS MEAN SEA LEVEL

GEOLOGIC MAP OF THE LOWER CACHE LA POUDRE RIVER BASIN, NORTH-CENTRAL COLORADO

By
Lloyd A. Hershey and Paul A. Schneider, Jr.

1972

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D.C.—1972—W70512

For sale by U.S. Geological Survey, price $1.00