

## CONDENSED DESCRIPTION OF MAP UNITS

The complete description of map units and references is in the accompanying booklet.

### SURFICIAL DEPOSITS

#### HUMAN-MADE DEPOSITS

**af** Artificial fill (latest Holocene)—Waste rock and fill placed during construction of roads, buildings, dams, landfills, and military installations

#### ALLUVIAL DEPOSITS

**Ql<sub>1</sub>** Terrace alluvium one (Holocene)—Silt, sand, and minor pebble to boulder gravel deposited in modern channels and flood plains. Includes low stream-terrace alluvium that is as much as 10 ft above modern stream level and some local fan and sheetwash alluvium and hilllope colluvium

**Qsw** Sheetwash deposits (Holocene and late Pleistocene)—Pebbly and locally cobbly sand, silt, and clay and clasts of Pierre Shale (Kp) transported by sheetflow and deposited on valley sides. Locally well bedded and deposited on hillslopes below landslides and alluvial fans, and in basins. Map unit locally grades into and interfingers with colluvium (Qc) on steeper hillslopes

**Ql<sub>2</sub>** Terrace alluvium two (late Pleistocene)—Sand and pebbly to bouldery gravel that underlie dissected surfaces about 10 to 20 ft above the level of modern streams. Correlated with the Monument Creek Alluvium on the Air Force Academy and the Broadway Alluvium in the Denver area

**Ql<sub>3</sub>** Terrace alluvium three (late middle Pleistocene)—Sand and pebbly to cobbly gravel that underlie dissected surfaces about 25 to 30 ft above the level of modern streams. Correlated with the Kettle Creek Alluvium on the Air Force Academy and the Louvers Alluvium in the Denver area

**Qg<sub>1</sub>** Pediment gravel one (middle Pleistocene)—Light-reddish-brown clay, sand, and pebbly to bouldery gravel that overlie dissected, gently sloping pediment surfaces about 30 to 100 ft above the level of modern streams. Two levels of erosion/deposition were noted along Little Fountain Creek unit Qg<sub>1</sub> is younger (lower in elevation) than unit Qg<sub>2</sub> (upper in elevation); unit Qg<sub>1</sub> is used where the surface could not be assigned to Qg<sub>1</sub> or Qg<sub>2</sub>. Correlated with the Pine Valley Gravel on the Air Force Academy and the Slocum Alluvium in the Denver area

**Qg<sub>2</sub>** Pediment gravel two (middle Pleistocene)—Locally consolidated, medium-reddish-brown, and brown, well stratified pebble to cobble gravel and sand that overlie dissected, gently sloping pediment surfaces from 150 to 250 ft above the level of modern streams. Two levels were noted by Scott and Wilson (1973): unit Qg<sub>2</sub> is younger (lower in elevation) than unit Qg<sub>3</sub> (upper in elevation); unit Qg<sub>2</sub> is used where the surface could not be assigned to Qg<sub>2</sub> or Qg<sub>3</sub>. Correlated with the Douglas Mesa Gravel of the Air Force Academy and the Vardos Alluvium in the Denver area

**Qg<sub>3</sub>** Pediment gravel three (early Pleistocene)—Slightly consolidated, dark-reddish-brown and brown, stratified cobble and boulder gravel that overlie dissected, gently sloping pediment surfaces from 200 to 250 ft above the level of modern streams. Correlated with the Lehman Ridge Gravel of the Air Force Academy and the Rocky Flats Alluvium in the Denver area

**QTg<sub>4</sub>** Pediment gravel four (early Pleistocene? to Pliocene)—Moderately consolidated, reddish-brown and brown, stratified pebble to boulder gravel and sand that overlie a dissected, gently sloping pediment surface from 550 to 700 ft above the level of modern streams. Correlated with the Nussbaum Alluvium

**Qly** Younger fan deposits (Holocene)—Poorly stratified, poorly sorted deposits of sand, gravel, silt, and clay that are coarser near the heads of fans. May include small landslide deposits

**Qlo** Older fan deposits (Holocene and late and middle Pleistocene)—Poorly stratified, poorly sorted deposits of sand, gravel, silt, and clay that are coarser near the heads of fans. May include small landslide deposits. Deposit is dissected so that the deposit may no longer be active, but the channels cut into it may still be active and subject to flooding and plugging by debris flows

#### MASS-WASTING DEPOSITS

**Qlsr** Recent landslide deposits (late Holocene)—Mostly angular, unsorted, and unstratified rock debris moved by gravity from nearby bedrock slopes or cliffs. The map unit is restricted to recently active landslides that have been observed, through aerial photos and consultants reports, or inferred to have moved within the last 20 years

**Qls** Landslide deposits (Holocene and late Pleistocene)—Mostly angular, unsorted, and unstratified rock debris moved by gravity from nearby bedrock slopes or cliffs. Mapped where there is no evidence that the slide has been active in the last 20 years. The deposits contain fresh to subfresh (older) morphological features, such as shear zones, hummocky terrain, headscarp, and slip-plane toes

**Qlro** Older landslide, fan, and rockfall deposits, undivided (late to middle? Pleistocene)—Unstratified, unsorted, clast- and matrix-supported boulders, cobbles, pebbles, sand, and clay at the base of Cheyenne Mountain. Characterized by boulders as much as 20 ft in diameter that are almost as common and large at the eastern margin of the deposit as they are at the mountain front; in the upper part of the deposit, the matrix that supported these boulders has been removed by erosion, leaving the boulders on the surface. The deposit results from multiple processes along this, the steepest part of the mountain front in the quadrangle. The primary process was a catastrophic landslide or a debris avalanche, which may have transformed itself into a rapid earthflow (earth slide) or debris flow at its eastern toe

**Qlso** Older landslide deposits (late, middle, and early Pleistocene)—Mostly angular, unsorted, and unstratified rock debris that moved by gravity from nearby bedrock slopes or cliffs. Mapped where morphological features are subdued. Unit includes both rotational and translational landslides

**Qt** Talus deposits (Holocene and late Pleistocene)—Angular cobbly and bouldery rubble on steep slopes developed on Precambrian igneous and metamorphic rocks on the western side of the map area. This debris was transported downslope by gravity, as rockfalls, rockslides, or rock topples

**Qc** Colluvium (Holocene and late Pleistocene)—Unsorted, matrix-supported clayey sand and sandy clay and less common pebble to cobble gravel or boulders in a sandy matrix. Derived largely from weathered bedrock and other surficial deposits that are transported downslope primarily by gravity aided locally by sheetwash. Colluvium is gradational into sheetwash deposits, which are found on slopes of generally less than 10 percent. Not mapped unless it conceals underlying bedrock units and structures

### EOLIAN DEPOSITS

**Qes** Eolian sand (Holocene and late Pleistocene)—Fine- to coarse-grained, tan-colored frosted sand and silt deposited by wind. Mostly vegetated (stable), generally unstratified and poorly exposed as only a thin veneer on other surficial deposits

### BEDROCK

**Kp** Pierre Shale (Upper Cretaceous)—Soft, medium- and dark-gray and greenish-gray shale and local sparse thin beds of tan siltstone and fine-grained sandstone. Weathers tan to light- and medium-gray to olive-green and commonly into chunks ("popcorn") and shale chips

**Kpp** Teepee zone of Gilbert (1896) of the Pierre Shale—tan, moderately resistant siltstone and fine-grained sandstone containing abundant fossils. Unit represents bioherms in the Pierre Shale

**Kn** Niobrara Formation (Upper Cretaceous)—Consists of two members, the poorly exposed Smoky Hill Shale Member and the underlying distinctive Fort Hayes Limestone Member. The Smoky Hill Member is made up of soft, light- to dark-gray, yellowish-orange, and brown, thin-bedded and laminated, limy shale and local thin beds of slightly resistant, gray and white chalk and limestone; the unit commonly weathers to small light-gray and buff shale chips. The Fort Hayes Member consists of resistant, light- to medium-bedded, fine-grained limestone interbedded with thin beds of light-gray shale

**Kgg** Carlile Shale, Greenhorn Limestone, and Graneros Shale, undivided (Upper Cretaceous)—The Carlile Shale, the upper formation, consists of several members that are not exposed in the mapped area, except for the uppermost ones, the Juana Lopez Member and the underlying Codell Sandstone Member. The Juana Lopez Member is a distinctive buff, marine limestone coquina of oyster shells only several inches thick. The Codell Member is a moderately resistant light-gray (light-tan when weathered because of brown stringers of iron oxide), mottled, burrowed, fine- to medium-grained sandstone that is well bedded in detail because it is interbedded with dark-gray shale, although the member weathers to rounded form. The rest of the Carlile Shale is the lowermost area consists of soft, yellow, blue-gray, and black limy shale. The Greenhorn Limestone consists of thin (less than 1 in. to 2 ft) beds of moderately resistant, medium-gray, mottled fine-grained limestone beds that weather to light-gray and that occur separated by soft dark-gray marine shale and bentonite. The Graneros Shale is a soft dark-gray and black shale with local 0.5-in.-thick, tan and brown silt beds; the unit weathers to clay chips about 0.25 in. on a side; its lower part locally contains bentonite

**Kdp** Dakota Sandstone and Purgatoire Formation, undivided (Lower Cretaceous)—The Dakota Sandstone consists of gray, light-yellow, and greenish-gray, medium-bedded, ripple-marked, cross bedded, fine- to medium-grained sandstone and minor gray carbonaceous shale, yellow and gray mudstone, and light-green siltstone. The underlying Purgatoire Formation consists of the Glencairn Shale Member and underlying Lytle Sandstone Member. The Glencairn is a poorly to moderately resistant yellow and gray, poorly bedded sandstone and tan shale, whereas the Lytle is a moderately resistant, light-gray, pebbly, medium- to coarse-grained sandstone

**Jmr** Morrison Formation and Ralston Creek Formation, undivided (Upper Jurassic)—The Morrison Formation is soft, reddish-brown, light-gray, and light-green, well bedded, thin-bedded mudstone, shale, and limestone. The underlying Ralston Creek Formation consists of soft, gray, medium-grained sandstone underlain by light-red and gray laminated shale and in turn by gray and red sandstone, siltstone, and shale; the shale and siltstone beds weather to small plates

**Trp<sub>1</sub>** Lykins Formation (Lower Triassic? and Upper Permian)—Soft to moderately resistant, reddish-brown and light-gray shale and siltstone interbedded with thin beds of light-gray and tan, mottled, fine- to coarse-grained limestone

**Ply** Lyons Sandstone (Upper and Middle? Permian)—Made of moderately consolidated, pink to red, medium-bedded, commonly cross bedded, well sorted, fine- to medium-grained sandstone. A middle unit consists of soft red siltstone and conglomerate

**Pp<sub>1</sub>** Fountain Formation (Lower Permian and Pennsylvanian)—Moderately consolidated, orange-red, light-red, light-reddish-brown, pink, and light- to medium-gray, well bedded, locally cross bedded, locally bioturbated, pebbly medium-grained sandstone and pebble to boulder conglomerate with subordinate thin, medium- to dark-red, reddish-brown, and dark-purplish-red beds of shale and mudstone

**Om** Manitou Limestone (Lower Ordovician)—Moderately resistant, pink, light-gray, and pinkish-tan, medium-bedded, fine-grained dolomite

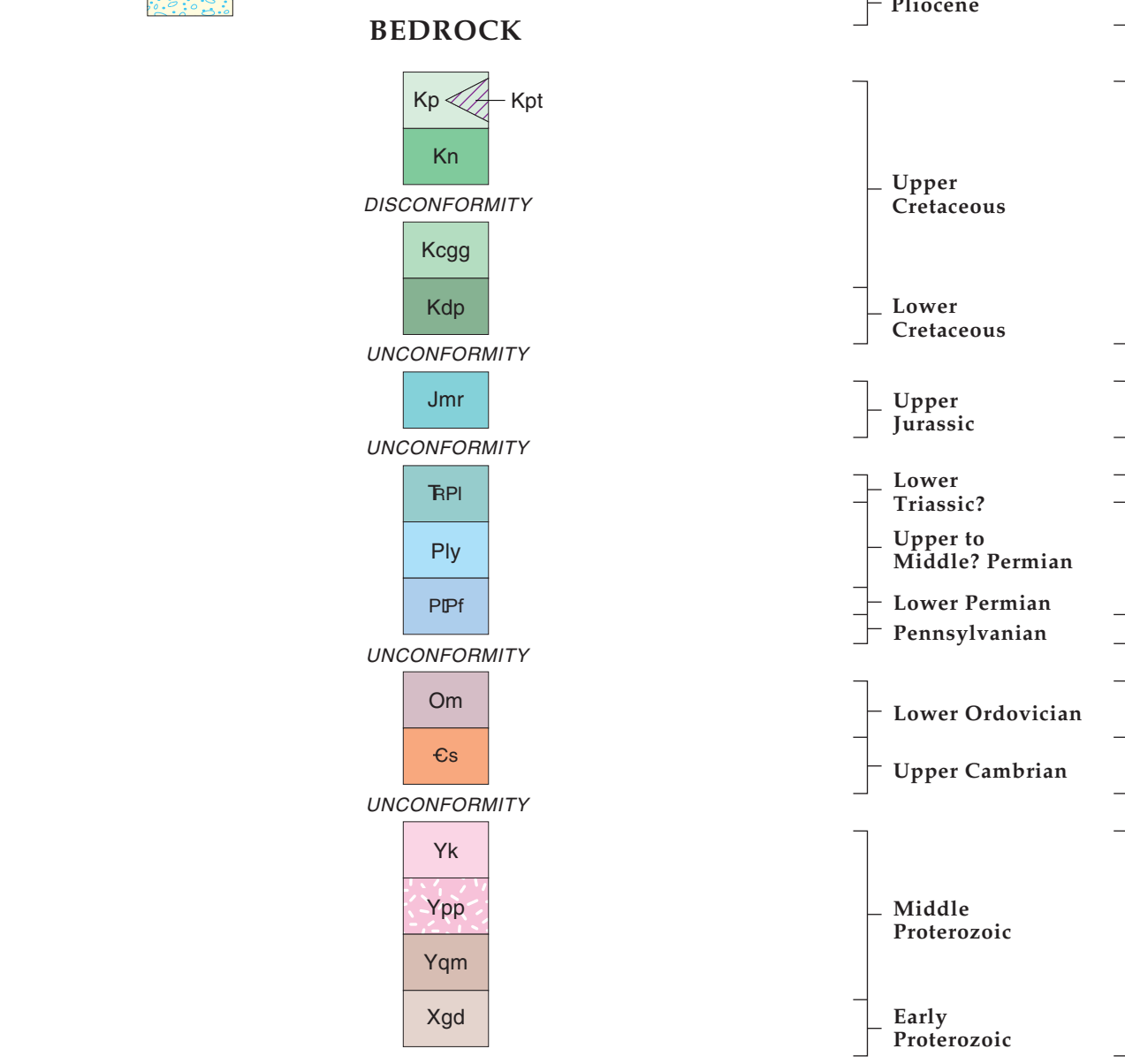
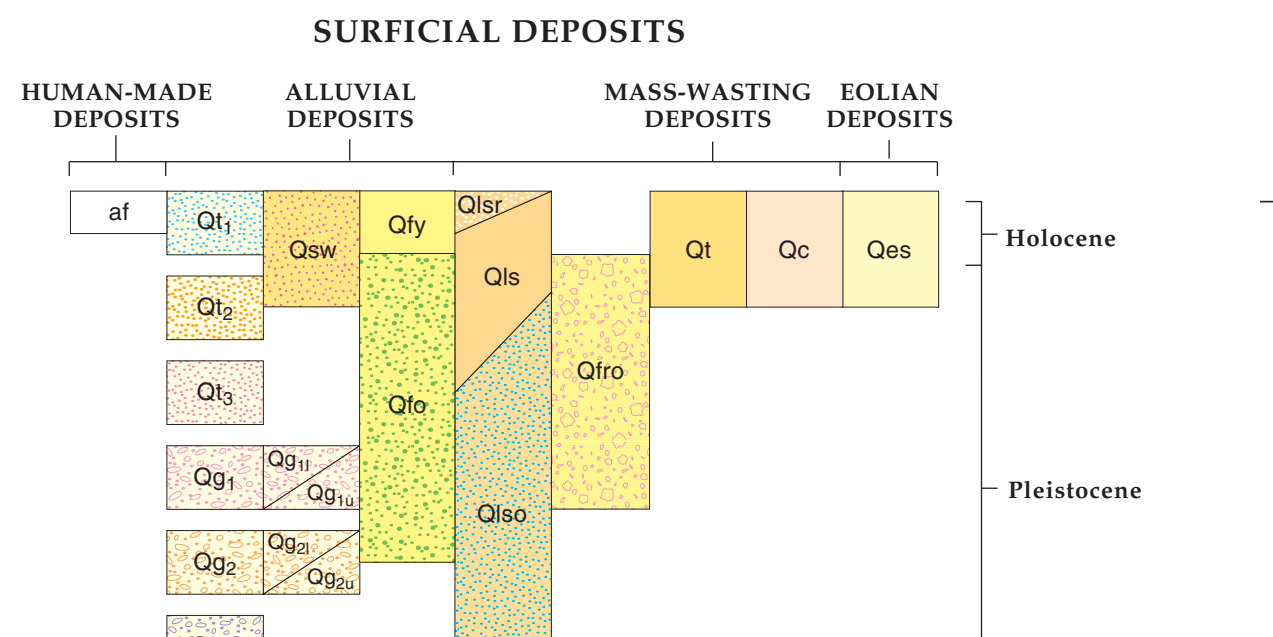
**Ca** Sawatch Sandstone (Upper Cambrian)—Resistant medium-purple, light-red, light-gray, and khaki-green, poorly bedded, locally cross bedded, locally bioturbated, pebbly medium-grained quartzite and sandstone; sparsely exposed in the western parts of the map area in thin faulted sections

**Yk** Keeton Porphyry of Murray (1975) (Middle Proterozoic)—Generally resistant red dikes and sills of porphyritic granodiorite or quartz monzonite. Zoned plagioclase phenocrysts as much as 0.5 in. long make up about 20 percent of the rock and occur in a coarse-grained aphanitic matrix; smaller phenocrysts of potassium feldspar and beta quartz are also present. Sparse ferromagnesian minerals that originally consisted of biotite and hornblende now are altered or weathered to chlorite

**Ypp** Pikes Peak Granite (Middle Proterozoic)—Resistant, red, medium- to coarse-grained granite intrusions. Identified by equigranular texture and by abundant red microcline, abundant quartz, and low amounts of biotite and hornblende. Unit includes aplite and pegmatite veins. Weathers to gray on north-facing slopes, but can form cliffs on south-facing slopes

**Yqm** Quartz monzonite (Middle Proterozoic)—Resistant, pink, locally foliated, medium- to coarse-grained, locally porphyritic, quartz monzonite intrusions; has significantly higher biotite and hornblende and lower quartz than the Pikes Peak Granite (Ypp), but significantly less biotite and hornblende than the granodiorite (Xgd). Includes granite pegmatite and aplite dikes

### CORRELATION OF MAP UNITS



**Xgd** Granodiorite (Early Proterozoic)—Resistant, gray and pink, medium- to coarse-grained, generally porphyritic granodiorite and quartz diorite intrusions and locally intervening country rocks, now metamorphosed to biotite schist, biotite-feldspar gneiss, and migmatite. Ranges from granite to quartz diorite in composition and is characterized by a gneissic foliation. Phenocrysts are mostly microcline, generally pink, that are as long as 1 in. Minerals include at least several percent biotite and much subordinate hornblende; sphene and apatite are locally abundant accessory minerals. Includes gray and pink, granite to quartz monzonite aplite and pegmatite dikes as wide as 100 ft. dark-gray and dark-greenish-gray fine-grained hornblende diorite dikes as wide as 50 ft. and quartz veins as wide as 1 ft. Hydrothermally altered and metamorphosed to schist within several hundred yards of where intruded by the younger Pikes Peak Granite in the northeastern part of the mapped area

### MAP SYMBOLS

Formation or unit contact—Dashed where approximately located

High-angle fault—Dashed where approximately located; dotted where concealed; ball and bar on downthrown side. Measured angle of dip is shown in degrees

Thrust fault—Shown only south of Little Fountain Creek

Intact landslide mass (llam)—Masses of intact bedrock that have moved downslope within the older landslide deposits (Qlso). All masses are of pediment gravel four (QTg<sub>4</sub>)

Strike and dip of inclined beds—Angle of dip shown in degrees

Strike and dip of overturned beds—Angle of dip shown in degrees

Strike and dip of foliation—Angle of dip shown in degrees

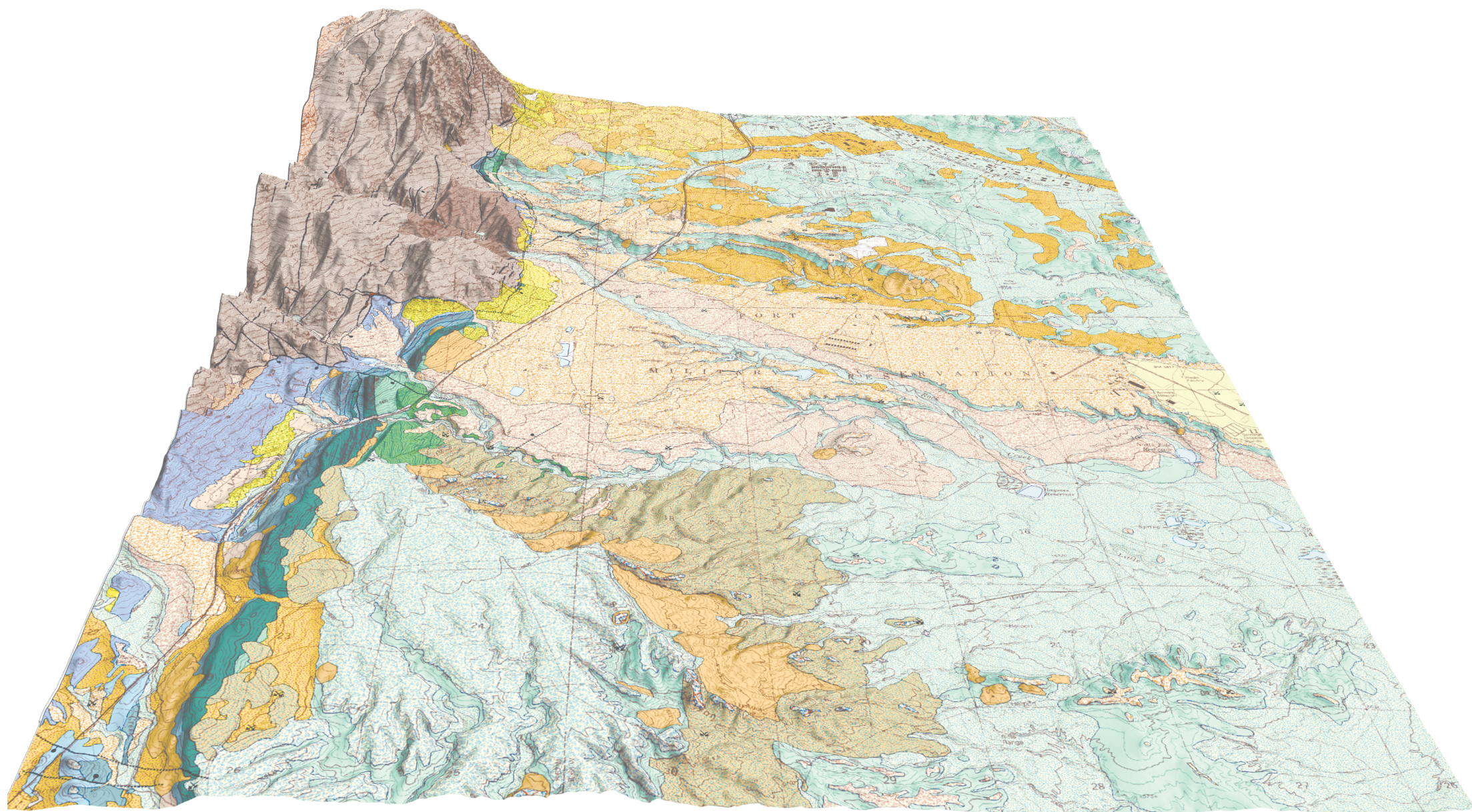
Sand and gravel pit

Alignment of cross section

### QUATERNARY TIME CHART

Formal Time Divisions	Informal Time Divisions	Age (Sideral Years)
Holocene Epoch	late Pleistocene	~11,700
Quaternary Period	middle Pleistocene	~127,000
	early Pleistocene	~778,000
Tertiary Period (part)	Pliocene Epoch	~1,806,000

## SHADED-RELIEF MAP OF THE CHEYENNE MOUNTAIN QUADRANGLE WITH GEOLOGY AND TOPOGRAPHY OVERLAY, OBLIQUE VIEW LOOKING NORTH



## GEOLOGIC MAP OF THE CHEYENNE MOUNTAIN QUADRANGLE, EL PASO COUNTY, COLORADO

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