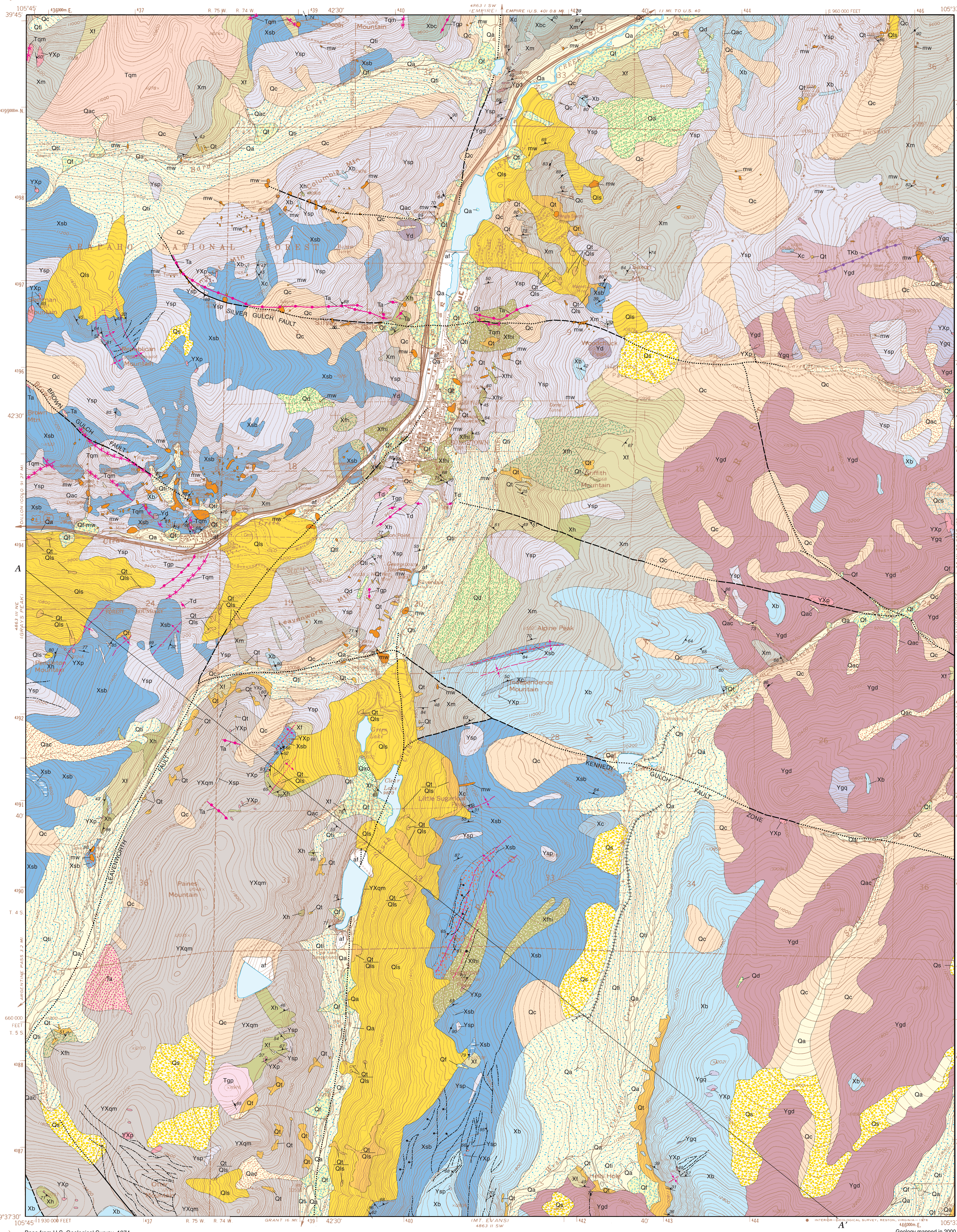
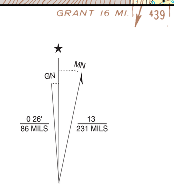
COLORADO GEOLOGICAL SURVEY
DIVISION OF MINERALS AND GEOLOGY
DEPARTMENT OF NATURAL RESOURCES
DENVER, COLORADO

OPEN-FILE MAP 01-5
GEOLOGIC MAP OF THE GEORGETOWN QUADRANGLE
CLEAR CREEK COUNTY, COLORADO
Booklet accompanies map

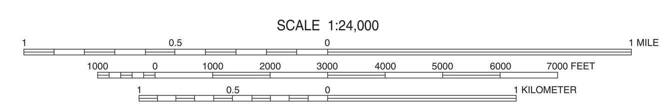


Base from U.S. Geological Survey, 1974
Polyconic projection, 1927 North American datum
10,000-foot grid based on Colorado coordinate system, central zone
1000-meter Universal Transverse Mercator grid ticks, zone 13

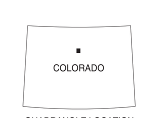


UTM GRID AND 1974 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

SCALE 1:24,000

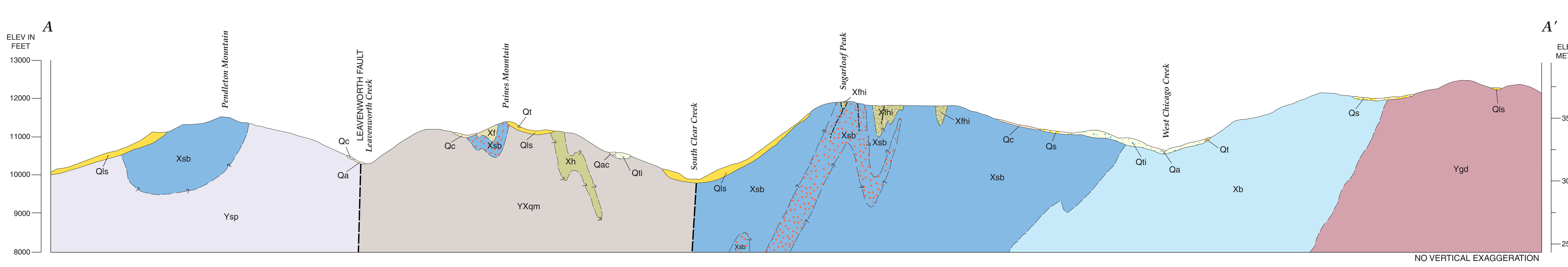


CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929



QUADRANGLE LOCATION

Geology mapped in 2000
Digital cartography by Cheryl Brchan



NO VERTICAL EXAGGERATION

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)**—Unsorted silt, sand, and rock fragments from alluvial, debris-fan, and rockfall deposits, mine and mill waste, and recycled construction materials deposited by humans

mw — **Mine and mill waste (latest Holocene)**—Pebble- to cobble-size waste rock from mines, prospecting pits, and milling operations.

ALLUVIAL DEPOSITS—Sediments deposited in stream channels, on flood plains, terraces, and minor debris fans, and in sheet-wash areas

Qa — **Stream-channel, flood-plain, and low terrace alluvium (Holocene)**—Mostly clast-supported, sandy to bouldery pebble and cobble gravel interbedded and often overlain by silty sand. Includes organic-rich mud, peat, sand, and gravel underlying terraces up to about 10 ft above modern stream level

Qao — **Older alluvium (late Pleistocene)**—Poorly sorted, matrix-supported, pebble and cobble gravel in a sandy matrix. Includes stream alluvium and sheetwash deposits underlying a single small terrace remnant near Green Lake about 40 ft above the modern South Clear Creek stream level

COLLUVIAL DEPOSITS—Silt, sand, and gravel on valley sides and floors transported and deposited primarily by gravity

Qc — **Colluvium (Holocene and late Pleistocene)**—Ranges from clast-supported, pebble to boulder gravel in a sandy matrix to matrix-supported gravelly, silty sand

Qls — **Landslide deposits (Holocene and late Pleistocene)**—Clast-supported, heterogeneous deposits consisting primarily of large blocks of rock and silt- to boulder-size debris. Includes slides characterized by numerous linear scarps, hummocky terrain, interrupted drainages, and large toreva blocks

Qt — **Talus deposits (Holocene and late Pleistocene)**—Bedrock-derived angular, cobbly and bouldery rubble transported as rockfalls, rockslides, rock avalanches, and rock topples

ALLUVIAL AND COLLUVIAL DEPOSITS—Sediments in stream channels and on flood plains, debris fans, and lower reaches of adjacent hillslopes

Qf — **Debris-fan deposits (Holocene and late Pleistocene)**—Poorly sorted to moderately sorted, matrix-supported, gravelly, sandy silt to clast-supported, pebble and cobble gravel in a sandy silt or silty sand matrix. Includes debris-flow, hyperconcentrated-flow, fluvial, and sheetwash deposits on debris-fans and in drainage channels

Qac — **Alluvium and colluvium, undivided (Holocene and late Pleistocene)**—Poorly sorted to moderately sorted, stratified, interbedded sand, pebbly sand, and sandy gravel to poorly sorted, unstratified or poorly stratified, silty sand and bouldery sand

Qcs — **Colluvium and sheetwash deposits, undivided (Holocene and late Pleistocene)**—Colluvium on steeper slopes, sheetwash on gentler slopes. Colluvium ranges from unsorted to poorly sorted, clast-supported, pebble to boulder gravel in a sandy matrix to matrix-supported gravelly sand. Sheetwash deposits typically consist of pebbly, silty sand and sandy silt

PERIGLACIAL DEPOSITS—Boulder- to clay-size fragments transported primarily by solifluction and creep

Qs — **Solifluction deposits (Holocene and late Pleistocene)**—Pebbles, cobbles, and large boulders in a sandy matrix transported down slope by solifluction and frost creep

GLACIAL DEPOSITS—Gravel, sand, silt, and clay deposited by ice

Qti — **Till (late and late middle Pleistocene)**—Unsorted, unstratified, matrix-supported bouldery to pebble gravel in a sandy matrix deposited by ice. Locally may contain interlayers of stratified drift

NONSORTED TERRIGENOUS DEPOSITS—Bouldery material of uncertain origin

Qd — **Diamicton (early to middle Pleistocene)**—Nonsorted deposits consisting largely of boulders and cobbles in a sandy matrix. May include Bull Lake ice, landslides, earthflows, mudflows, or solifluction (Flint and others, 1960)

BEDROCK

TERTIARY AND UPPER CRETACEOUS INTRUSIVE ROCKS—Most are associated with the Oligocene-Eocene Montezuma stock southwest of Silver Plume (Bookstrom and others, 1987). One dike appears to be related to Tertiary and Upper Cretaceous porphyries of the Empire stock northeast of Georgetown

Td — **Dacite (Oligocene and/or Eocene)**—Bluish-gray to light-purple porphyry exhibiting conchoidal fracturing and generally characterized by altered feldspar phenocrysts in a groundmass of feldspar and quartz. Less commonly includes phenocrysts of quartz, hornblende, and biotite. Bookstrom (1993) suggested the dacite intrusives are 35 to 46 Ma

Tgp — **Granite porphyry (Oligocene and/or Eocene)**—Tan to pinkish-gray, very fine-grained porphyry with numerous feldspar (orthoclase) phenocrysts and fewer biotite phenocrysts in a dense groundmass of quartz and orthoclase. Porphyry may be chalky yellow to orange-red where altered and is commonly extensively fractured. Occurs as small dikes and a larger stock northeast of Otter Mountain intruded 36.6 ± 4.2 Ma (Bookstrom and others, 1987)

Ta — **Alaskite porphyry (Oligocene and/or Eocene)**—White to light-gray porphyry composed of very fine-grained quartz and orthoclase with scattered orthoclase and plagioclase phenocrysts, and less commonly, quartz and mica. Dendrites of manganese oxide are pervasive along fracture and joint surfaces. Occurs as dikes typically less than 15 ft wide and as a large stock on the west flank of Paines Mountain intruded 37.0 ± 4 Ma (Bookstrom and others, 1987)

Tqm — **Quartz monzonite porphyry (Oligocene and/or Eocene)**—Pale-violet to medium-gray porphyry composed of plagioclase, orthoclase, and quartz with phenocrysts of plagioclase and sanidine, and less commonly, amphibole and biotite. Occurs as dikes typically less than 15 ft wide and as a large stock on Lincoln Mountain. These intrusives are associated with the 35 to 40 Ma Montezuma stock (Bookstrom, 1993)

TKb — **Bostonite porphyry (early Tertiary to Upper Cretaceous)**—Single lilac to redish-purple porphyry dike east of Saxon Mountain. Consists primarily of orthoclase and plagioclase with lesser amounts of quartz and amphibole. Rhombic orthoclase phenocrysts exhibit tan alteration haloes extending outwards about 0.1 to 0.2 inches. This dike is similar in texture and mineralogy to rocks of the Empire stock, located northeast of the Georgetown quadrangle, which was emplaced between 61 to 68 Ma (Cunningham and others, 1994; Marvin and others, 1989; Simmons and Hedge, 1978)

PROTOROZOIC INTRUSIVE ROCKS—The majority of the Proterozoic intrusive rocks in the Georgetown quadrangle belong to the 1,400 Ma Berthoud plutonic suite (Tweto, 1987). Two small bodies of granodiorite at the northern end of the quadrangle belong to the 1,700 Ma Routt plutonic suite (Tweto, 1987)

Yd — **Diorite and associated hornblendite (Middle Proterozoic)**—Dark-gray to mottled dark-gray and white, medium- to coarse-grained igneous rock composed primarily of plagioclase and hornblende with minor quartz and biotite. Associated greenish-black, fine- to medium-grained granular hornblendite is defined almost entirely by hornblende. Spurr and others (1908) suggested the diorite and associated hornblendite are slightly younger differentiation products of the magma that generated the granodiorite of the Mount Evans batholith

Ysp — **Silver Plume Granite (Middle Proterozoic)**—Pink to pinkish-gray granite consisting primarily of microcline, plagioclase, and quartz, with minor to moderate amounts of biotite and/or muscovite. Abundant microcline phenocrysts are tabular and locally are weakly aligned. Where mineralized, off-white phenocrysts contrast with a rust- to purple-stained matrix. Age of the granite is 1,422 ± 2 Ma (Graubard and Mattison, 1990)

Ygq — **Biotite-muscovite granite and quartz monzonite (Middle Proterozoic)**—Gray to pinkish-buff, fine- to medium-grained granite composed of microcline, plagioclase, and quartz, with lesser amounts of biotite and muscovite. May represent fine-grained equivalent of the Silver Plume Granite

Ygd — **Granodiorite of the Mount Evans batholith (Middle Proterozoic)**—Weakly to moderately foliated, medium- to coarse-grained, mottled black and white granodiorite composed of plagioclase, microcline, quartz, biotite, and accessory hornblende, magnetite, and sphene. Recent dating indicates the Mount Evans batholith was emplaced 1,442 ± 2 Ma and, therefore, is not equivalent to the Boulder Creek Granodiorite (Aleinikoff and others, 1993)

YXqm — **Quartz monzonite gneiss (Middle or Early Proterozoic)**—Mottled black and white, medium- to coarse-grained, locally porphyritic gneiss composed essentially of plagioclase, orthoclase, and quartz with variable amounts of hornblende and biotite. Exhibits a gneissic structure defined by alternating bands of aligned quartz and feldspar and aligned biotite and hornblende. Locally intruded by dikes and small bodies of aplite and Silver Plume Granite

YXp — **Pegmatite, aplite, and related rocks (Middle and Early Proterozoic)**—Includes pegmatite, granite pegmatite, and aplite, all of which consist of quartz and feldspar with various amounts of biotite, muscovite, magnetite, and hornblende. Granite pegmatite is medium-grained to pegmatitic. Aplite dikes and veinlets are composed of fine-grained quartz and feldspar

Xbc — **Boulder Creek Granodiorite (Early Proterozoic)**— Medium- to coarse-grained, weakly foliated granodiorite exposed north of Empire Pass and composed of plagioclase, microcline, quartz, biotite, and accessory hornblende and sphene. Locally porphyritic with elongate or rounded, pinkish potassium feldspar crystals up to about 2 in. long. Age of the granodiorite is 1,665 ± 40 Ma (Peterman and others, 1968)

PROTEROZOIC METAMORPHIC ROCKS—Metavolcanic rocks in northern Colorado and Wyoming that are lithologically similar to those in Georgetown have U-Pb zicron ages ranging from 1,780 to 1,800 Ma (Premo and Fanning, 1997)

Xm — **Migmatite (Early Proterozoic)**—Rocks that have been extensively intruded by granite or pegmatite, and/or intensely deformed and heated to the point of partial melting. Most commonly characterized by sillimanitic biotite gneiss (Xsb) strongly intruded by Silver Plume Granite. Less commonly, includes layers or pods, biotite gneiss, hornblende gneiss, and felsic gneiss

Xf — **Felsic gneiss (Early Proterozoic)**—Fine- to medium-grained, white to light-gray or tan, moderately well-foliated microcline-quartz-plagioclase-biotite gneiss. Light- or dark-gray where biotite is lacking; tan where biotite content is greater; banded white and dark-gray where both biotite-rich and biotite-poor layers occur. Magnetite, hornblende, or garnet present locally

Xh — **Hornblende gneiss and amphibolite (Early Proterozoic)**—Medium- to dark-gray, fine-grained, massive or well-layered hornblende gneiss, and dark-green to black, fine- to medium-grained amphibolite. Hornblende gneiss is composed of hornblende and plagioclase and lesser amounts of quartz, biotite, and pyroxene. Amphibolite is composed almost entirely of hornblende and plagioclase with almost no quartz, biotite, or pyroxene

Xc — **Calc-silicate gneiss (Early Proterozoic)**—Fine- to medium-grained, dark-gray to light-green gneiss consisting of quartz, feldspar, and hornblende, with accessory diopside, epidote, magnetite, and garnet. Commonly occurs as layers less than about 10 in. thick but locally may be several tens of feet thick

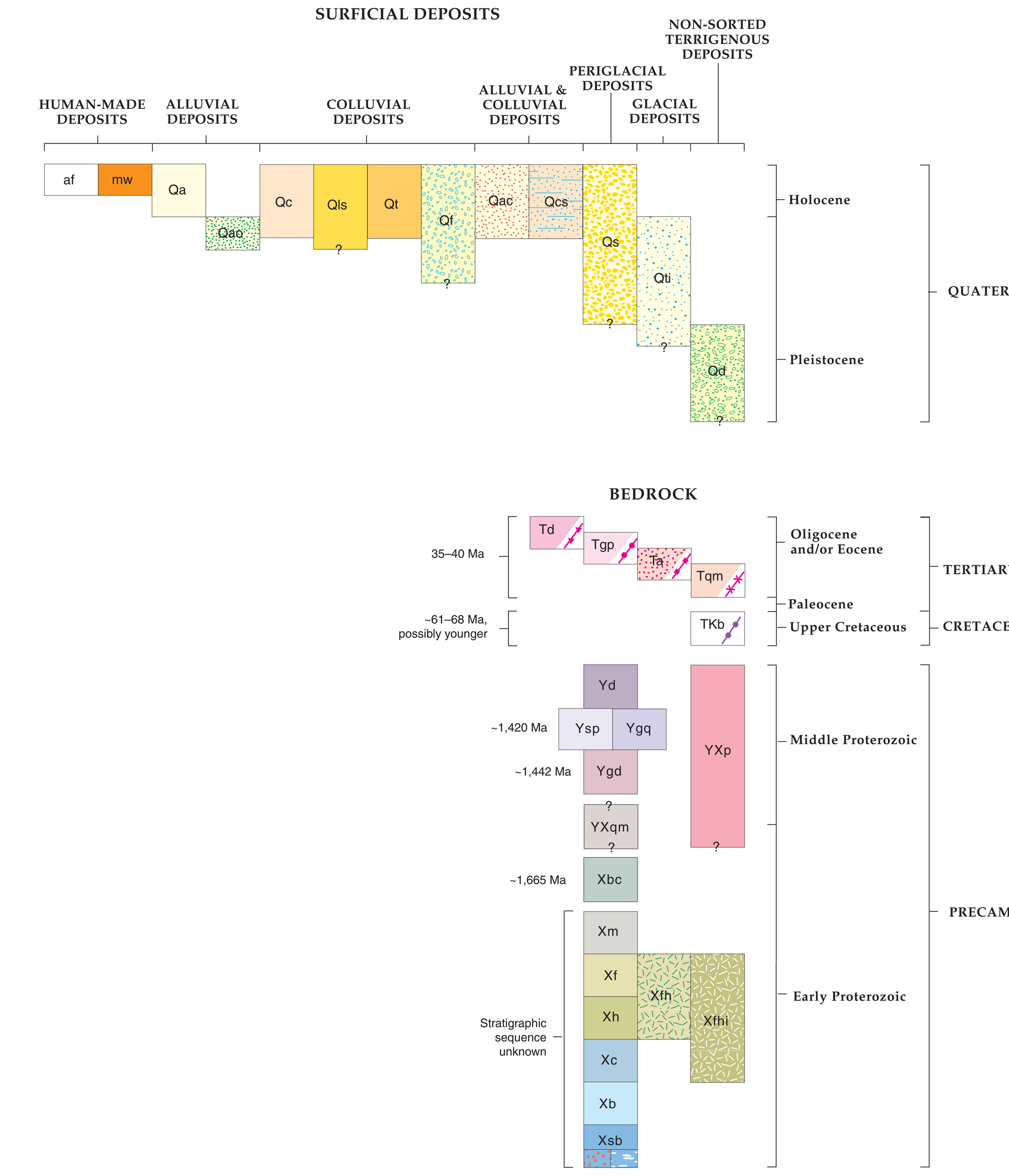
Xfh — **Interlayered felsic and hornblende gneiss (Early Proterozoic)**—Felsic gneiss (Xf) interlayered with hornblende gneiss (Xh). Thickness of individual layers is typically only a few feet but locally may exceed several tens of feet

Xfhi — **Interlayered felsic, hornblende, biotite, and calc-silicate gneiss (Early Proterozoic)**—Felsic gneiss interlayered with hornblende gneiss, biotite gneiss, and sparse layers or pods of calc-silicate gneiss. Felsic and biotite gneiss layers range from a few inches to several tens of feet thick; hornblende and calc-silicate gneiss layers are usually less than about 18 in. thick

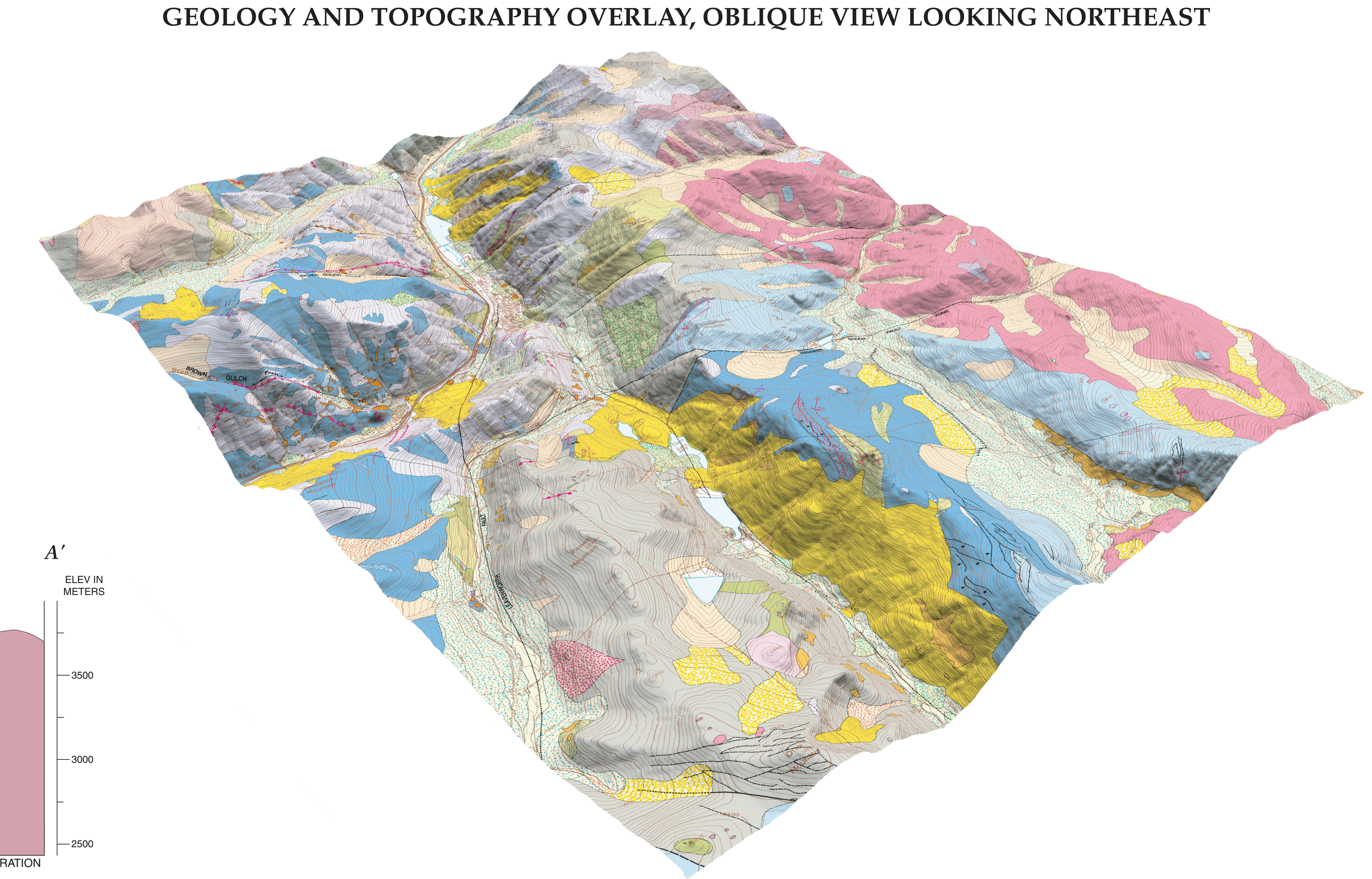
Xb — **Biotite gneiss (Early Proterozoic)**—Fine-grained, light- to medium-gray gneiss composed primarily of biotite, quartz, and plagioclase, with minor magnetite, sillimanite, garnet, and/or cordierite. Typically equigranular and "salt and pepper" in appearance, though schistose in some areas

Xsb — **Sillimanitic biotite gneiss (Early Proterozoic)**—Medium- to dark-gray, strongly foliated gneiss composed primarily of biotite, sillimanite, and quartz, with minor microcline, muscovite, garnet, tourmaline, and cordierite. Sillimanite is easily recognizeable either as cloudy white rods and bundles or flattened pods elongate parallel to foliation. Open oval pattern indicates a high concentration of sillimanite pods generally greater than 1 in. and locally exceeding 8 in. in length. Pattern of red dots indicates a high concentration of macroscopic garnet crystals ranging from less than 0.1 in. up to about 1 in. diameter

CORRELATION OF MAP UNITS



SHADED-RELIEF MAP OF THE GEORGETOWN QUADRANGLE WITH GEOLOGY AND TOPOGRAPHY OVERLAY, OBLIQUE VIEW LOOKING NORTHEAST



MAP SYMBOLS

af/Qa — **Geologic contact**—Dashed where approximately located. Units shown as fractions where thin upper deposit overlies or occurs within lower unit

Fault—Dashed where approximately located; dotted where concealed. Arrows show apparent direction of relative horizontal movement. Sense of movement on other faults is unknown

Sackung—Linear scarp occurring on mountain ridges suggesting deep-seated rock creep, ridge-spreading movement, and slope failure in response to gradual gravitational movement of rock masses into adjacent valleys. Bar and ball on downthrown side of scarp

65 — **Antiform**—Showing axial trace and locally, plunge; dashed where approximately located; dotted where concealed

56 — **Synform**—Showing axial trace and locally, plunge; dashed where approximately located; dotted where concealed

66 — **Trend and plunge of minor fold**—Showing axial trace of minor folds in Proterozoic metamorphic rocks.

Moraine crest—Crest of prominent lateral and terminal moraines in Chicago Creek valley

Strike and dip of foliation or compositional layering—Foliation is typically parallel to compositional layering in Proterozoic metamorphic rocks

35 — **Inclined**

Vertical

35 — **Strike and dip of joint**

A—A' — **Alignment of cross section**

GEOLOGIC MAP OF THE GEORGETOWN QUADRANGLE, CLEAR CREEK COUNTY, COLORADO

By Beth L. Widmann and Ulrike Miersemann

2001