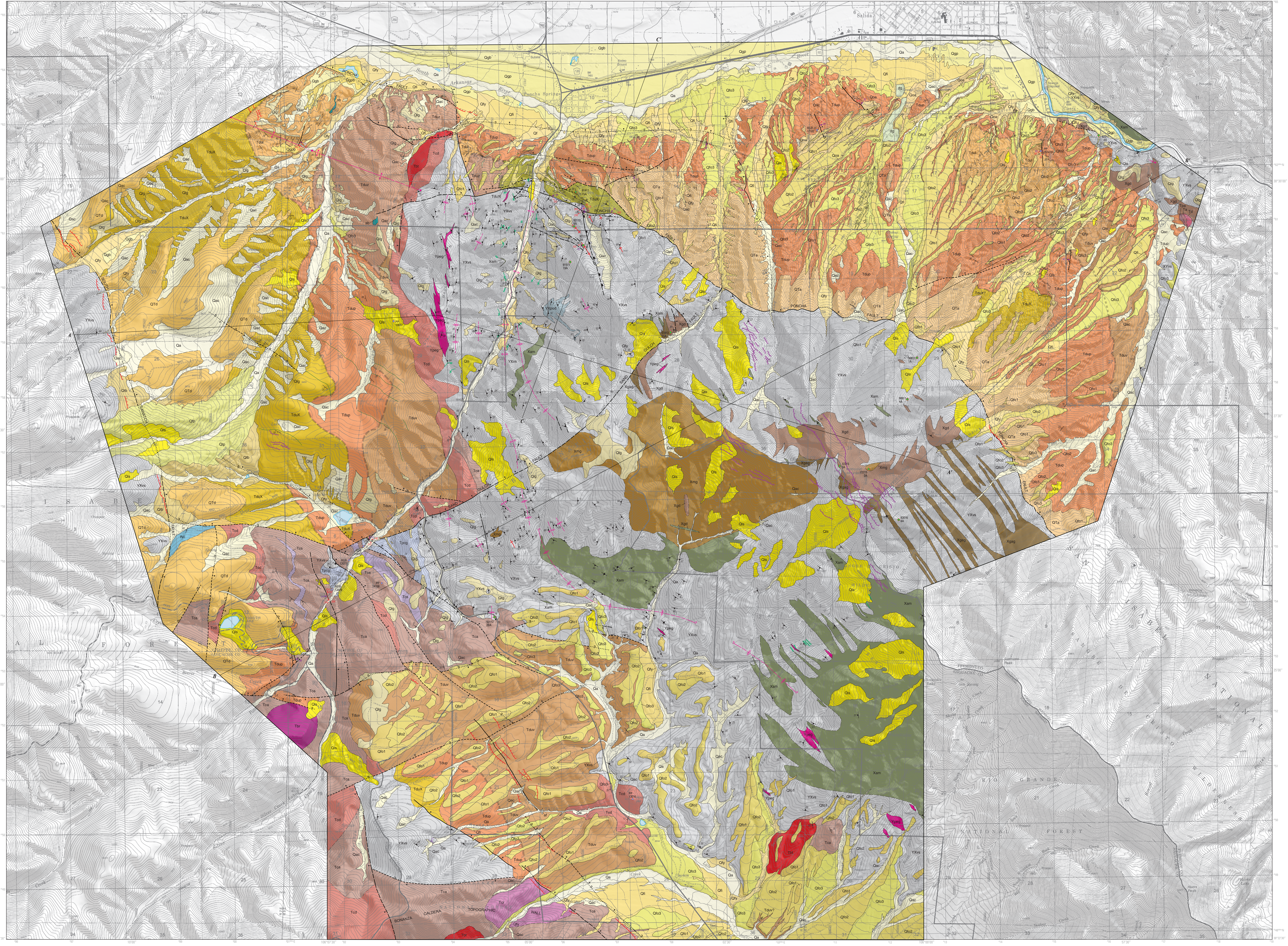
USGS
science for a changing world

U.S. Department of the Interior
U.S. Geological Survey

Scientific Investigations Map 3436
Sheet 1 of 3


Salida
Poncha Springs
South Arkansas River
Arkansas River
PONCHA FAULT
SAND GULCH FAULT
SOUTH SAWATCH FAULT
O'HAVER LAKE
CHAFFEE CO
SAGUACHE CO
FREMONT CO
BONANZA CALDERA TOPOGRAPHIC WALL
SAN ISABEL NATIONAL FOREST
RIO GRANDE NATIONAL FOREST
SANGRE DE CRISTO WILDERNESS
A
A′
B
B′
C
C′
Qgb
Qgp
Qa
Qac
Qfy
Qfi
Qfo1
Qfo2
Qfo3
Qoa
QTa
QTd
Qlg
Qls
Qtp
Qtb
Qgpb
dg
af
Tdup
TduX
Tduv
Tdul
Tduz
TduXl
sb
Tbt
Tbr
Tpa
Ta
Td
Tcd
Tca
Tcs
Tcr
Tpcg
Pzc
Ypeg
Xgd
Xmg
Xam
Xgag
YXpod
YXvs

Base from U.S. Geological Survey 1:24,000-scale maps of Maysville (1994), Salida West (1994), Salida East (1994), Mount Ouray (1994), Poncha Pass (1994), and Wellsville (1994).
North American Datum 83 (NAD 83)
1,000-meter grid, Universal Transverse Mercator, zone 13N
10,000-foot ticks, Colorado Coordinate System (south and central zones)
Shaded-relief base from U.S. Geological Survey National Elevation Dataset (NED) (accessed in 2018 at https://viewer.nationalmap.gov/basic/), 10-meter resolution elevation data.

For more information concerning this publication, contact the
Center Director, USGS Geosciences and Environmental Change Science Center
Box 25046, Mail Stop 980
Denver, CO 80225
(303) 236-5344

Or visit the Geosciences and Environmental Change Science Center website at
https://www.usgs.gov/centers/gecsc

Digital files available at https://doi.org/10.3133/sim3436

ScienceBase data release GIS and other files that support this report are available at https://doi.org/10.5066/P9GYYF4F

To learn about the USGS and its information products visit
https://www.usgs.gov/
1-888-ASK-USGS

This report is available at https://doi.org/10.3133/sim3436

Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Although this information product, for the most part, is in the public domain, it also contains copyrighted materials as noted in the text. Permission to reproduce copyrighted items must be secured from the copyright owner.

Although these data have been processed successfully on a computer system at the USGS, no warranty expressed or implied is made regarding the display or utility of the data on any other system or for general or scientific purposes, nor shall the act of distribution constitute any such warranty. The USGS or the U.S. Government shall not be held liable for improper or incorrect use of the data described and/or contained herein.

APPROXIMATE MEAN DECLINATION, 2019

SCALE 1:24 000

CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

MAP LOCATION

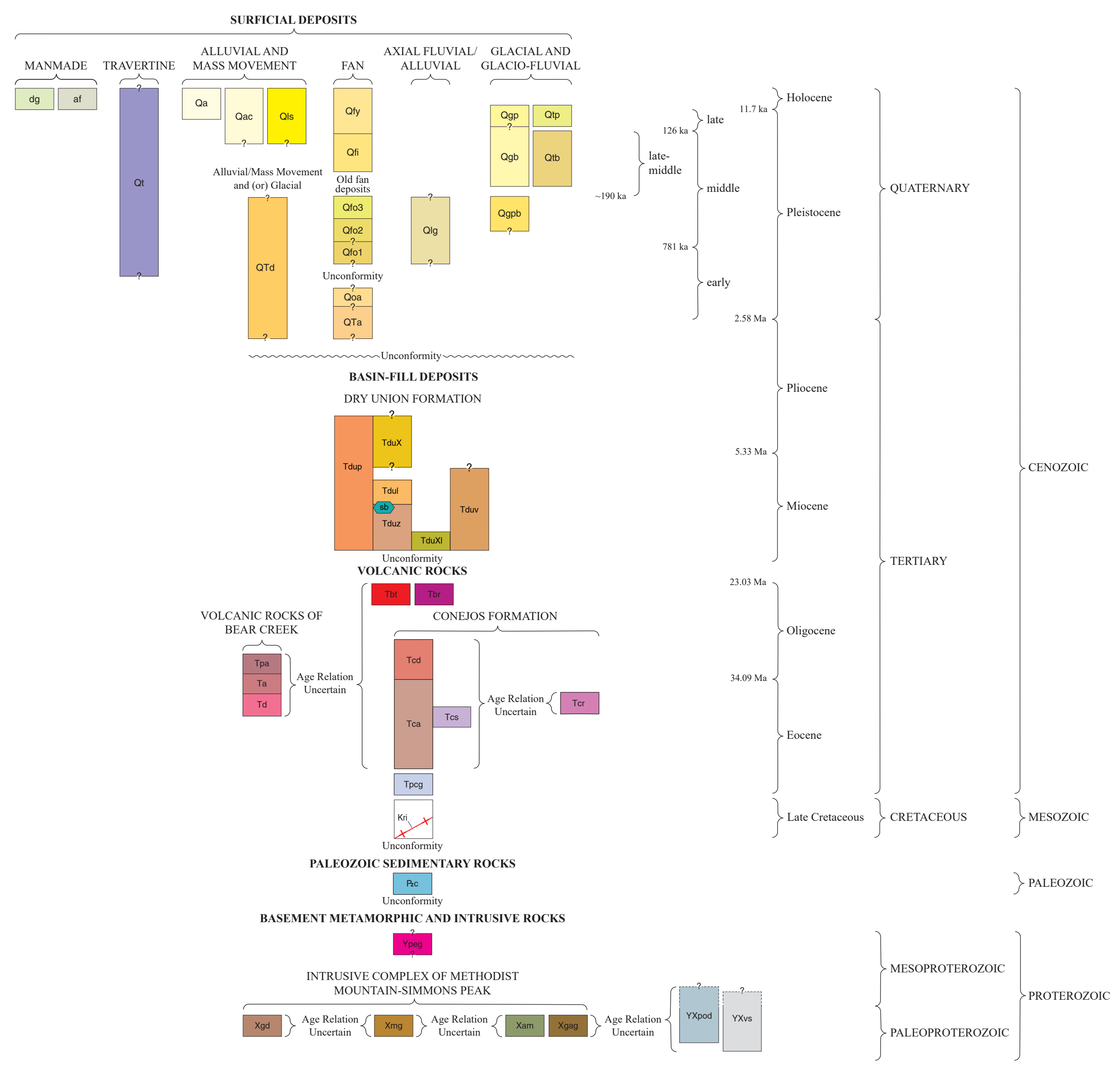
Geology mapped during 2011–2016 by S.A. Minor, J.S. Caine, C.A. Ruleman, and C.J. Fridrich
The geodatabase (including the digital topographic base) was developed by T.R. Brandt
Publishing support provided by Denver Publishing Service Center. Digital cartographic production and editing by J.A. Herrick and L.J. Binder
Manuscript approved for publication July 24, 2019

Geologic Map of the Poncha Pass Area, Chaffee, Fremont, and Saguache Counties, Colorado

By

Scott A. Minor, Jonathan Saul Caine, Chester A. Ruleman, Christopher J. Fridrich, Christine F. Chan, Theodore R. Brandt,
Christopher S. Holm-Denoma, Leah E. Morgan, Michael A. Cosca, and V.J.S. Grauch
2019

CORRELATION OF MAP UNITS


SURFICIAL DEPOSITS
MANMADE
TRAVERTINE
ALLUVIAL AND MASS MOVEMENT
FAN
AXIAL FLUVIAL/ ALLUVIAL
GLACIAL AND GLACIO-FLUVIAL
dg
af
Qt
Qa
Qac
Qls
Alluvial/Mass Movement and (or) Glacial
QTd
Qfy
Qfi
Old fan deposits
Qfo3
Qfo2
Qfo1
Unconformity
Qoa
QTa
Qlg
Qgp
Qtp
Qgb
Qtb
Qgpb
Unconformity
BASIN-FILL DEPOSITS
DRY UNION FORMATION
Tdup
TduX
Tdul
sb
Tduz
TduXl
Tduv
Unconformity
VOLCANIC ROCKS
Tbt
Tbr
VOLCANIC ROCKS OF BEAR CREEK
Tpa
Ta
Td
Age Relation Uncertain
CONEJOS FORMATION
Tcd
Tca
Tcs
Age Relation Uncertain
Tcr
Tpcg
Kri
Unconformity
PALEOZOIC SEDIMENTARY ROCKS
Pzc
Unconformity
BASEMENT METAMORPHIC AND INTRUSIVE ROCKS
Ypeg
INTRUSIVE COMPLEX OF METHODIST MOUNTAIN-SIMMONS PEAK
Xgd
Age Relation Uncertain
Xmg
Age Relation Uncertain
Xam
Xgag
Age Relation Uncertain
YXpod
YXvs
11.7 ka
126 ka
~190 ka
781 ka
2.58 Ma
5.33 Ma
23.03 Ma
34.09 Ma
late
late-middle
middle
early
Holocene
Pleistocene
Pliocene
Miocene
Oligocene
Eocene
Late Cretaceous
QUATERNARY
TERTIARY
CRETACEOUS
CENOZOIC
MESOZOIC
PALEOZOIC
MESOPROTEROZOIC
PALEOPROTEROZOIC
PROTEROZOIC

LIST OF MAP UNITS

[Colors on the map may appear darker due to the hillshade transparency]

SURFICIAL DEPOSITS

MANMADE

dg	**Disturbed ground (Holocene)**
af	**Artificial fill (Holocene)**

TRAVERTINE

Qt	**Travertine deposits (Quaternary)**

ALLUVIAL AND MASS MOVEMENT

Qa	**Alluvium (Holocene and latest Pleistocene)**
Qac	**Alluvium and colluvium, undivided (Holocene and late and late middle? Pleistocene)**
Qls	**Landslide deposits (Holocene and late and late middle? Pleistocene)**

ALLUVIAL/MASS MOVEMENT AND (OR) GLACIAL

QTd	**Diamicton (middle and early Pleistocene? and Pliocene?)**

FAN

Qfy	**Young fan deposits (Holocene and late Pleistocene)**
Qfi	**Intermediate fan deposits (late middle Pleistocene)**
	Old fan deposits (middle and early? Pleistocene)
Qfo3	**Youngest subunit**
Qfo2	**Intermediate subunit**
Qfo1	**Oldest subunit**
Qoa	**Older alluvial deposits (early Pleistocene?)**
QTa	**Old alluvial deposits (early Pleistocene? and Pliocene?)**

AXIAL FLUVIAL/ALLUVIAL

Qlg	**Lag gravel deposits (middle and early Pleistocene?)**

GLACIAL AND GLACIO-FLUVIAL

Qgp	**Outwash gravel of Pinedale glaciation (late Pleistocene)**
Qtp	**Till of Pinedale glaciation (late Pleistocene)**
Qgb	**Outwash gravel of Bull Lake glaciation (late? and middle Pleistocene)**
Qtb	**Till of Bull Lake glaciation (late middle Pleistocene)**
Qgpb	**Outwash gravel of pre-Bull Lake glaciation (middle Pleistocene)**

BASIN-FILL UNITS

	Dry Union Formation (Pliocene? and Miocene)
Tdup	**Polymict deposits**
TduX	**Proterozoic-clast deposits**
Tduv	**Volcanic-clast deposits**
Tdul	**Lacustrine deposits**
sb	**Paleozoic carbonate slide blocks**
Tduz	**Paleozoic-clast deposits**
TduXl	**Lower Proterozoic-clast deposits**

VOLCANIC ROCKS

Tbt	**Bonanza Tuff (lower Oligocene)**
Tbr	**Rhyolitic lava (lower Oligocene)**
	Volcanic rocks of Bear Creek (lower Oligocene?)
Tpa	**Phyric trachyandesite lava**
Ta	**Trachyandesite lava**
Td	**Trachydacite lava**
	Conejos Formation (lower Oligocene and upper Eocene)
Tcd	**Trachydacite lavas and breccias**
Tca	**Trachyandesite lavas and breccias**
Tcs	**Interflow sediments**
Tcr	**Rhyolitic lava**
Tpcg	**Pre-Conejos Formation gravels (upper Eocene)**
Kri	**Rhyolite dikes (Late Cretaceous)**

PALEOZOIC SEDIMENTARY ROCKS

Pzc	**Carbonate rocks (Paleozoic)**

BASEMENT METAMORPHIC AND INTRUSIVE ROCKS

Ypeg	**Pegmatite dikes (Mesoproterozoic?)**
	Intrusive complex of Methodist Mountain-Simmons Peak (Paleoproterozoic)
Xgd	**Granodiorite**
Xmg	**Microgranitoid**
Xam	**Amphibolite**
Xgag	**Interleaved intrusives**
YXpod	**Porphyroblastic sillimanite gneiss and schist (Mesoproterozoic? and Paleoproterozoic)**
YXvs	**Metavolcanic and metasedimentary rocks, undifferentiated (Mesoproterozoic? and Paleoproterozoic)**

CONVERSION FACTORS

Multiply	By	To obtain
inch (in.)	25.4	millimeter (mm)
inch (in.)	2.54	centimeter (cm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
square mile (mi²)	259.0	hectare (ha)
square mile (mi²)	2.590	square kilometer (km²)

EXPLANATION

Contact—Solid where location is certain, long dash where location is approximate, short dash where location is inferred; contact attitude (green tick) shows direction and angle of dip

Gradational contact, approximate—Widely segmented where location is concealed

Keybed

Fault—Solid where location is certain, long dash where approximate, short dash where inferred, dotted where concealed; queried where identity or existence is questioned; red diamond-headed arrow shows bearing and rake of slickenlines; small purple arrow shows direction and angle of dip

Normal Fault—Ball and bar on relative downthrown block; solid where location is certain, long dash where approximate, short dash where inferred, dotted where concealed; queried where identity or existence is questioned

Reverse Fault—Rectangles on upthrown block; solid where location is certain; dashed where location is approximate

Lineament—Inferred fault scarp with hachures pointing downscarp

Sakung scarp—Hachures point downscarp

Sill of Xam

Dike of Xam

Anticline—Solid where location is certain, dashed where approximate, dotted where concealed; large arrowhead shows direction of plunge

Antiform—Dashed where location is approximate, dotted where location is concealed

Synform—Dashed where location is approximate, dotted where concealed; queried where identity or existence is questionable

Minor syncline—Showing bearing and plunge

Horizontal bedding

Inclined bedding—Showing strike and dip

Inclined bedding, approximate—Showing strike and dip

Inclined bedding, questionable—Showing strike and dip

Vertical bedding

Inclined foliation—Showing strike and dip

Inclined foliation, questionable—Showing strike and dip

Vertical foliation

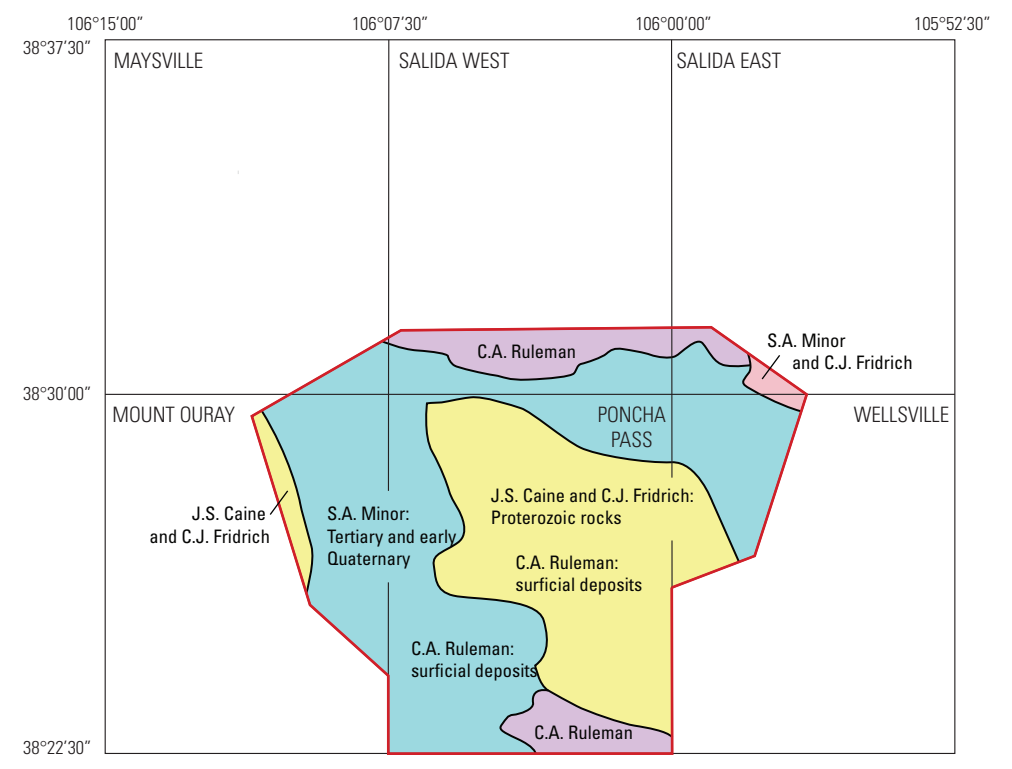
Inclined foliation, volcanic flow—Showing strike and dip

Compaction foliation—In ash-flow tuff; showing strike and dip

Geochronological sample—Uranium lead; Showing sample locations with sample number

Geochronological sample—Argon-argon; Showing sample locations with sample number

Water body

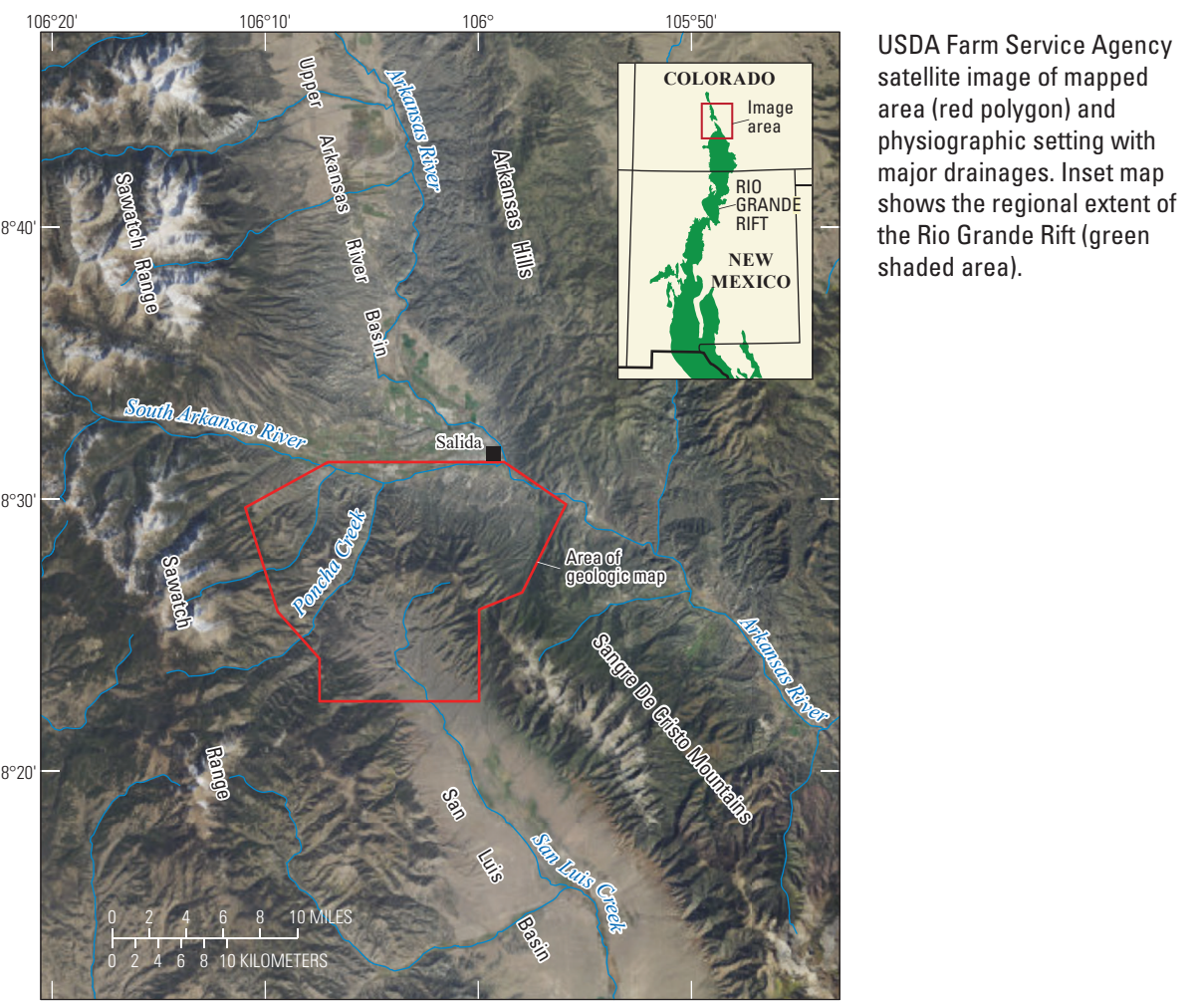

106°15'00"
106°07'30"
106°00'00"
105°52'30"
38°37'30"
38°30'00"
38°22'30"
MAYSVILLE
SALIDA WEST
SALIDA EAST
MOUNT OURAY
PONCHA PASS
WELLSVILLE
C.A. Ruleman
S.A. Minor and C.J. Fridrich
J.S. Caine and C.J. Fridrich
S.A. Minor: Tertiary and early Quaternary
J.S. Caine and C.J. Fridrich: Proterozoic rocks
C.A. Ruleman: surficial deposits
C.A. Ruleman: surficial deposits
C.A. Ruleman

Index map showing map area in red outline, corresponding 7.5' quadrangles, and subdivisions of the mapped area attributed to coauthors (Scott A. Minor, Jonathan Saul Caine, Chester A. Ruleman, Christopher J. Fridrich).

DIVISIONS OF GEOLOGIC TIME USED IN THIS REPORT

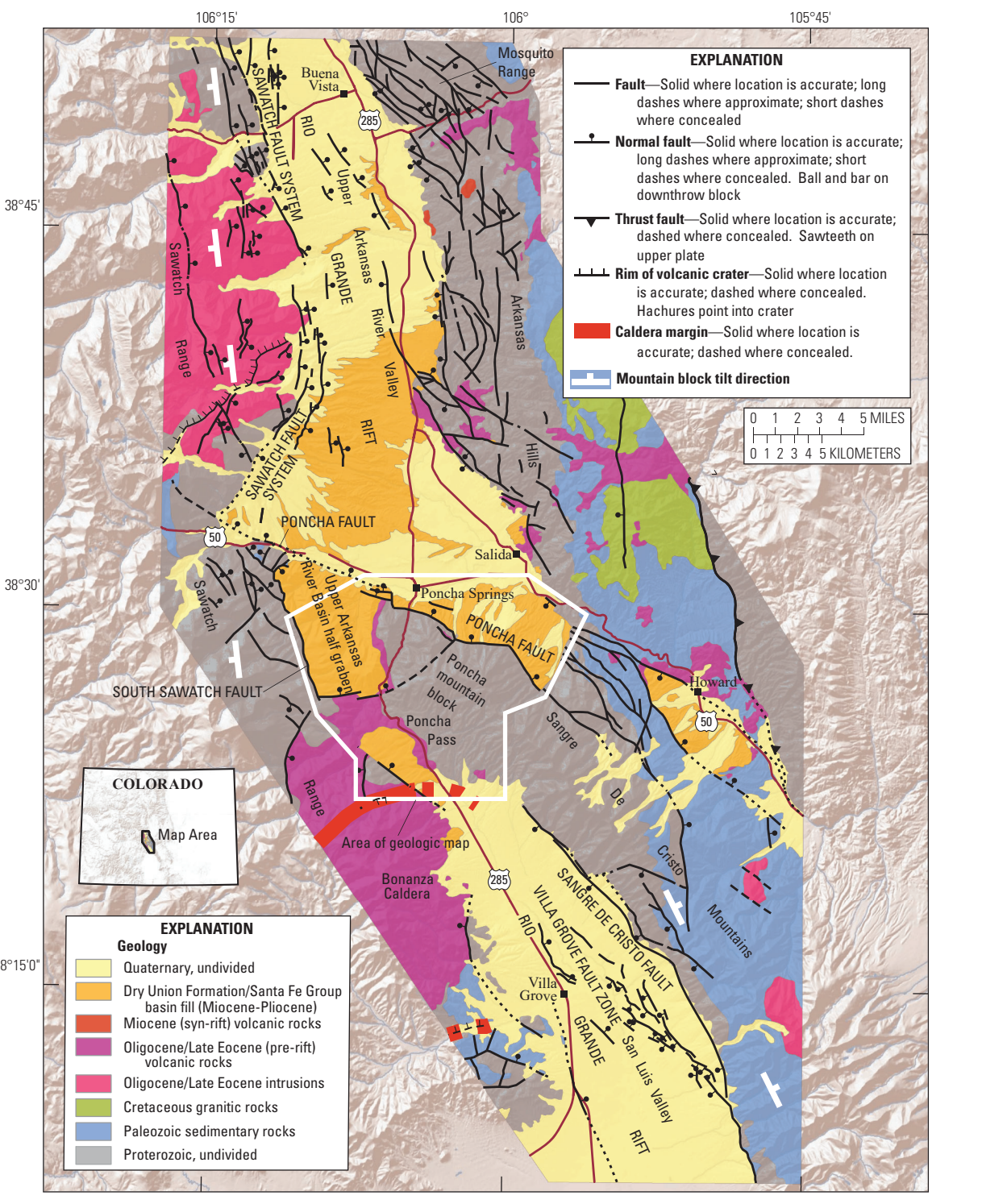
Era	Period	Epoch		Age[1]
Cenozoic	Quaternary	Holocene		0 ka–11.7 ka
		Pleistocene[2]	late	11.7–126 ka
			middle	126–781 ka
			early[3]	781 ka–2.58 Ma
	Tertiary (part)	Pliocene		2.58–5.33 Ma
		Miocene		5.33–23.03 Ma
		Oligocene		23.03–34.09 Ma
		Eocene		34.09–55.9 Ma
Mesozoic (part)	Cretaceous (part)	Late		66.0–100.5 Ma
Paleozoic				251.9–541.0 Ma
Mesoproterozoic				1,000–1,600 Ma
Paleoproterozoic				1,600–2,500 Ma

[1] Ma, million years; ka, thousand years.
[2] Subdivisions of the Pleistocene are informal divisions from Cohen and others (2013; updated).
[3] Early Pleistocene as applied here is the combination of the Calabrian and Gelasian Ages from Cohen and others (2013; updated).

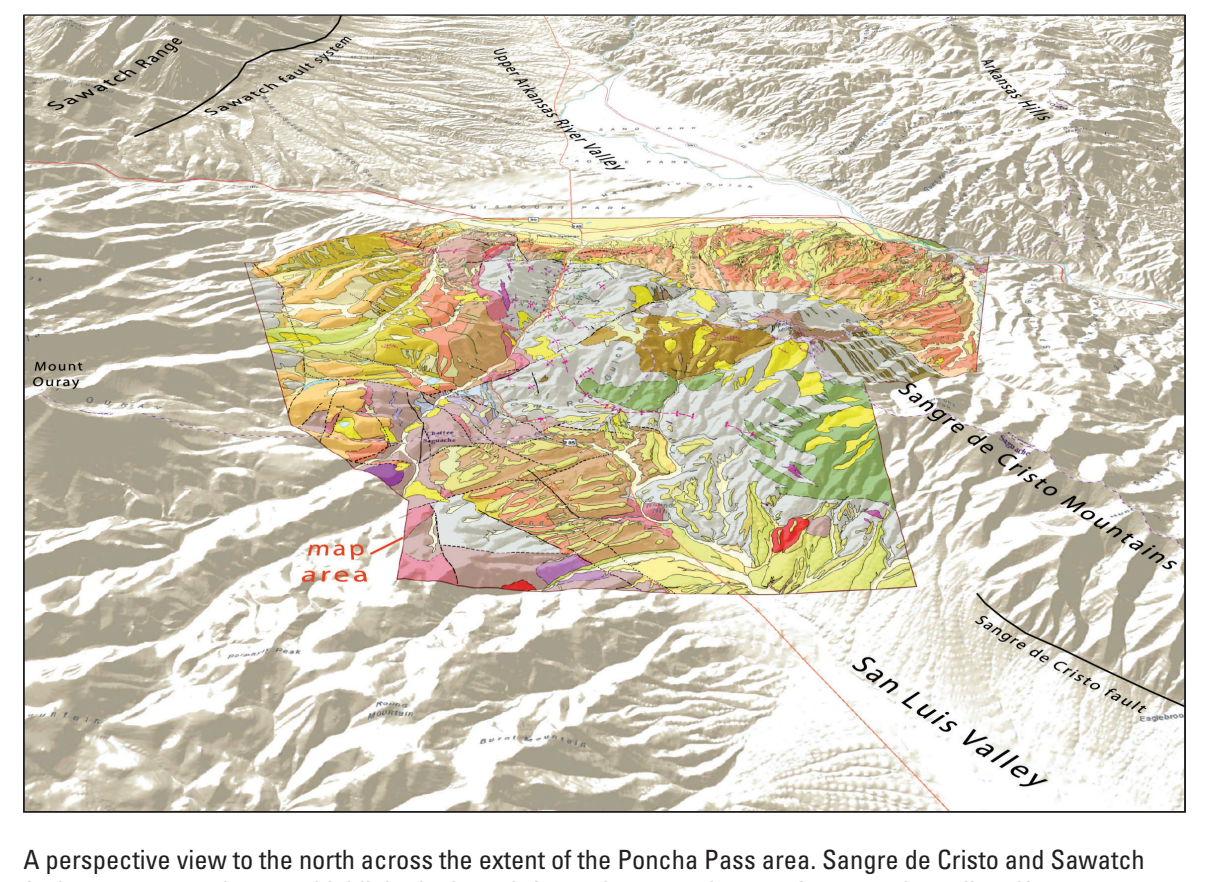

106°20'
106°10'
106°
105°50'
38°40'
38°30'
38°20'
COLORADO
Image area
RIO GRANDE RIFT
NEW MEXICO
Sawatch Range
Upper Arkansas River Basin
Arkansas River
Arkansas Hills
South Arkansas River
Salida
Poncha Creek
Area of geologic map
Saguache
Sangre De Cristo Mountains
Arkansas River
San Luis Basin
San Luis Creek
0 2 4 6 8 10 MILES
0 2 4 6 8 10 KILOMETERS

USDA Farm Service Agency satellite image of mapped area (red polygon) and physiographic setting with major drainages. Inset map shows the regional extent of the Rio Grande Rift (green shaded area).

Base from U.S. Geological Survey The National Map; Orthoimagery, 2019; WGS 1984 Web Mercator projection


106°15'
106°
105°45'
38°45'
38°30'
38°15'0"
EXPLANATION
Fault—Solid where location is accurate; long dashes where approximate; short dashes where concealed
Normal fault—Solid where location is accurate; long dashes where approximate; short dashes where concealed. Ball and bar on downthrown block
Thrust fault—Solid where location is accurate; dashed where concealed. Sawteeth on upper plate
Rim of volcanic crater—Solid where location is accurate; dashed where concealed. Hachures point into crater
Caldera margin—Solid where location is accurate; dashed where concealed.
Mountain block tilt direction
0 1 2 3 4 5 MILES
0 1 2 3 4 5 KILOMETERS
Mosquito Range
Buena Vista
SAWATCH FAULT SYSTEM
Sawatch Range
RIO GRANDE RIFT
Upper Arkansas River Valley
Arkansas Hills
PONCHA FAULT
Salida
Poncha Springs
Upper Arkansas River Basin half graben
Poncha mountain block
Poncha Pass
SOUTH SAWATCH FAULT
Howard
Sangre De Cristo Mountains
Bonanza Caldera
Area of geologic map
Villa Grove
VILLA GROVE FAULT ZONE
SANGRE DE CRISTO FAULT
RIO GRANDE RIFT
San Luis Valley
COLORADO
Map Area
EXPLANATION
Geology
Quaternary, undivided
Dry Union Formation/Santa Fe Group basin fill (Miocene-Pliocene)
Miocene (syn-rift) volcanic rocks
Oligocene/Late Eocene (pre-rift) volcanic rocks
Oligocene/Late Eocene intrusions
Cretaceous granitic rocks
Paleozoic sedimentary rocks
Proterozoic, undivided

Tectonic map of the Poncha Pass area, Colo. The white outline indicates the extent of geologic mapping at 1:24,000 (extent of this Scientific Investigations Map). Shaded-relief base from U.S. Geological Survey National Elevation Dataset (accessed in 2018 at https://viewer.nationalmap.gov/basic/), 10-meter resolution elevation data; North American Datum 1983 (NAD83).


Sawatch Range
Sawatch fault system
Upper Arkansas River Valley
Arkansas Hills
Mount Ouray
map area
Sangre de Cristo Mountains
Sangre de Cristo fault
San Luis Valley

A perspective view to the north across the extent of the Poncha Pass area. Sangre de Cristo and Sawatch fault systems are shown to highlight the large left step between these major range-bounding rift structures. The area of the geologic map spans much of the upland terrain separating the two fault systems. Shaded-relief base from U.S. Geological Survey National Elevation Dataset (accessed in 2018 at https://viewer.nationalmap.gov/basic/, 10-meter resolution elevation data; North American Datum 1983 (NAD83).

View, looking west from near O'Haver Lake, of southern Sawatch fault escarpment. Summit of Mount Ouray (west of map area) is visible in upper center of photograph.

View, looking east, of the Poncha mountain block forming the northwest end of the Sangre de Cristo Mountains. Visible peaks on the skyline along the crest of the mountain block are, from right to left, Simmons Peak, Methodist Mountain (rounded summit), Poncha Mountain, and Cleveland Mountain. These peaks are underlain by Proterozoic basement rocks (mostly unit YXvs), whereas the smooth grassy uplands in the middle ground are mostly underlain by deposits of Miocene–Pliocene Dry Union Formation and Pliocene–Pleistocene diamicton (unit QTd).

ISSN 2329-132X (online)
https://doi.org/10.3133/sim3436

Suggested citation: Minor, S.A., Caine, J.S., Ruleman, C.A., Fridrich, C.J., Chan, C.F., Brandt, T.R., Holm-Denoma, C.S., Morgan, L.E., Cosca, M.A., and Grauch, V.J.S., 2019, Geologic map of the Poncha Pass area, Chaffee, Fremont, and Saguache Counties, Colorado: U.S. Geological Survey Scientific Investigations Map 3436, 3 sheets, scale 1:24,000, https://doi.org/10.3133/sim3436.