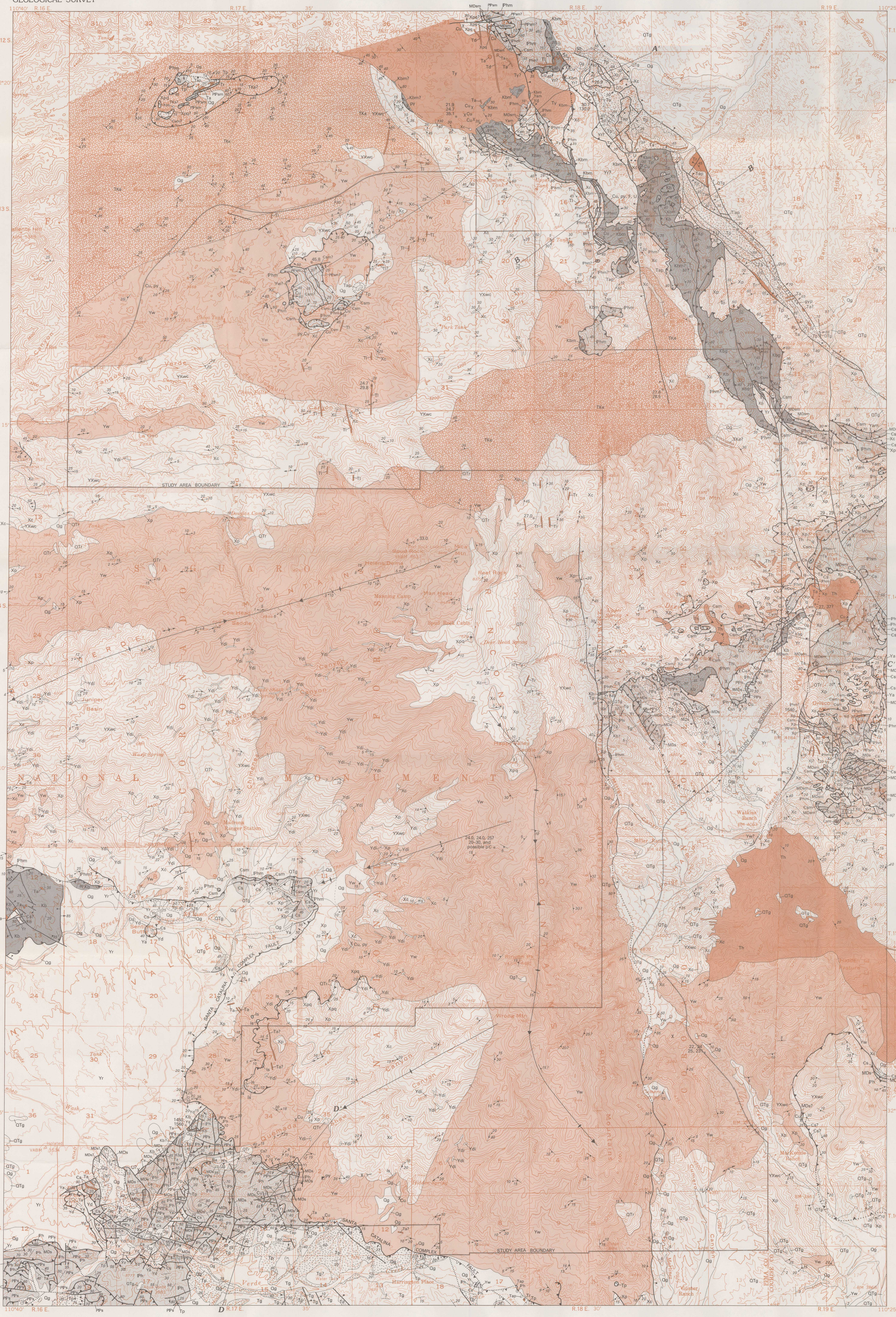
UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

BULLETIN 1500
PLATE 1



Base from U.S. Geological Survey 1:62,500 Rincon Valley, Redington, and Bellota Ranch, 1957, and Happy Valley, 1958

TRUE NORTH — MAGNETIC NORTH — 12½°
APPROXIMATE MEAN DECLINATION, 1980

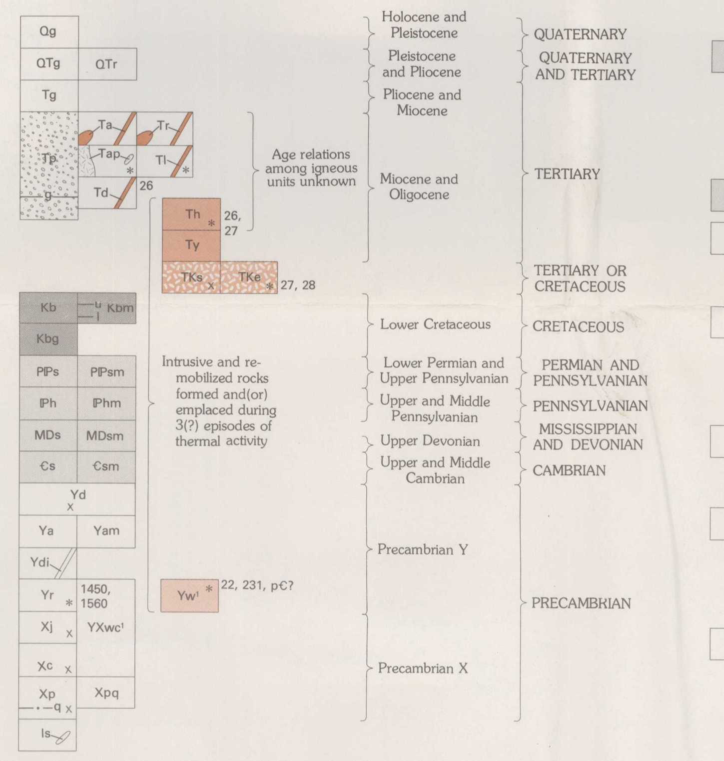
SCALE 1:48 000
1 ½ 0 1 2 3 MILES
1 .5 0 1 2 3 KILOMETERS
CONTOUR INTERVAL 50 AND 80 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

ARIZONA — Study area

Geology by Harald Drewes and C. H. Thorman, 1969–1977, assisted by A. J. Toevs, 1969, J. L. Lessman and Tim Brady, 1971, Gregory Lee, 1972, and C. N. Culver, 1976

CORRELATION OF MAP UNITS

*27 Age, in million years, of local rocks
x Age determined in nearby areas



DESCRIPTION OF MAP UNITS

Qg GRAVEL (HOLOCENE AND PLEISTOCENE)—Includes sand in lentils, especially toward valleys, and coarser detritus toward steep slopes. Deposits along streams and on stream terraces; poorly to moderately sorted and bedded, light gray to brownish gray and unindurated. Alluvial origin

QTg GRAVEL (PLEISTOCENE AND PLIOCENE)—Includes sand. Poorly to moderately sorted and bedded light-gray to pinkish-gray deposits mainly filling basin. Clasts derived largely from Precambrian crystalline rocks. Alluvial origin

QTr RUBBLE DEPOSITS (PLEISTOCENE AND PLIOCENE)—Coarse blocks in jumbled masses. Older deposits are locally capped by reddish-brown soil; younger deposits have typical hummocky surfaces, and some may still be intermittently active. Landslide and slump origin

Tg GRAVEL AND CONGLOMERATE (PLIOCENE AND MIOCENE)—Gray to pinkish-gray generally coarse grained moderately indurated deposits. Alluvial origin. May be correlative with Nogales Formation, which is present a few kilometers south of southwest corner of map

Tp PANTANO FORMATION (MIOCENE AND OLIGOCENE)—Reddish-gray, brownish-gray, and some greenish-gray clastic rocks ranging in coarseness from megabreccia to clay, and some intercalated limestone and gypsum. Mostly moderately well sorted and indurated except for claystone. Clasts mainly subangular to subrounded pebbles and cobbles derived from Precambrian to Cretaceous sedimentary rocks and Precambrian Rincon Valley Granodiorite, from the flanks of the Rincon Mountains, and from Tertiary volcanic rocks. Rocks northeast of the mountains referred to as Mineta Formation by Chew (1962) and Clay (1970), where they contain rhinoceros fossils of Oligocene age

—g— Marker horizon—Base of gypsum-bearing claystone unit

IGNEOUS ROCKS (MIOCENE OR OLIGOCENE)—Rocks postdate the major thermal alteration:

Ta Andesitic rocks—Small dikes of andesite or dacite, and local lava intercalated in Pantano Formation

Tr Rhyolitic rocks—Includes small dikes, a small mass of tuff east of Harrington Place near southern margin of map, and more extensive welded tuff deposits above and beneath the Pantano Formation in the northeast part of the map area

Tap Andesite porphyry—Dark-brown very coarsely porphyritic feldspar porphyry andesite dikes and lava flows. Locally known as "turkey-track porphyry" (Cooper, 1961). A specimen from the northeastern part of the map is dated at 26.3±2.4 m.y. (Damon, 1970, p. 40)

Tl Latitic intrusive rock—Dikes and irregular masses of quartz-free feldspar and biotite porphyry

Td Diorite intrusive rocks—Dikes and pods of dark-gray diorite and microdiorite

Th GRANODIORITE OF HAPPY VALLEY (OLIGOCENE)—Forms stocks. Includes quartz monzonite and small aplite bodies. Moderately coarse grained, massive, biotite bearing. Biotite from sample near Barney Ranch has age of 27.3±1.1 m.y. (Marvin and others, 1973, p. 20); sample from about 8 km southeast of Miller Place (Drewes, 1974) has age of 26.3±0.9 m.y. Probably a fully magmatic end-member of a series of remobilized rocks that postdates all low-angle faulting

Ty QUARTZ MONZONITE OF YOUTCY RANCH (OLIGOCENE)—Stock of moderately coarse grained massive to faintly foliated muscovite- and biotite-bearing rock containing a trace amount of garnet. Probably a largely magmatic rock, remobilized from rocks such as the quartz monzonite of Samaniego Ridge of Creasey and Theodore (1975), and postdating thrust faulting

TKs QUARTZ MONZONITE OF SAMANIEGO RIDGE OF THEODORE AND CREASEY (1975) (TERTIARY OR CRETACEOUS)—Moderately massive, pale-reddish-gray weathering, two-mica- and garnet-bearing gneissic quartz monzonite. Contact with Wrong Mountain Quartz Monzonite subtle or gradational. A substantially remobilized rock, probably formed from a parent rock slightly different from that which formed the Wrong Mountain Quartz Monzonite, and emplaced before the end of the youngest low angle faulting

TKe QUARTZ MONZONITE OF ESPIRITU CANYON (TERTIARY OR CRETACEOUS)—Includes small bodies of aplite. Massive to faintly gneissic pale-pinkish-gray weathering, two-mica- and garnet-bearing quartz monzonite. In part borders are well defined and in part they are gradational. A substantially remobilized rock, probably formed from the Wrong Mountain Quartz Monzonite, and possibly emplaced before the end of the youngest low angle faulting

BISBEE FORMATION (LOWER CRETACEOUS):

Kb Upper part, unmetamorphosed facies—Includes shale, arkosic sandstone, and some limestone and conglomerate. Typical beds are red; others are gray or olive gray. Limestone in thin units, some containing fragments of clam fossils, and others laminar bedded. Mainly in upper major thrust plate

Kbm Upper part, metamorphosed facies—Hornfelsed argillic rocks, and some quartzitic and marmorized beds. Mainly in lower major thrust plate. u, l, marker zone of marble beds; u, upper limit; l, lower limit

Kbg Glance Conglomerate Member—Pebble and cobble conglomerate; probably lenticular. Includes some sandstone and shale. Clasts of Paleozoic rocks, chiefly limestone

UPPER PALEOZOIC SEDIMENTARY ROCKS (LOWER PERMIAN AND UPPER PENNSYLVANIAN)

PIPs Sedimentary rocks, unmetamorphosed—Includes Concha Limestone (Lower Permian), Scherrer Formation (Lower Permian) mainly of quartzite, Epitaph Dolomite (Lower Permian) of dark-gray dolomite and light-gray marlstone and limestone, Colina Limestone (Lower Permian), and Earp Formation (Lower Permian and Upper Pennsylvanian) of reddish-gray marlstone and siltstone, intercalated pale-brownish-gray limestone, and a thin bed of reddish-gray chert-pebble conglomerate

PIPsm Sedimentary rocks, metamorphosed—Hornfelsed and marmorized rocks sparsely present in the eastern and northeastern parts of the map area

HORQUILLA LIMESTONE (UPPER AND MIDDLE PENNSYLVANIAN):

IPh Unmetamorphosed facies—Light-pinkish-gray generally fine grained thin- to thick-bedded sparsely cherty limestone. Upper half contains many intercalated units of reddish-gray siltstone 0.3 to 3 m thick. Mainly in upper major thrust plate

IPhm Metamorphosed facies—Very light gray to nearly white mostly fine grained slightly cherty marble, and hornfelsed siltstone. In lower major thrust plate

MIDDLE PALEOZOIC SEDIMENTARY ROCKS (MISSISSIPPIAN AND DEVONIAN):

MDs Sedimentary rocks, unmetamorphosed—Includes Escabrosa Limestone (Mississippian) and Martin Formation (Upper Devonian). Escabrosa is medium-gray thick- to thin-bedded medium- to coarse-grained bioclastic and in part crinoidal and cherty limestone. Some limestone and shale beds at top of formation in eastern part of map area may be correlative with the Black Prince Limestone of Late Mississippian or Early Pennsylvanian(?) age. Martin is a brown cherty dolomite with units of gray dolomitic limestone and some sandstone. Mainly in upper major thrust plate

MDsm Sedimentary rocks, metamorphosed facies—Very light gray to nearly white coarse-grained massive to thick-bedded cherty marble and brown cherty dolomite marble and calc-silicate beds. In lower major thrust plate

LOWER PALEOZOIC SEDIMENTARY ROCKS (UPPER AND MIDDLE CAMBRIAN):

Ꞓs Sedimentary rocks, unmetamorphosed—Includes Abrigo Formation (Upper and Middle Cambrian) and Bolsa Quartzite (Middle Cambrian). Abrigo a brownish-gray to brown shale, sandstone, and quartzite and some light-gray thin-bedded bioclastic limestone and intraformational conglomerate. Bolsa is a light- to dark-gray purplish-gray or brownish-gray coarse-grained to conglomeratic thick-bedded quartzite and a basal conglomerate. In upper major thrust plate

Ꞓsm Sedimentary rocks, metamorphosed—Brownish-gray hornfels, metaquartzite and calc-silicate beds. In lower major thrust plate

Yd DIABASE (PRECAMBRIAN Y)—Includes diorite, metadiabase, and metadiorite. Typically dark greenish gray fine- to coarse-grained small intrusive masses spatially associated with the Apache Group

APACHE GROUP (PRECAMBRIAN Y):

Ya Sedimentary rocks, unmetamorphosed—Includes Dripping Spring Formation and Pioneer Shale. Dripping Spring is a banded light-colored and reddish-brown arkose, siltstone, and quartzite and includes the basal Barnes Conglomerate Member. Pioneer is a reddish-brown shale, siltstone, and argillite and locally includes the basal Scanlan Conglomerate Member

Yam Sedimentary rocks, metamorphosed—Meta-arkose, hornfelsed siltstone and metaquartzite. Includes thin unit of flattened-pebble or stretched-pebble conglomerate derived from the Barnes Conglomerate Member of the Dripping Spring Formation

Ydi DIORITIC INTRUSIVE ROCKS (PRECAMBRIAN Y)—Sills and dikes of metadiorite, meta-andesite, and lamprophyre, that seem unassociated with the Apache Group and its mafic rocks of diabasic origin. Provisionally assigned the Precambrian age of its usual host rock because they are similarly gneissic, but may be younger and related to an early phase of magma remobilization

Yr RINCON VALLEY GRANODIORITE (PRECAMBRIAN Y)—Massive medium-grained biotite-bearing and biotite-hornblende-bearing granodiorite and some quartz monzonite. K-Ar age on biotite from one sample 1,540±60 m.y.; on biotite from another sample 1,450±50 m.y. and on hornblende from that sample 1,560±100 m.y. (Marvin and others, 1973). Rock commonly lies between lower and upper major thrust plates, intrudes Pinal Schist, and is everywhere allochthonous. The rock labeled as Yr? in the northeastern part of map area may be Johnny Lyon (Xj) type of rock or a similar mass found north of the map area

Yw¹ WRONG MOUNTAIN QUARTZ MONZONITE (PRECAMBRIAN Y)[1]—Light-yellowish-gray to pale-orange-gray gneissic two-mica- and garnet-bearing quartz monzonite, and local aplitic and pegmatitic masses and unmapped inclusions of Continental Granodiorite. Contains pervasive incipient recrystallization texture, weakly to moderately developed foliation, and lineation. Most radiometric ages record thermal event that ended about 25 m.y. ago, but a few ages suggest the rock was emplaced during Precambrian time or derived from Precambrian material. Probably the oldest end-member of a series of remobilized and partly remobilized rocks

YXwc¹ WRONG MOUNTAIN QUARTZ MONZONITE AND CONTINENTAL GRANODIORITE (PRECAMBRIAN Y AND X)[1]—Lit-par-lit sheeted mixture of the light-colored quartz monzonite and dark granodiorite. Strongly gneissic to ultramylonitic fabric, foliation, and lineation. Includes migmatitic layers, some aplitic and pegmatitic masses, and, south of Tanque Verde Peak, an extensive mass of hybridized (partly assimilated?) Continental Granodiorite

Xj JOHNNY LYON GRANODIORITE (PRECAMBRIAN X)—Massive medium- to coarse-grained biotite-hornblende granodiorite and quartz monzonite. Forms a much-sheared and altered mass on the western margin of a batholith

Xc CONTINENTAL GRANODIORITE (PRECAMBRIAN X)—Dark-gray coarsely porphyritic or porphyroblastic gneissic granodiorite. Strongly foliated, lineated, and typically with blasto-mylonitic and recrystallization texture. Contains abundant biotite, sphene, and magnetite. In many places includes thin sheets of Wrong Mountain Quartz Monzonite. Grades into mylonitic gneiss low on flanks of gneiss dome near low-angle fault separating gneissic core rocks from the cover rocks. Radiometric age obtained from nearby area (Drewes, 1971) is probably reset, for rocks east of this map area (Drewes, 1974) are intruded by the Johnny Lyon Granodiorite, which has a currently accepted radiometric age of 1,630±30 m.y.

PINAL SCHIST (PRECAMBRIAN X):

Xp Schist and phyllite—Includes muscovite schist, muscovite-biotite schist, and some metaquartzite and metarhyolite. Locally contains pods of aplite and unmapped small masses of Continental Granodiorite and Wrong Mountain Quartz Monzonite. Typically deformed through dynamic and thermal events

—q— Marker beds of quartzite and quartz conglomerate

Xpq Metaquartzite and phyllite—Includes schist and local conglomerate with subrounded pebbles of quartz. May be an upper part of Pinal Schist

ls LIMESTONE AND MARBLE—Metamorphosed carbonate and calc-silicate rocks of uncertain age. May be as young as Permian formations or may possibly be hitherto unrecognized facies of the Pinal Schist

CONTACT—Showing dip; dotted where concealed; queried where uncertain

MARKER HORIZON—Undesignated horizon or bed

FAULT—Showing dip; dotted where concealed; half-arrow shows orientation of slickensides

Normal fault—Bar and ball on downthrown side

Tear fault—Arrow couple shows relative direction of movement where known; double-headed arrow couple shows relative movement unknown

Thrust fault—Solid sawteeth on upper plate; open arrow shows transport direction of upper plate based on local evidence

Glide fault or low-angle normal fault—Open sawteeth on glide plate or hanging wall

Complex fault—Faults with multiple diverse movement shown by using several of the above movement conventions

FOLD—Showing trace of axial plane and plunge of axis of fold in bedded rocks—Allochthonous rocks contain many small unmapped folds

Anticline

Overturned anticline—Showing plunge

Overturned syncline—Showing plunge

Flexure folds in foliated rocks

Anticline—Showing plunge

Syncline—Showing plunge

STRIKE AND DIP OF BEDS

Horizontal

Inclined

Vertical

Overturned

STRIKE AND DIP OF FOLIATION

Horizontal

Inclined

Vertical

BEARING AND PLUNGE OF LINEATION

Inclined lineation—Showing plunge

Horizontal lineation

SAMPLE SITE AND AGE OF SAMPLE IN MILLION YEARS

MINES, PROSPECT PITS, AND ADITS—Showing minerals present: py, pyrite; Cu, secondary copper minerals; F, fluorite; Ba, barite; gyp, gypsum and anhydrite; clay; and U, uranium

Prospect pit

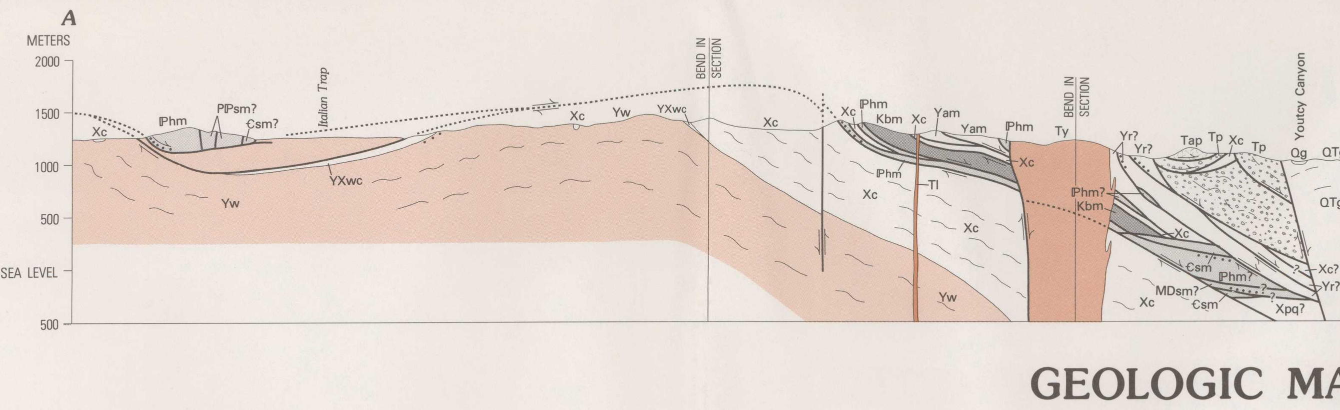
Mine shaft

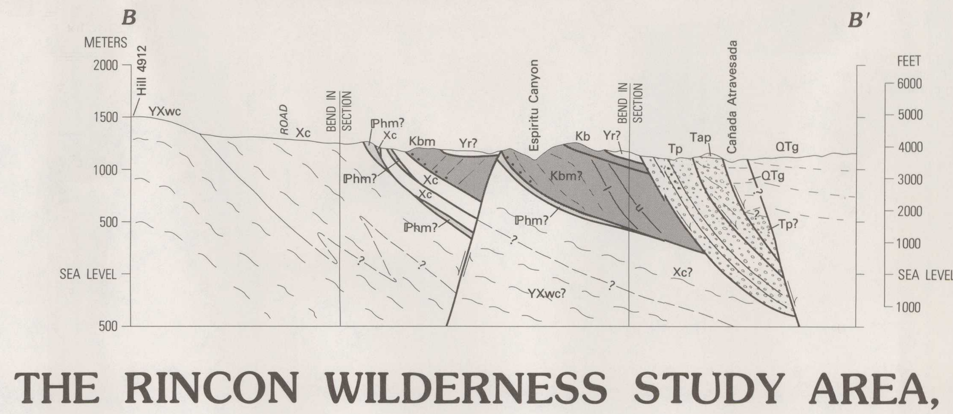
Adit

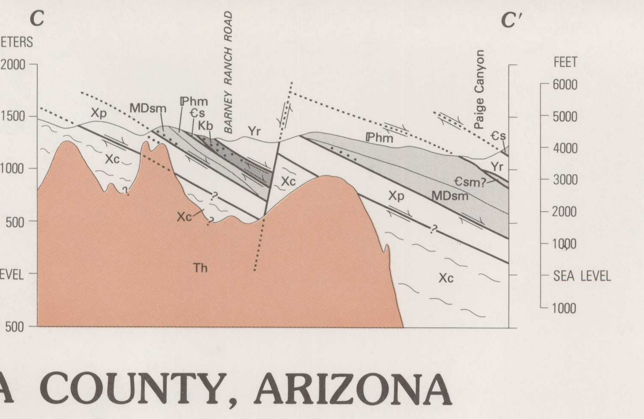
Trench

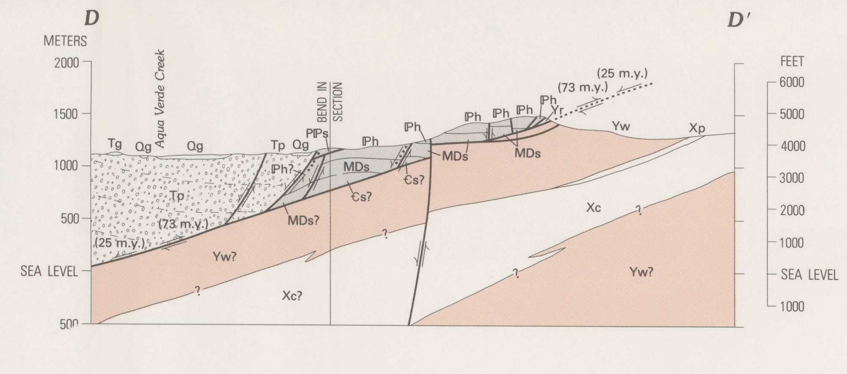
MINERALIZED ROCK—Shown in structure section, with probable control along faults. In most places shown projected into plane of structure section from locations a few hundred to a few thousand meters distant

[1]At the time of completion of this study the weight of the evidence was judged to favor a tentative age assignment of the Wrong Mountain Quartz Monzonite (Yw) to the Precambrian, rather than to the mid-Tertiary, as suggested by a major clustering of radiometric dates at 25 m.y. Subsequently acquired dates show a secondary clustering of values in the 40–50-m.y. range, which suggests that the rock records a second thermal event at or before that time. The few remaining older ages are scattered and may reflect diversely or incompletely reset Precambrian material. With the additional input of latest considerations stemming from the regional tectonic synthesis, the position is now favored that the Wrong Mountain was almost wholly (re?)mobilized in Late Cretaceous or Paleocene time. The age assignment used here thus shows not the likely age of latest major movement of magma, but the oldest time of the age range of pluton emplacement, and that age is here retained to offer the greatest cohesion between the main source maps and this map.









GEOLOGIC MAP OF THE RINCON WILDERNESS STUDY AREA, PIMA COUNTY, ARIZONA