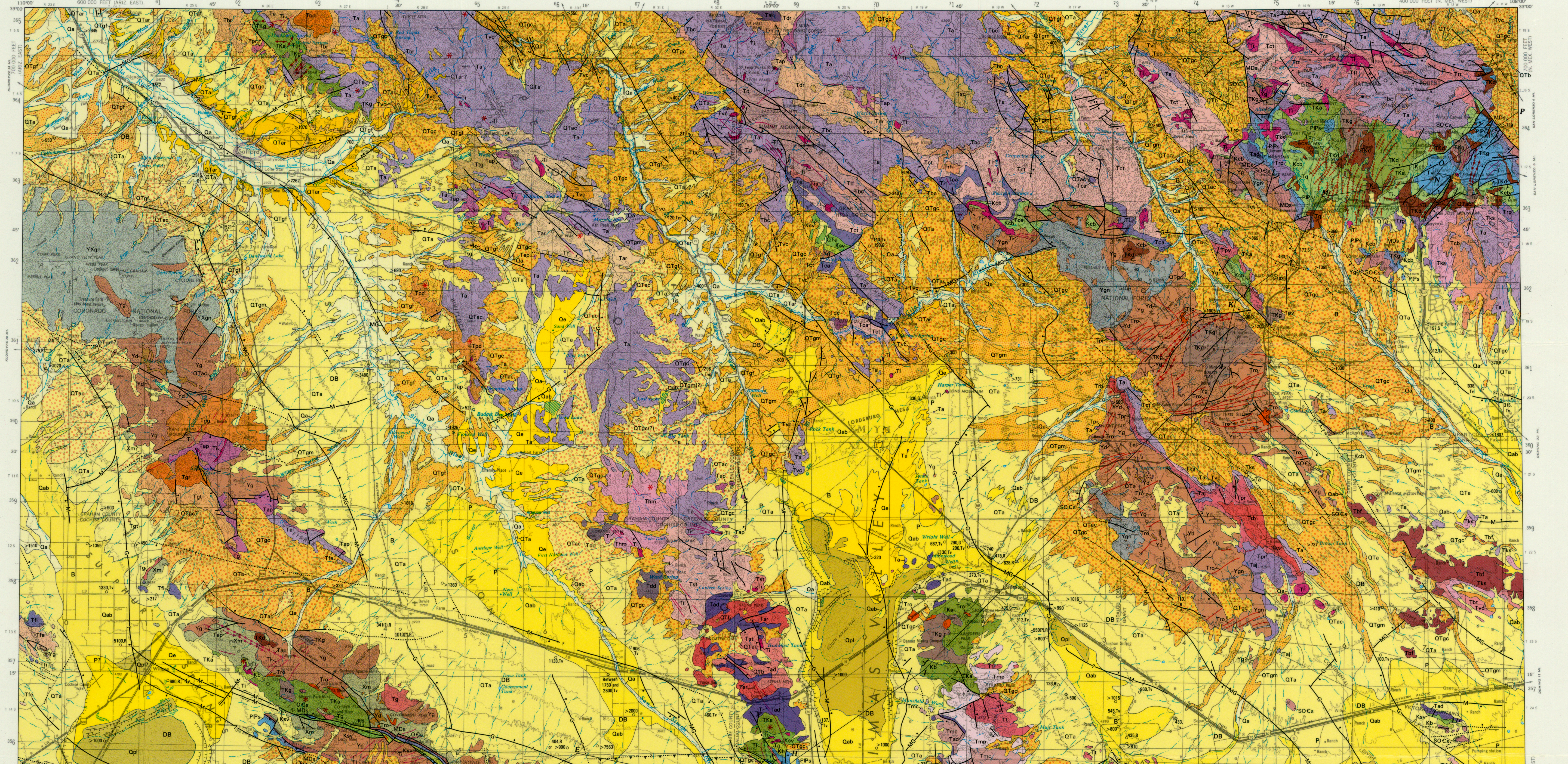
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

MISCELLANEOUS INVESTIGATIONS SERIES
I-1310-C

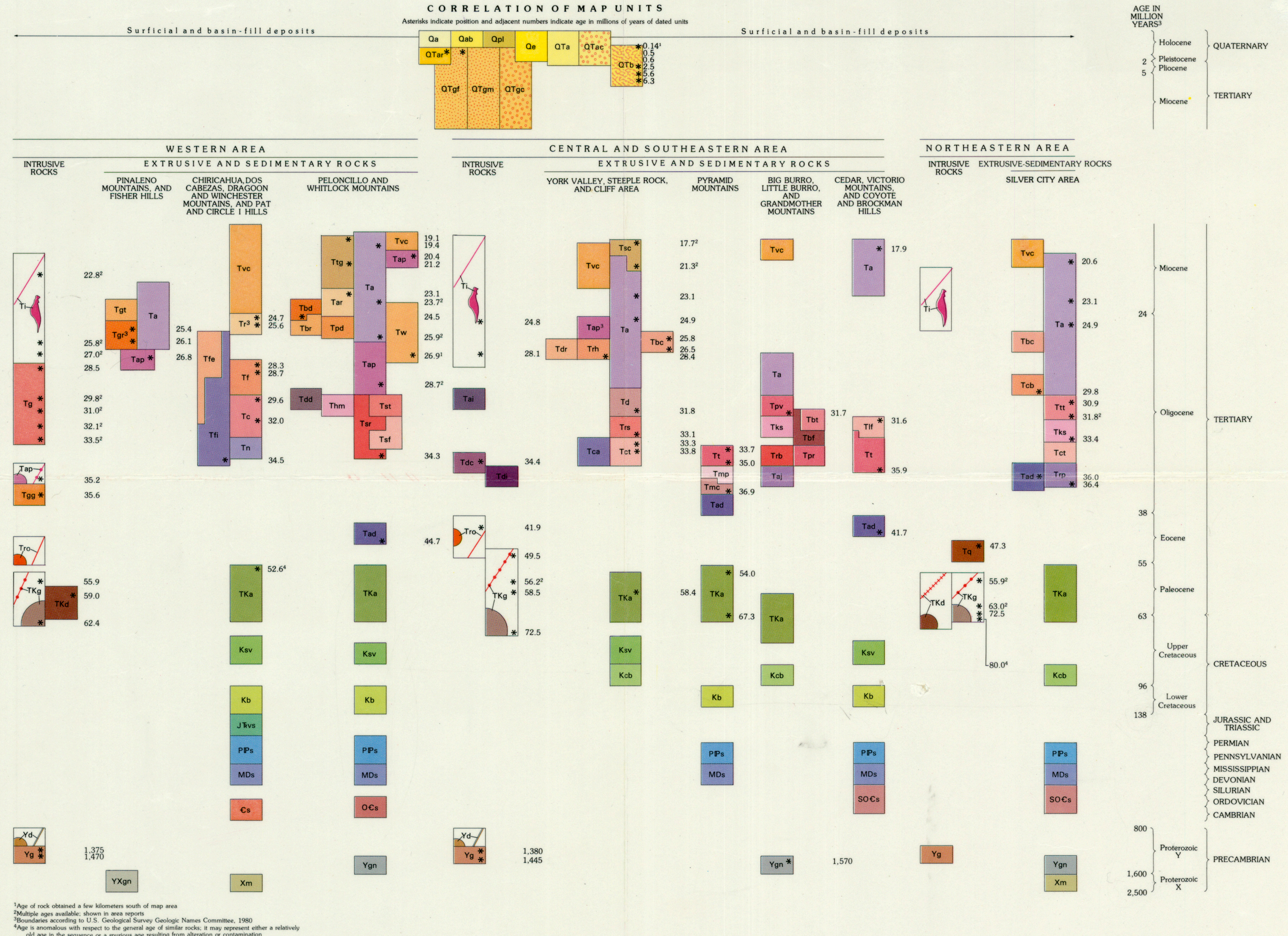


Base from U.S. Geological Survey, 1954
Revised 1970
100,000-foot grid ticks based on New Mexico coordinate system, west zone and Arizona coordinate system, east zone
10,000-meter Universal Transverse Mercator grid, zone 12

This map is part of a folio of maps of the Silver City 1° X 2° quadrangle, New Mexico-Arizona, prepared under the Conterminous United States Mineral Assessment Program.

CORRELATION OF MAP UNITS

Asterisks indicate position and adjacent numbers indicate age in millions of years of dated units



[1]Age of rock obtained a few kilometers south of map area
[2]Multiple ages available; shown in area reports
[3]Boundaries according to U.S. Geological Survey Geologic Names Committee, 1980
[4]Age is anomalous with respect to the general age of similar rocks; it may represent either a relatively old age in the sequence or a spurious age resulting from alteration or contamination

DESCRIPTION OF MAP UNITS

Qa — ALLUVIUM (HOLOCENE)—Gravel, sand, and silt of channel, point bar, and floodplain deposits along the larger watercourses

DEPOSITS IN CLOSED BASINS (HOLOCENE)

Qab — Fine-grained alluvium of poorly defined ephemeral stream systems in the axial parts of intermontane basins. Includes deposits in the southern part of San Simon Valley

Qpl — Fine-grained playa and lacustrine sediments; locally includes beach sand and gravel

Qe — EOLIAN DEPOSITS (HOLOCENE AND PLEISTOCENE)—Silt and sand in sheet deposits and irregular dunes

FAN AND PEDIMENT ALLUVIUM (HOLOCENE TO PLIOCENE)—Grades into colluvial aprons along mountain fronts

QTa — Fine- to coarse-grained alluvium along small intermittent streams on alluvial fans and pediments

QTac — Very coarse grained alluvium deposited in part as debris flows

QTar — RIVER ALLUVIUM (PLEISTOCENE AND UPPER PLIOCENE)—Alluvium, typically silt, sand, and well-rounded gravel of widely dispersed provenance along the Gila River. Includes alluvium of ancestral Duck Creek (?) west and northwest of Cliff, N.M.

QTb — ALKALI BASALT (PLEISTOCENE TO UPPER MIOCENE)—Generally olivine-bearing and porphyritic; locally contains large olivine, spinel, and pyroxene xenocrysts and mafic to ultramafic xenolithic nodules. Forms flows, plugs, and some cinder deposits

GILA CONGLOMERATE (PLEISTOCENE TO UPPER MIOCENE)—Alluvial and lacustrine deposits, generally locally derived and deposited in closed basins. Interbedded with QTb

QTgf — Fine-grained alluvial, playa, and lacustrine deposits—Contains intercalated lenses of coarser grained alluvium and thin beds of volcanic ash

QTgm — Medium-grained alluvium, chiefly sand and fine gravel—Deposits in distal parts of alluvial fans and pediments. Includes lenses of coarser and finer grained sediments

QTgc — Coarse-grained alluvium and fanglomerate—Deposits mainly in proximal parts of alluvial fans and pediments. Includes debris flow deposits and lenses of finer grained sediment

Tvc — VOLCANIC CONGLOMERATE (LOWER MIOCENE)—Chiefly well indurated, light-brown to light-gray, crudely bedded, matrix-supported conglomerate containing abundant volcanic clasts. Tuffaceous matrix commonly altered to clinoptilolite. Includes intercalated andesite flows and rhyolite ash-flow tuff beds. Deposited in basins in part different from the present ones

Ta — ANDESITE (MIOCENE AND OLIGOCENE)—Includes basalt, basaltic andesite, and dacite flows, and local intercalations of silicic pyroclastic deposits and volcaniclastic rocks, erupted from several largely unknown centers throughout the quadrangle. Forms extensive terranes. Most rocks are sparsely porphyritic, and some of the older units are amygdaloidal

Ti — RHYOLITE (MIOCENE AND OLIGOCENE)—Forms dikes, plugs, and diatremes, but includes some domes and short massive flows. Chiefly fresh, fine-grained equigranular to porphyritic rhyolite and rhyodacite. Includes the highly altered silicic plugs and domes of Three Sisters and Saddle Mountain in the Big Burro Mountains

Ttg — ROCKS OF THE TOLLGATE WASH ERUPTIVE CENTER (MIOCENE)—Porphyritic rhyolite flows and high-silica rhyolite dome

Tsc — ROCKS OF THE SYCAMORE CAMP ERUPTIVE CENTER (MIOCENE)—Rhyolite flows, domes, and pyroclastic deposits with intercalated tuffaceous sandstone beds

Tap — PORPHYRITIC ANDESITE (MIOCENE AND OLIGOCENE)—Flows of coarse feldspar porphyry that resembles the turkey-track porphyry of Cooper (1961)

Tar — ROCKS OF THE ASH PEAK-RHYOLITE PEAK ERUPTIVE CENTER (MIOCENE AND OLIGOCENE)—Crystal-poor rhyolite domes, flows, and pyroclastic deposits and porphyritic dacite to rhyodacite domes and flows

ROCKS OF THE GREASEWOOD MOUNTAIN ERUPTIVE CENTER (MIOCENE AND OLIGOCENE)

Tgt — Rhyolitic air-fall tuff deposits, thin vitrophyric flows and interclated volcaniclastic units

Tgr — Porphyritic-rhyolite domes and massive flows, and flow breccias

ROCKS OF THE BEAR SPRINGS VOLCANO (MIOCENE AND OLIGOCENE)

Tbd — Crystal-poor rhyolite dome

Tbr — Rhyolite-breccia cone and dacite to rhyolite flows—Includes massive rhyolite flow and dacite flows at Bonita Creek

Tw — TUFF OF WEATHERBY CANYON (MIOCENE AND OLIGOCENE)—Crystal-poor and crystal-rich ash-flow tuff and intercalated air-fall deposits and some rhyolite flows

Tr — RHYOLITE CANYON FORMATION (OLIGOCENE)—Chiefly rhyolite ash-flow tuff, and intercalated volcaniclastic rocks and a rhyodacite flow

Tpd — ROCKS OF THE POWERLINE PASS AND DRY MOUNTAIN ERUPTIVE CENTERS (OLIGOCENE)—Chiefly andesite to rhyolite flows and pyroclastic deposits at Powerline Pass center and high-silica rhyolite dome-flow and pyroclastic deposits at Dry Mountain center

Tfe — FELSIC VOLCANIC ROCKS (OLIGOCENE?)—Mainly rhyolite, at scattered small localities

Tfi — FELSIC TO INTERMEDIATE VOLCANIC ROCKS (OLIGOCENE)—Rhyolite to andesite flows, at scattered small localities

Tbc — BLOODGOOD CANYON TUFF (OLIGOCENE)—Partly to densely welded, moderately crystal-rich, rhyolite ash-flow tuff derived from Bursum caldera north of Silver City quadrangle. In the Summit Mountains, may include older ash-flow tuff units from different sources

Tdr — DACITE AND RHYOLITE (OLIGOCENE)—Chiefly thick silicic flows; possibly related to rhyolite of unit Trh

Trh — RHYOLITE (OLIGOCENE)—Large dome-flow complex near Tillie Hall Peak and smaller aphanitic flows and intrusive rocks to the southeast

Tf — FARAWAY RANCH FORMATION (OLIGOCENE)—Mainly rhyodacite flows and some intercalated andesite flows and pyroclastic and volcaniclastic rocks, and small intrusive masses

Tg — GRANODIORITE AND QUARTZ MONZONITE (OLIGOCENE)—Chiefly medium-grained, subhedral granular, biotite- or biotite-hornblende-bearing plutonic rocks and associated fine-grained porphyritic rocks. Forms dikes, sills, and small irregular intrusive masses. Include the Circle I Hills, Ninemile Canyon, and Buckhorn Basin plutons in the Dos Cabezas and Chiricahua Mountains and the Granite Gap pluton in Peloncillo Mountains

Tcb — PYROCLASTIC AND VOLCANICLASTIC ROCKS (OLIGOCENE)—Crystal-rich ash-flow tuff, tuffaceous sandstone, and air-fall tuff. Includes the Caballo Blanco Rhyolite Tuff Member of Datil Formation and some basaltic andesite flows

Tdd — DACITE (OLIGOCENE)—Massive biotite-hornblende dacite domes of Orange Butte and McKenzie Peak in the Peloncillo Mountains

Tai — PORPHYRITIC ANDESITE (OLIGOCENE)—Fine- to medium-grained, locally vuggy, coarsely porphyritic intrusive andesite

Td — DACITE AND LATITE (OLIGOCENE)—Porphyritic flows with intercalated felsic tuff and tuffaceous sandstone. Unit may include flows of more widely diverse ages than indicated

Trs — RHYOLITE (OLIGOCENE)—Massive, slightly porphyritic flow and celadonitic sandstone at Steeple Rock in the Summit Mountains

Tc — ROCKS OF THE COCHISE HEAD ERUPTIVE CENTER (OLIGOCENE)—Mainly rhyolite flows, ash-flow tuff beds, some air-fall tuff beds, volcaniclastic units and andesite flows

Thm — ROCKS OF THE HORSECAMP ERUPTIVE CENTER (OLIGOCENE)—Rhyolite dome, dacite breccias, and andesite to rhyolite flows. Includes massive rhyodacite flows at Midway Peak. May also include flows related to dome of Orange Butte

ROCKS OF STEINS VOLCANO (OLIGOCENE)

Tsr — Massive rhyolite and rhyodacite domes, flows, and breccias

Tst — Rhyolite ash-flow tuff, partly filling a shallow subsidence structure

Tsf — Massive rhyolite flows and air-fall tuff beds—Includes some intercalated andesite flows and massive dacite flows and breccia

Tpv — PYROCLASTIC AND VOLCANICLASTIC ROCKS (OLIGOCENE)—Rhyolitic, crystal-rich ash-flow tuff, coarse sedimentary breccia, and air-fall tuff

Ttt — TADPOLE RIDGE FORMATION OF ELSTON AND OTHERS, 1973 (OLIGOCENE)—Densely welded rhyolitic ash-flow tuff

ROCKS OF THE BESSIE RHOADES ERUPTIVE CENTER (OLIGOCENE)

Tbf — Rhyolitic flows and small domes and plugs

Tbt — Rhyolitic ash-flow tuff and volcaniclastic rocks—May include some deposits from other sources

Tks — KNEELING NUN AND SUGARLUMP TUFFS (OLIGOCENE)—Crystal-rich ash-flow tuff. Sugarlump Tuff present mainly in Silver City area; Kneeling Nun Tuff more widespread. Source probably the Emory cauldron northeast of quadrangle

Tlf — LATITE AND PYROCLASTIC ROCKS (OLIGOCENE)—Chiefly latite flows and some intercalated rhyolitic ash-flow and air-fall tuffs. Pyroclastic deposits may correlate with unit Tt

Tt — PYROCLASTIC AND VOLCANICLASTIC ROCKS (OLIGOCENE)—Mainly rhyolitic ash-flow tuff and sedimentary deposits, and some intercalated andesite and rhyolite flows. Source may be largely south of quadrangle

Tn — NIPPER FORMATION OF SABINS (1957a) (OLIGOCENE)—Chiefly andesitic flows and breccias and some pyroclastic and volcaniclastic rocks

ROCKS OF THE CLIFF ERUPTIVE CENTER (OLIGOCENE)

Tca — Porphyritic andesite flows

Tct — Thin to massive, rhyolitic to quartz latitic ash-flow tuff beds, air-fall deposits, volcaniclastic rocks, and some silicic flows. May include some rocks from other sources

Trb — ROCKS OF THE BURRO CIENAGA ERUPTIVE CENTER (OLIGOCENE)—Massive rhyolite flows, domes, and pyroclastic rocks

Tpr — PYROCLASTIC AND VOLCANICLASTIC ROCKS (OLIGOCENE)—Mainly rhyolitic nonwelded ash-flow tuffs, air-fall tuffs, volcaniclastic rocks, and some intercalated basalt and rhyolite flows

Tdc — DACITE (OLIGOCENE)—Plug of hornblende dacite porphyry containing sparse, large quartz phenocrysts

Trp — RUBIO PEAK FORMATION (OLIGOCENE)—Andesite to rhyodacite flows and breccia, conglomerate, and some tuffaceous sandstone

Tdi — DIORITE (OLIGOCENE)—Fine-grained diorite plug

ROCKS OF THE MUIR ERUPTIVE CENTER (OLIGOCENE)

Tmp — Postcaldera rocks—Rhyolitic ash-flow tuff beds, ring-fracture latite and rhyolite domes and flows, and some andesite flows, volcaniclastic rocks, and lacustrine deposits

Tmc — Precaldera and caldera rocks—Rhyolite flows and pyroclastic rocks from precaldera eruptions, and rhyolite ash-flow tuff and megabreccias from caldera-forming eruption

Taj — ROCKS OF THE JPB MOUNTAIN ERUPTIVE CENTER (OLIGOCENE)—Andesite to dacite domes, flows, and volcaniclastic rocks

Tgg — GRANITE (OLIGOCENE)—Medium-grained, porphyritic biotite granite of Gillespie Mountain pluton in the Pinaleno Mountains

Tro — RHYOLITE (OLIGOCENE AND EOCENE)—Mainly dikes of sparsely porphyritic rhyolite and other felsic rocks, chiefly in the Big Burro Mountains. Strongly altered. May include some older rocks in the Dragoon and Pyramid Mountains

Tad — ANDESITE AND DACITE (OLIGOCENE AND EOCENE)—Mainly flows and some intercalated altered tuff, agglomerate, and volcaniclastic rocks, derived from dispersed centers, such as the Attorney Mountain eruptive center, 7 km south of Steins Mountain in the Peloncillo Mountains. Unit also includes irregular andesite intrusive masses north of Silver City in the Pinos Altos Range

Tq — QUARTZ MONZONITE (EOCENE)—Medium grained, porphyritic, hypidiomorphic-granular amphibole quartz monzonite; locally biotite and pyroxene bearing. Includes the Silver City, Gomez Peak, and some smaller plutons in the southwest flank of the Pinos Altos Range

TKa — ANDESITE (PALEOCENE AND UPPER CRETACEOUS)—Aphanitic and porphyritic flows and breccias, and some pyroclastic and volcaniclastic rocks, commonly strongly propylitized. Derived from scattered centers such as the Dos Cabezas eruptive center

TKg — GRANODIORITE AND QUARTZ MONZONITE (PALEOCENE AND UPPER CRETACEOUS)—Medium-grained porphyritic rocks in plutons, plugs, and dikes. Includes the Silver Camp pluton (Dos Cabezas Mountains), Lone Star pluton (Peloncillo Mountains), Lordsburg pluton (Pyramid Mountains), Tyrone pluton (Big Burro Mountains), and the Pinos Altos and Fierro-Hanover plutons (Pinos Altos Range)

TKd — INTERMEDIATE INTRUSIVE ROCKS (PALEOCENE AND UPPER CRETACEOUS)—Mainly porphyritic diorite, quartz diorite, monzonite, and syenodiorite in sills, laccoliths, dikes, and small plutons, chiefly south of the Pinos Altos Range. Includes the Cowboy pluton in the Dos Cabezas Mountains

Ksv — SEDIMENTARY AND VOLCANIC ROCKS (UPPER CRETACEOUS)—Commonly includes siltstone and volcaniclastic conglomerate with intercalated andesite flows and rhyolitic welded tuff. Conglomerate mainly coarse and subangular. Andesite resembles that of unit TKa. Welded tuff strongly altered, moderately indurated, contains chloritized biotite

Kcb — COLORADO FORMATION AND BEARTOOTH QUARTZITE (UPPER CRETACEOUS)—Dark-gray marine shale and sandstone and reddish-gray orthoquartzite and minor conglomerate

Kb — BISBEE GROUP (LOWER CRETACEOUS)—Dark-gray to pale-yellowish-brown and reddish-gray shale, siltstone, and some intercalated sandstone, limestone, and conglomerate. Commonly has a basal conglomerate unit. Includes marine, estuarine, and fluvial deposits

J-Tvs — VOLCANIC AND SEDIMENTARY ROCKS (JURASSIC AND TRIASSIC)—Tuffaceous rocks, red shale, and conglomerate that locally is volcaniclastic. Includes the Walnut Gap Formation

PPs — SEDIMENTARY ROCKS (PERMIAN AND PENNSYLVANIAN)—Mainly limestone and some dolomite, shale, and quartzite. To the west includes Permian Concha Limestone, Scherrer Formation, Epitaph Dolomite, Colina Limestone, Earp Formation, and Permian and Pennsylvanian Horquilla Limestone of the Naco Group; to the east includes Permian Abo Formation, Pennsylvanian Syrena and Oswaldo Formations

MDs — SEDIMENTARY ROCKS (MISSISSIPPIAN AND DEVONIAN)—Mainly limestone and some shale. Includes Mississippian Paradise Formation and Escabrosa Limestone, and Devonian Portal (Sabins, 1957b) or Martin Formation to the west, and Mississippian Lake Valley Limestone and Devonian Percha Shale to the east

SO-Cs — SEDIMENTARY ROCKS (SILURIAN TO CAMBRIAN)—Mainly dolomite, limestone, and sandstone, and some shale and conglomerate. Includes Silurian Fusselman Dolomite, Ordovician Montoya Group and El Paso Limestone, and Ordovician and Cambrian Bliss Formation

O-Cs — SEDIMENTARY ROCKS (ORDOVICIAN AND CAMBRIAN)—Dolomite, limestone, sandstone, and some shale, quartzite, and conglomerate. Includes Ordovician El Paso Limestone and Cambrian Coronado Sandstone

-Cs — SEDIMENTARY ROCKS (CAMBRIAN)—Limestone, sandstone, shale, quartzite, and some dolomite and conglomerate. Includes Abrigo Formation and Bolsa Quartzite, and in the Dos Cabezas and Chiricahua Mountains includes a unit transitional between the El Paso and Abrigo

Yd — DIABASE (PROTEROZOIC Y)—Includes metadiabase and some metadiorite. Forms dikes, plugs, and small plutons. Probably correlative with diabase of east-central Arizona dated at 1,200 m.y. (Shride, 1967)

Yg — GRANODIORITE TO GRANITE (PROTEROZOIC Y)—Includes some aplite, pegmatite, and lamprophyre. Forms large plutons and dikes. Includes rocks of Rattlesnake Point (Chiricahua Mountains) and Big Burro Mountains plutons

Ygn — GNEISS (PROTEROZOIC Y)—Hornblende and biotite gneiss, amphibolite, and migmatite. Probably largely of sedimentary origin. Includes Bullard Peak Series of Hewitt (1959) in the Big Burro Mountains

YXgn — GNEISS (PROTEROZOIC Y OR X)—Quartzofeldspathic gneiss that contains biotite or biotite and hornblende, and some amphibolite and schist. Probably of sedimentary and volcanic origin

Xm — METASEDIMENTARY AND METAVOLCANIC ROCKS (PROTEROZOIC X)—Phyllite, schist, quartzite, and aphanitic to porphyritic metarhyolite to meta-andesite, and some conglomerate. Locally includes some rocks similar to those in unit Ygn. Includes Pinal Schist of western area

CONTACT

FAULT—Dashed where inferred, dotted where concealed, queried where uncertain. Fault movements are indicated by the following symbols used in combination for composite or diverse movement:

Normal fault—Ball and bar on downthrown side. In structure cross section arrow couple shows relative movement

Strike-slip fault—Arrow couple shows relative movement. In structure cross section: A, movement away from viewer; T, movement toward viewer

Thrust fault—Sawteeth on upper plate

—M— —G— Subsurface fault—Inferred from geophysical data (Klein, unpub. data). M, aeromagnetics; G, gravity

STRANDLINE—Beaches, spits, and wave-cut benches of pluvial lakes, locally modified by alluvial or eolian processes. Hachures on lake side

VOLCANIC VENT—Chiefly local vent sites marked by pyroclastic cones in larger eruptive centers and some stratovolcanos and shield volcanos. Additional vents may be inferred at some small intrusive bodies

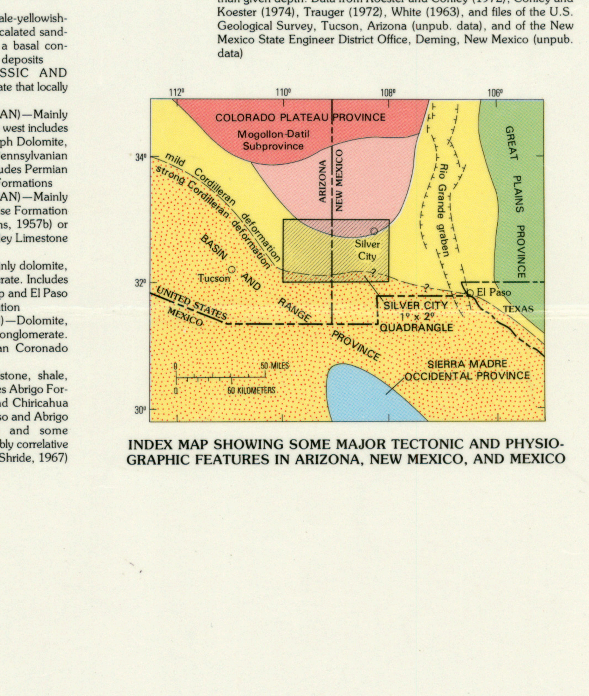
GEOPHYSICAL DATA ON BASINS—Depth estimates are relative to other local basin features. Data from Klein (unpub. data)

DB — Deep basin

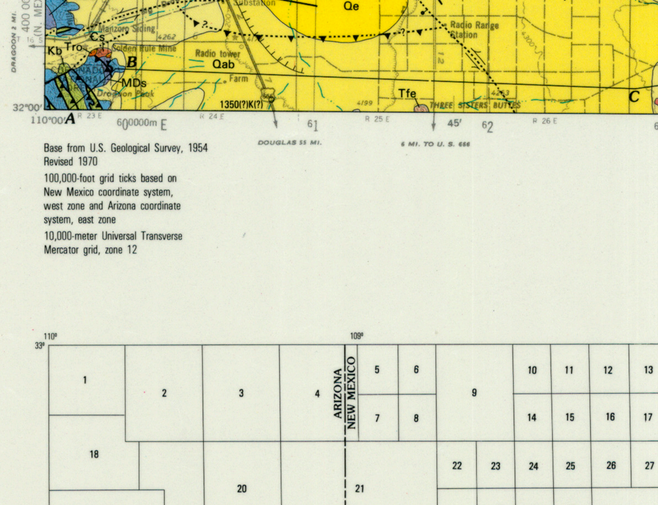
B — Basin

P — Platform

140,Tv / 196,G — WELL LOCATION—Showing depth in feet and bedrock encountered. Bedrock symbols: Tv, Tertiary volcanic rocks; Tvc, Tertiary volcanic conglomerate; G, granitic rock; K, Cretaceous rock; S, pre-Cenozoic sedimentary rock; R, undifferentiated rock. >, indicates well bottomed in basin-fill at depth given; <, indicates well penetrated bedrock at less than given depth. Data from Koester and Conley (1972), Conley and Koester (1974), Trauger (1972), White (1963), and files of the U.S. Geological Survey, Tucson, Arizona (unpub. data), and of the New Mexico State Engineer District Office, Deming, New Mexico (unpub. data)



INDEX MAP SHOWING SOME MAJOR TECTONIC AND PHYSIOGRAPHIC FEATURES IN ARIZONA, NEW MEXICO, AND MEXICO



INDEX SHOWING SOURCES OF GEOLOGIC DATA

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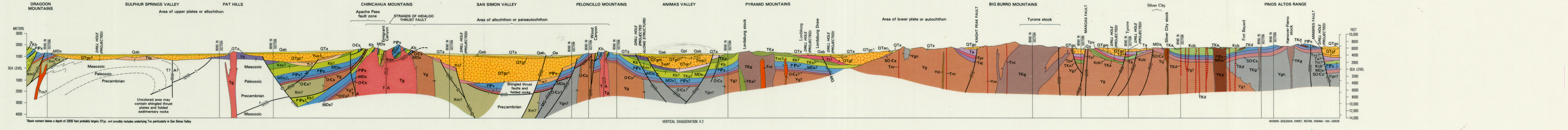

[1]Basin content below a depth of 2000 feet probably largely QTgc, and possibly includes underlying Tvc particularly in San Simon Valley

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GEOLOGIC MAP OF THE SILVER CITY 1° x 2° QUADRANGLE, NEW MEXICO AND ARIZONA

By
Harald Drewes, B.B. Houser, D.C. Hedlund, D.H. Richter, C.H. Thorman, and T.L. Finnell

1985

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