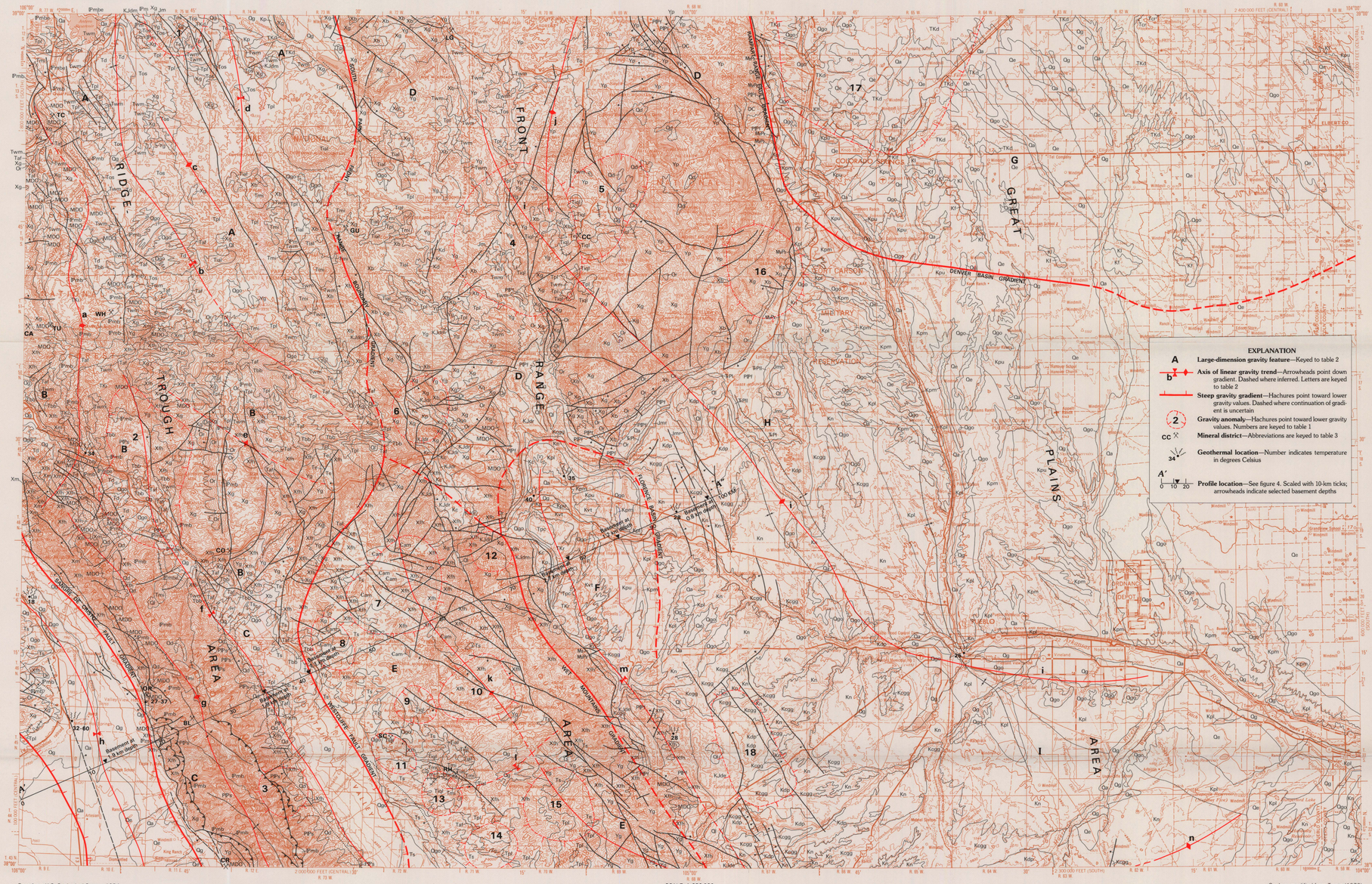
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

MISCELLANEOUS INVESTIGATIONS SERIES
MAP I–1419–B (SHEET 2 OF 2)
Explanatory pamphlet accompanies map.



Base from U.S. Geological Survey, 1954
Limited revision 1962

SCALE 1:250 000

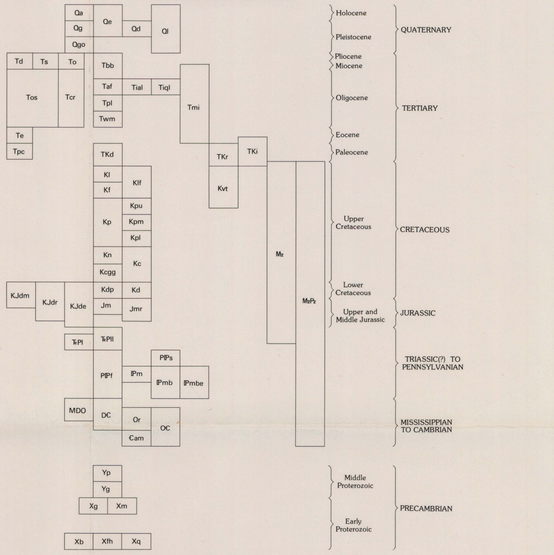
5 0 5 10 15 20 25 MILES

5 0 5 10 15 20 25 KILOMETERS

CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Geology modified from Tweto (1979)

CORRELATION OF MAP UNITS



LIST OF MAP UNITS

QUATERNARY SURFICIAL DEPOSITS

- Qa — Modern alluvium (Holocene)
- Qg — Gravels and alluviums (Pleistocene; Pinedale and Bull Lake age)
- Qgo — Older gravels and alluviums (Pleistocene; pre-Bull Lake age)
- Qe — Eolian deposits (Holocene and Pleistocene)
- Qd — Glacial drift of Pinedale and Bull Lake age (Pleistocene)
- Ql — Landslide deposits (Holocene and Pleistocene)

TERTIARY SEDIMENTARY ROCKS

- Td — Dry Union Formation (Pliocene to Miocene)
- Ts — Santa Fe Formation (Pliocene and Miocene)
- To — Gravel at Divide (Pliocene and Miocene)
- Tos — Oligocene sedimentary rocks
- Tcr — Castle Rock Conglomerate (Oligocene)
- Te — Eocene prevolcanic sedimentary rocks
- Tpc — Poison Canyon Formation (Paleocene)

TERTIARY IGNEOUS ROCKS

- Tbb — Basalt flows and associated tuff, breccia, and conglomerate of late-volcanic bimodal suite (Pliocene to Oligocene)
- Taf — Ash-flow tuff of main volcanic sequence (Oligocene)
- Tial — Intra-ash-flow andesitic lavas (Oligocene)
- Tiql — Intra-ash-flow quartz latite lavas (Oligocene)
- Tpl — Pre-ash-flow andesitic lavas, breccias, tuffs, and conglomerates (Oligocene)
- Twm — Wall Mountain Tuff (Oligocene)
- Tmi — Middle Tertiary intrusive rocks (Miocene to Eocene)

LOWER TERTIARY AND UPPER CRETACEOUS SEDIMENTARY AND IGNEOUS ROCKS

- TKd — Dawson Formation (Paleocene and Upper Cretaceous)
- TKr — Raton Formation (Paleocene and Upper Cretaceous)
- TKi — Laramide intrusive rocks (Eocene to Upper Cretaceous)—Includes Upper Cretaceous Whitehorn Granodiorite

CRETACEOUS SEDIMENTARY ROCKS

- Kl — Laramie Formation (Upper Cretaceous)
- Kf — Fox Hills Sandstone (Upper Cretaceous)
- Klf — Laramie Formation and Fox Hills Sandstone
- Kvt — Vermejo Formation and Trinidad Sandstone (Upper Cretaceous)
- Kp — Pierre Shale, undivided (Upper Cretaceous)
  - Kpu — Upper unit
  - Kpm — Middle unit
  - Kpl — Lower unit—Includes Sharon Springs Member
- Kn — Niobrara Formation (Upper Cretaceous)
- Kcgg — Carlile Shale, Greenhorn Limestone, and Graneros Shale (Upper Cretaceous)
- Kc — Colorado Group (Upper Cretaceous)
- Kdp — Dakota Sandstone and Purgatoire Formation (Lower Cretaceous)
- Kd — Dakota Sandstone or Group (Lower Cretaceous)

CRETACEOUS AND JURASSIC SEDIMENTARY ROCKS

- KJdm — Dakota (Lower Cretaceous) and Morrison (Jurassic) Formations
- KJdr — Dakota Group (Lower Cretaceous) and Morrison and Ralston Creek Formations (Jurassic) at mountain front north of Colorado Springs; Dakota, Purgatoire, Morrison, and Ralston Creek Formations in Canon City area
- KJde — Dakota and Purgatoire Formations (Lower Cretaceous) and Morrison and Ralston Creek Formations and Entrada Sandstone (Jurassic)

JURASSIC SEDIMENTARY ROCKS

- Jm — Morrison Formation (Upper Jurassic)
- Jmr — Morrison (Upper Jurassic) and Ralston Creek Formations (Upper and Middle Jurassic)

TRIASSIC AND PERMIAN SEDIMENTARY ROCKS

- ℞Pl — Lykins Formation (Triassic? and Permian)
- ℞Pll — Lykins Formation (Triassic? and Permian) and Lyons Sandstone (Permian)

PERMIAN AND PENNSYLVANIAN SEDIMENTARY ROCKS

- PIPf — Fountain Formation (Permian and Pennsylvanian)
- PIPs — Sangre de Cristo Formation (Permian and Pennsylvanian)

PENNSYLVANIAN SEDIMENTARY ROCKS

- IPm — Minturn Formation (Pennsylvanian)
- IPmb — Minturn and Belden Formations (Pennsylvanian)
- IPmbe — Evaporitic facies of Minturn and Belden Formations (Pennsylvanian)

SEDIMENTARY ROCKS BROADLY CLASSIFIED

[Shown in small areas of complex structure]

- Mz — Mesozoic rocks
- MzPz — Mesozoic and Paleozoic rocks

PRE-PENNSYLVANIAN PALEOZOIC SEDIMENTARY ROCKS

- MDO — Leadville Limestone (Mississippian), Williams Canyon Limestone (Devonian), and one or more Ordovician formations: Fremont Limestone, Harding Sandstone, and Manitou Limestone
- DC — Williams Canyon Limestone (Devonian), Manitou Limestone (Ordovician), and Sawatch Quartzite (Upper Cambrian)
- Or — One or more Ordovician formations
- OC — Manitou Limestone (Ordovician) and Sawatch Quartzite (Cambrian)

CAMBRIAN IGNEOUS ROCKS

- Cam — Alkalic and mafic intrusive rocks in small plutons, and diabase dikes (age 510–570 m.y.)—Includes Gem Park and McClure Mountain Complexes and igneous complexes at Democrat Creek and Iron Mountain

PROTEROZOIC IGNEOUS ROCKS

- Yp — Rocks of Pikes Peak batholith (Middle Proterozoic)
- Yg — Granitic rocks of Berthoud Plutonic Suite (Middle Proterozoic)
- Xg — Granitic rocks of Routt Plutonic Suite (Early Proterozoic)
- Xm — Mafic rocks of Routt Plutonic Suite (Early Proterozoic)

EARLY PROTEROZOIC METAMORPHIC ROCKS

- Xb — Biotitic gneiss, schist, and migmatite—Derived principally from sedimentary rocks
- Xfh — Felsic and hornblendic gneisses, either separate or interlayered—Derived principally from volcanic rocks
- Xq — Quartzite, conglomerate, and interlayered mica schist

Contact—Approximately located

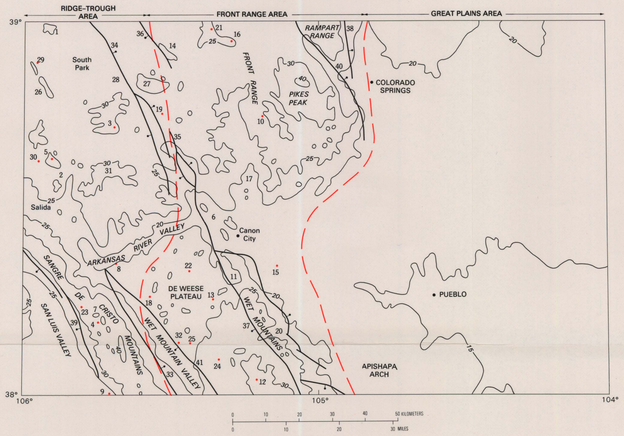
Fault—Showing relative movement where known; bar and ball on downthrown side. Dashed where approximately located or inferred; dotted where concealed

Thrust fault—Sawteeth on upper plate

Anticline—Approximately located

Syncline—Approximately located; dotted where concealed

Dike



Geographic features

1. Antero Reservoir
2. Arkansas Hills
3. Black Mountain
4. Blake
5. Cameron Mountain
6. Canon City embayment
7. Cottonwood Peak
8. Cotopaxi
9. Crestone
10. Cripple Creek
11. Curley Peak
12. Deer Peak
13. Syenite complex at Democrat Creek
14. Elevenmile Canyon Reservoir
15. Florence basin
16. Florissant
17. Fourmile Canyon graben
18. Gem Park Complex
19. Guffey
20. Hardscrabble Creek
21. Lake George
22. McClure Mountain
23. Orient mine
24. Rosita Hills
25. Silver Cliff
26. Southern Mosquito Range
27. Thirtynine Mile Mountain
28. Thirtynine Mile volcanic field
29. Trout Creek
30. Turret-Calumet
31. Waugh Mountain
32. Westcliffe

Faults

33. Alvarado fault
34. Currant Creek fault
35. Currant Creek-Ilse fault
36. Elkhorn fault
37. Ilse fault
38. Rampart Range fault
39. Sangre de Cristo fault
40. Ute Pass fault
41. Westcliffe fault

Fault—Bar and ball on downthrown side

Boundary between different physiographic-geologic areas

Topographic contour—In meters divided by 100 at 500-m intervals

Figure 3. Generalized topography of the Pueblo quadrangle showing the location of the ridge-trough area, the Front Range area, and the Great Plains area of the gravity interpretation.

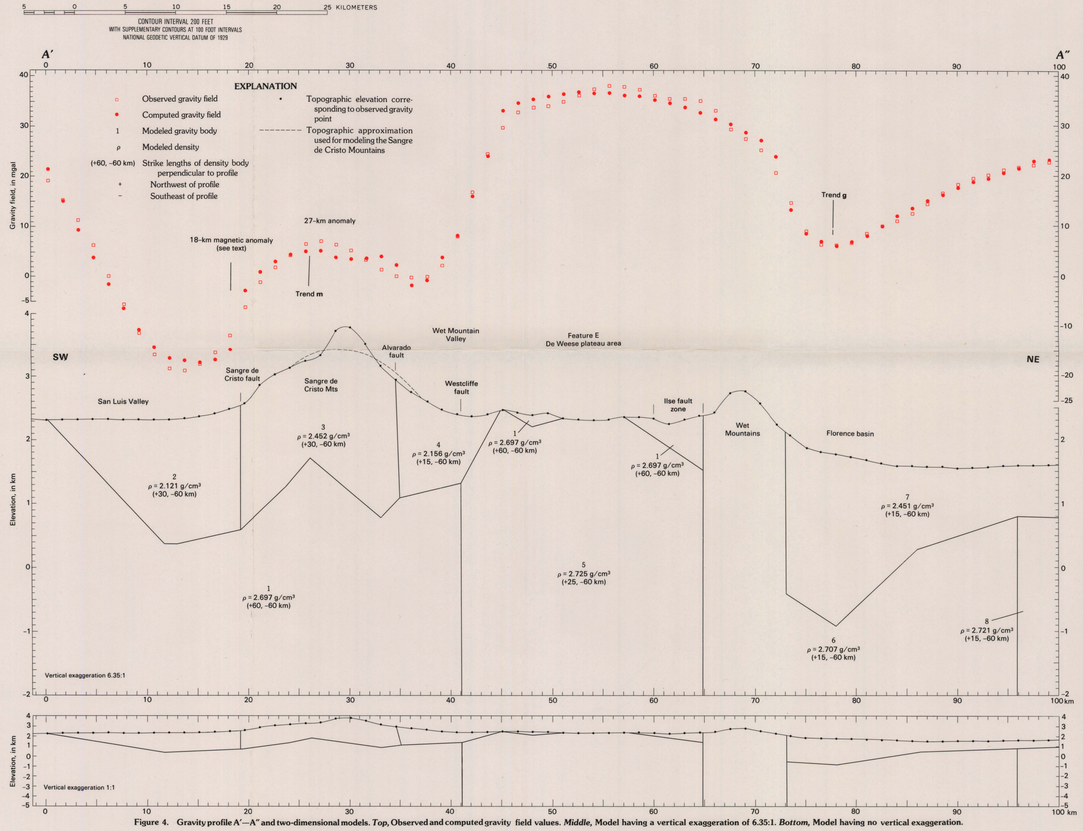


Figure 4. Gravity profile A′—A″ and two-dimensional models. *Top*, Observed and computed gravity field values. *Middle*, Model having a vertical exaggeration of 6.35:1. *Bottom*, Model having no vertical exaggeration.

Table 1. *Residual Bouguer gravity anomalies discussed for the Pueblo quadrangle*

Anomaly number	Feature	Location	Main geologic map units[1]	Elevation of the topography (km)	Inferred source
1	A	39°00′ N., 105°47′ W.	Xg, Yg, Tos	2.74–2.87	Local Precambrian rock outcrop.
2	B	38°30′ N., 105°50′ W.	PIPs, Td, Xfh, Xg	2.04–3.05	Low density Paleozoic sedimentary rocks.
3	C	38°06′ N., 105°37′ W.	PIPs, Pmb	2.74–3.84	Buried intrusion?
4	D	38°45′ N., 105°15′ W.	Xg, Xb, Yg, Yp	2.08–3.11	Early Proterozoic granites (Xg), local isostatic imbalance.
5	D	38°48′ N., 105°10′ W.	Tiql, Yp	2.74–3.72	Volcanic collapse structure.
6	D	38°32′ N., 105°25′ W.	Kp, Kc, KJdr, Xg	1.89–2.01	Graben with low-density sedimentary fill.
7	E	38°20′ N., 105°26′ W.	Cam, Xfh	1.92–2.56	McClure Mountain Complex.
8	E	38°17′ N., 105°32′ W.	Cam, Xfh, Taf	2.38–2.65	Gem Park Complex.
9	E	38°12′ N., 105°24′ W.	Xfh, Xm, Ts, Tiql	2.32–2.56	Volcanic collapse structure.
10	E	38°12′ N., 105°13′ W.	Xfh	2.38–2.93	Buried alkalic-mafic intrusion?
11	E	38°08′ N., 105°26′ W.	Tiql, Qgo	2.38–2.65	Brecciated volcanic rocks.
12	E	38°22′ N., 105°18′ W.	Xg, Xfh	2.01–2.83	Local isostatic imbalance.
13	E	38°05′ N., 105°23′ W.	Tiql, Tmi	2.56–2.80	Brecciated volcanic rocks.
14	E	38°02′ N., 105°17′ W.	Xfh, Tpl, Ts	2.62–2.87	Early Proterozoic gneisses (Xfh)?
15	E	38°04′ N., 105°12′ W.	Xfh, Yg	2.87–3.54	Buried intrusions?
16	D,H	38°42′ N., 104°52′ W.	Xg, Yp	1.92–3.17	Local isostatic imbalance? Precambrian/Cretaceous contact.
17	G	38°55′ N., 104°45′ W.	Q, T, and K deposits	1.95–2.26	Sediment-filled basin.
18	I	38°09′ N., 104°55′ W.	Kdp, Kcgg, KJde	1.68–1.95	Basement uplift.

[1]Modified from Tweto (1979).

Table 2. *Residual Bouguer gravity trends of the Pueblo quadrangle*

Trend	Feature	High + Low –	Location	Geologic map units[1]	Inferred source
a	A,B	+	38°53′ N., 105°59′ W. to 38°25′ N., 105°55′ W.	Xg, TKi, Pmb, MDO, Taf	Precambrian and Cretaceous granitic rocks.
b	A,B	–	39°00′ N., 105°52′ W. to 38°30′ N., 105°30′ W.	Td, Tos, Tpl, Tbb, Xg	Syncline containing low-density volcanic sedimentary fill.
c	A	+	38°53′ N., 105°47′ W. to 38°46′ N., 105°44′ W.	Xg, Tpl, Tos	Precambrian basement high.
d	A	–	39°00′ N., 105°42′ W. to 38°52′ N., 105°41′ W.	Tpl, Tos	Graben or syncline containing thick volcanic sedimentary rocks.
e	B	+	38°34′ N., 105°48′ W. to 38°27′ N., 105°32′ W.	Xg, Xfh	Early Proterozoic gneiss (Xfh) outcrop.
f	B,C	–	38°35′ N., 105°50′ W. to 38°00′ N., 105°28′ W.	PIPs, Tki, Tbb, Qg	Graben containing Paleozoic and Quaternary sedimentary deposits.
g	C	+	38°20′ N., 105°56′ W. to 38°00′ N., 105°38′ W.	Xfh, MDO, IPmb, Tmi, PIPs	Basement high.
h	C	–	38°06′ N., 106°00′ W. to 38°00′ N., 105°49′ W.	Qa, Qe, Qg	Quaternary sediment-filled valley.
i	D,H,I	+	38°54′ N., 105°19′ W. to 38°14′ N., 104°20′ W.	Yg, Xg, Xb Kn and other K deposits	Precambrian granites, local isostatic imbalance, shallow basement to the southeast in the Great Plains.
j	D	+	39°00′ N., 105°11′ W. to 38°46′ N., 105°14′ W.	Yp	Precambrian granites, local isostatic imbalance.
k	E	+	38°27′ N., 105°21′ W. to 38°06′ N., 105°01′ W.	Xfh, Cam, Yg	Cambrian mafic-alkalic intrusions, Early Proterozoic metamorphic rocks (Xfh), local isostatic imbalance.
l	E	–	38°10′ N., 105°10′ W. to 38°06′ N., 105°22′ W.	Xfh, Taf, Tpl	Lack of Cambrian mafic-alkalic intrusions?
m	F	–	38°29′ N., 105°14′ W. to 38°00′ N., 104°50′ W.	Tpc, TKr, Kvt, Kpm, Qgo, PIPf	Sediment-filled syncline.
n	I	+	38°04′ N., 104°11′ W. to 38°01′ N., 104°18′ W.	Qgo, Qe, Kpl, Kn	Shallow basement?

[1]Modified from Tweto (1979).

Table 3. *Mineral districts in the Pueblo quadrangle*

Map designation	District	Elements	Location	Geologic occurrence	Gravity expression
TC	Trout Creek	Au, Ag, Cu Pb	38°52′ N. 105°58′ W.	Paleozoic sedimentary rocks	Moderate gradient, high.
LG	Lake George	Be, W	38°58′ N. 105°22′ W.	Veins in fractured Precambrian granite	Broad regional high.
CC	Cripple Creek	Au, Ag	38°45′ N. 105°10′ W.	Veins in Tertiary volcanic rocks	Steep gradient, low.
GU	Guffey	Cu, Zn, Au, Ag, Pb	38°45′ N. 105°31′ W.	Veins in fractured Precambrian granite and Tertiary volcanic rocks	Major gradient, high.
TU	Turret	Cu, Au, Ag	38°38′ N. 105°52′ W.	Veins in Precambrian granite	Moderate gradient, high.
CA	Calumet	Fe	38°35′ N. 106°00′ W.	Veins in Precambrian gneiss	Moderate gradient, high.
WH	Whitehorn	Au, Ag	38°40′ N. 105°50′ W.	Veins in Upper Cretaceous granite	Moderate gradient, high.
CO	Cotopaxi	Zn, Au, Cu, Ag, Be, Pb	38°23′ N. 105°42′ W.	Skarn in Precambrian gneiss	Broad linear low.
OR	Orient	Fe	38°12′ N. 105°49′ W.	Paleozoic sedimentary rocks	Major gradient, high.
BL	Blake	Au, Cu, Ag, Pb	38°11′ N. 105°45′ W.	Scattered veins in Paleozoic sedimentary rocks	Moderate gradient, high
SC	Silver Cliff	Au, Pb, Ag, Cu, Zn	38°09′ N. 105°27′ W.	Veins in Tertiary volcanic rocks	Major gradient, low.
RH	Rosita Hills	Au, Pb, Ag, Cu, Zn	38°06′ N. 105°20′ W.	Veins in breccia pipe, Tertiary volcanic rocks	Moderate gradient, low.
CR	Crestone	Au, Ag, Cu, Pb	38°00′ N. 105°42′ W.	Scattered veins in Precambrian granite	Major gradient, high.

B, INTERPRETATIVE MAP

RESIDUAL BOUGUER GRAVITY AND INTERPRETATIVE MAPS OF THE PUEBLO 1° X 2° QUADRANGLE, SOUTH-CENTRAL COLORADO

By
Frances M. Boler and Douglas P. Klein

1990