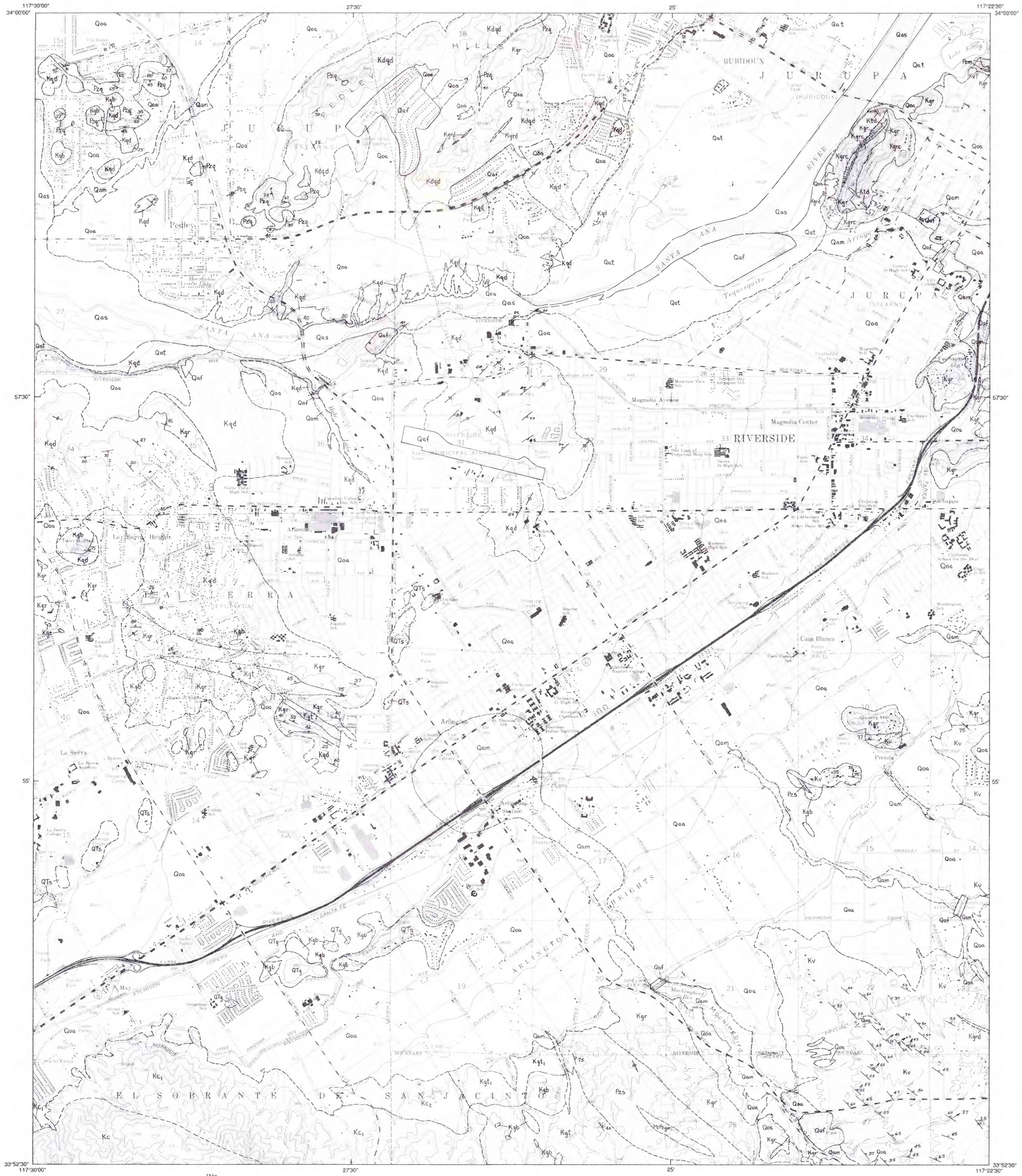
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

OPEN-FILE REPORT
88-753



Base from U.S. Geological Survey,
Riverside West, 1967
Photorevised 1973
Polyconic projection

APPROXIMATE MEAN DECLINATION, 1994

SCALE 1:24 000

1 MILE
1 KILOMETER

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10 FOOT CONTOURS
NATIONAL GEODETIC DATUM OF 1929

QUADRANGLE LOCATION

Geology mapped by D.M. Morton 1976-1980
and B.F. Cox 1980
Manuscript approved for publication January 20,1989

CORRELATION OF MAP UNITS

Qaf, Qas, Qat, Qam, Qoa	Holocene	QUATERNARY	CENOZOIC
QTg, QTs	Pleistocene		
QTg, QTs	Pleistocene or Pliocene	QUATERNARY OR TERTIARY	
Kgrd, Ktd, Kgr, Kgrc, Kc (Kc_1, Kc_2), Kgt (Kgt_1), Kv, Kqd, Kdqd, Kgb		CRETACEOUS	MESOZOIC
MzPzgm			MESOZOIC AND PALEOZOIC(?)
Pzq, Pzs, Pzm			PALEOZOIC(?)

DESCRIPTION OF MAP UNITS

Surficial deposits (Holocene to Pliocene) —Divided into:

Qaf **Artificial fill (Holocene)**—Compacted fill in housing and industrial developments, earth-fill dams, and roadbeds

Qas **Active alluvium of the Santa Ana River (Holocene)**—Unconsolidated, grayish, sandy alluvium subject to frequent reworking by the Santa Ana River

Qat **Alluvium of river terraces (Holocene)**—Unconsolidated, grayish to brownish, coarse-grained sandy alluvium forming broad, low stream terraces adjacent to active channel of the Santa Ana River; subject to infrequent reworking during major floods

Qam **Alluvium of minor streams (Holocene)**—Unconsolidated, brownish, sandy alluvium deposited within incised channels and small alluvial fans of ephemeral streams tributary to the Santa Ana River. Deposits typically are poorly sorted, containing abundant silt and clay eroded from older alluvium (unit Qoa)

Qoa **Older alluvium (Pleistocene)**—Weakly to moderately indurated, yellowish-brown to reddish-brown, coarse-grained sandy alluvium. Typically contains abundant silt and clay. Forms slightly dissected broad alluvial plains sloping toward Santa Ana River

QTg **Gravel (Pleistocene or Pliocene)**—Unconsolidated to moderately indurated gravel and conglomerate. Unit generally coarsens upward and consists of two stratigraphic divisions. Relatively fine-grained lower subunit contains pebbles and cobbles (to 30 cm in diameter) derived from the Transverse Ranges, whereas upper subunit contains cobbles and boulders (to 75 cm in diameter) of plutonic and metamorphic rocks derived from nearby sources in the Peninsular Ranges. Clasts of Transverse Ranges origin in the lower subunit consist of mylonite, quartzite, and several distinctive plutonic rocks including the Lowe granodiorite of Miller (1934). All of these rock types are presently exposed in the western San Bernardino Mountains

QTs **Sand (Pleistocene or Pliocene)**—Unconsolidated to moderately indurated sand, sandstone, and minor pebble gravel, locally containing cobble-size clasts. Many pebbles and cobbles apparently were derived from the Transverse Ranges, particularly the San Bernardino Mountains

Plutonic rocks (Cretaceous)—Divided into:

Kgrd **Granite dikes**—Light-tan-weathering, leucocratic, inequigranular, medium-grained to pegmatitic granite. Most dikes contain 1-3 percent biotite; some contain garnet. Dikes commonly contain textural layering parallel to their margins

Ktd **Tonalite dikes**—Light-gray, fine- to medium-grained, massive to foliated tonalite, forming dikes that intrude granite (units Kgr and Kgrc) on Mount Rubidoux. Mafic minerals constitute about 10-12 percent of the rock and consist of abundant biotite and lesser amounts of hornblende, hypersthene, and clinopyroxene. The tonalite contains equant to discoidal inclusions of dark-gray, fine-grained rock

Kgr **Biotite granite**—Light yellowish-gray to greenish-gray, massive to weakly foliated granite; medium to coarse-grained, with mean grain size ranging between 1-3 mm. Leucocratic, containing about 1-3 percent biotite. Inclusions typically are sparse or absent. Variant at Mount Rubidoux contains traces of disseminated hypersthene and olivine (fayalite) and fairly abundant equant inclusions of dark-gray, fine-grained rock. In west-central part of quadrangle, extensive outcrops north of Hole Avenue consist of foliated granite that is slightly enriched in biotite (2-8 percent) and contains sparse to abundant inclusions of quartz diorite, granodiorite, and fine-grained mafic rock

Kgrc **Coarse-grained granite**—Light yellowish-gray to greenish-gray, coarse-grained, massive granite, confined to Mount Rubidoux. Inequigranular texture, with mean grain size about 4-5 mm, but with potassium-feldspar crystals ranging up to 1 cm in diameter. Biotite and hornblende together constitute about 5 percent of the rock and are accompanied by traces of hypersthene and olivine (fayalite). Inclusions generally rare or absent

Kc **Monzogranite of the Cajalco pluton**—Light-gray, fine- to medium-grained, equigranular to porphyritic, massive biotite monzogranite and granodiorite. Constitutes northern part of Cajalco quartz monzonite of Dudley (1935). Locally contains mafic inclusions derived from gabbro and metavolcanic rocks. Northernmost outcrops of the body are divided into two subunits. Well exposed rocks containing abundant inclusions of gabbro are labeled Kc_1. Rocks near Dufferin Avenue that are very poorly exposed owing to deep weathering and extensive colluvium are labeled Kc_2; this subunit probably consists of rocks like those in Kc_1

Kgt **Granodiorite and tonalite**—Heterogeneous, light-gray, fine- to medium-grained, foliated plutonic rocks. Consists mainly of interlayered and intergrading masses of granodiorite and tonalite, accompanied by lesser amounts of granite and quartz diorite. Typically contains abundant discoidal inclusions of dark-gray, fine-grained rock aligned parallel to foliation. Exposures west of Mockingbird Canyon contain abundant inclusions of gabbro, including several large masses that are shown on the map. Deeply weathered, poorly exposed rocks near the northern limit of these exposures are distinguished as subunit Kgt_1

Kv **Val Verde tonalite of Osborn (1939)**—Light- to medium-gray, medium- to coarse-grained, foliated hornblende-biotite tonalite. Mean grain size ranges between 1-3 mm. Contains about 25 percent quartz. Mafic minerals about 15-25 percent, consisting of subequal amounts of biotite and hornblende. Abundant discoidal inclusions of dark-gray, fine-grained rock (typically with mineral composition of biotite-hornblende quartz diorite) are aligned parallel to foliation

Kqd **Quartz diorite**—Light- to medium-gray, medium-grained, equigranular, foliated biotite-hornblende quartz diorite. Mineral grains mostly 0.5-2.0 mm in diameter. Contains about 10-15 percent quartz. Mafic-minerals about 20 percent, consisting of nearly equal amounts of biotite and hornblende. Abundant discoidal inclusions of dark-gray, fine-grained rock are aligned parallel to foliation. Generally resembles the Val Verde tonalite (unit Kv) but is finer grained and contains less quartz

Kdqd **Diorite and quartz diorite**—Heterogeneous, light- to medium-gray, fine- to medium-grained, massive to foliated diorite and quartz diorite; restricted to Pedley Hills near north edge of the quadrangle. Prominently layered by variation in mineral composition and texture. Quartz typically sparse, about 3-10 percent. Mafic minerals 5-25 percent, consisting mainly of biotite in some layers and of hornblende in others. Biotite and epidote commonly replace hornblende, probably as a result of deuteric alteration during cooling of the pluton. Unit contains less quartz and is more heterogeneous and altered than neighboring unit of quartz diorite (unit Kqd)

Kgb **Gabbro and diorite**—Medium- to dark-gray, fine- to coarse-grained, massive gabbro and diorite. Hornblende constitutes 25-45 percent of the rock, with remainder consisting mostly of plagioclase; minor amounts of biotite, pyroxene, and pyrite are present locally. Local variants have prominent textural layering or have inequigranular texture, containing large (1-2 cm) anhedral poikilitic hornblende crystals

MzPzgm **Mixed granitic and metamorphic rocks (Mesozoic and Paleozoic?)**—Biotite-rich schist that is complexly intruded by large amounts of heterogeneous granitoid rocks.

Metamorphic rocks (Paleozoic?)—Divided into:

Pzq **Quartzite**—Light- to dark-gray, fine-grained, impure metaquartzite, interlayered with lesser amounts of biotite schist. Forms scattered pendants and septa of strongly deformed, isoclinally folded, rocks that are intruded by diorite and quartz diorite in northwestern and north-central parts of quadrangle. West of Van Buren Boulevard, unit consists of light-gray, laminated, biotitic quartzite, garnetiferous quartzite, and biotite schist; typically weathers yellowish brown or reddish brown. East of Van Buren Boulevard, unit consists of dark-gray, intensely recrystallized, hornblende-bearing quartzite that weathers yellowish gray; accompanied by minor amounts of calc-silicate hornfels and biotite schist

Pzs **Biotite schist**—Dark-gray, fine-grained biotite-quartz-feldspar schist

Pzm **Marble**—Heterogeneous metasedimentary rocks consisting of abundant marble and lesser amounts of metaquartzite, biotite schist, and calc-silicate hornfels. Unit restricted to small hill by Lake Evans (near northeast corner of quadrangle)

STRUCTURAL SYMBOLS

- Contact—Dashed where approximately located
- 40 — Strike and dip of inclined foliation
- Strike of vertical foliation
- 90 — Bearing and plunge of aligned mineral grains or elongate mafic inclusions in plutonic rocks

GEOLOGIC SUMMARY

The Riverside West 7.5-minute quadrangle lies near the north end of the Perris block in the Peninsular Ranges province of southern California (see index map). The Perris block is a relatively stable and apparently internally unfaulted mass of crustal rocks bounded on the southwest by the Elsinore fault and on the northeast by the San Jacinto fault. Like neighboring areas of the Perris block to the north and west, the Riverside West quadrangle contains island-like hills of plutonic rocks surrounded by broad fields of alluvium.

The plutonic rocks consist of tonalite, quartz diorite, granodiorite, granite, and sparse small bodies of gabbro and diorite— all products of the Cretaceous-age Peninsular Ranges batholith. (We have classified the plutonic rocks using the system of Streckeisen, 1976.) Small masses of older amphibolite-grade metasedimentary rocks, including metaquartzite, marble, and biotite schist, form pendants and septa within the plutonic rocks. The age and regional correlation of the metasedimentary rocks are uncertain because their original stratigraphic relations and fossil remains were destroyed by the deformation and metamorphism that accompanied plutonism. However, judging from the abundance of metaquartzite and marble, the rocks probably were deposited within the North American Cordilleran geosyncline during Paleozoic time.

Alluvial units in the quadrangle were deposited by local streams and by the throughgoing regional channel of the Santa Ana River, whose headwaters extend northward into the Transverse Ranges. The oldest deposits consist of strongly eroded gravel and pebbly sand that form small hills in the central and southwestern parts of the quadrangle. These sediments contain clasts of mylonite, quartzite, and plutonic rocks derived from the western San Bernardino Mountains, and they probably were deposited by a late Pliocene or early Pleistocene forerunner of the Santa Ana River (Morton and Matti, 1989, fig. 2, locs. 4A). Locally derived sandy alluvium of late Pleistocene age covers much of the quadrangle, forming alluvial plains that slope gently toward the Santa Ana River. These deposits, which constitute our "older alluvium" unit, consist of detritus eroded from nearby hills of plutonic rocks lying directly north, south, and east of the quadrangle. The older alluvium is dissected by shallow channels of the Santa Ana River and its tributaries, which contain thin deposits of Holocene-age sandy alluvium.

Geologic mapping in the Riverside West quadrangle was supported by the National Geologic Mapping and National Earthquake Hazard Reduction Programs of the U.S. Geological Survey.

REFERENCES CITED

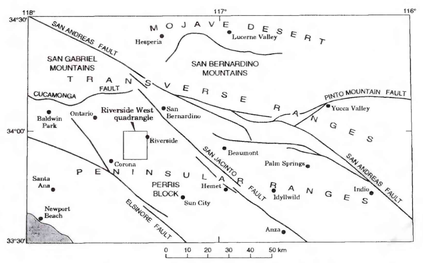
Dudley, P.H., 1935, Geology of a portion of the Perris block, southern California: California Journal of Mines and Geology, v. 31, no. 4, p. 487-506.

Miller, W.J., 1934, Geology of the western San Gabriel Mountains of California: University of California, Los Angeles, Publications in Mathematical and Physical Sciences, v. 1, no. 1, 114 p.

Morton, D.M., and Matti, J.C., 1989, A vanished late Pliocene to early Pleistocene alluvial-fan complex in the northern Perris block, southern California, *in* Colburn, I.P., Abbott, P.L., and Minch, John, eds., Conglomerates in basin analysis: A symposium dedicated to A.O. Woodford: Pacific Section, Society of Economic Paleontologists and Mineralogists, v. 62, p. 73-80.

Osborn, E.F., 1939, Structural petrology of the Val Verde tonalite, southern California: Geological Society of America Bulletin, v. 50, no. 6, p. 921-950.

Streckeisen, A., 1976, To each plutonic rock its proper name: Earth-Science Reviews, v. 12, p. 1-33.



INDEX MAP SHOWING LOCATION OF THE RIVERSIDE WEST QUADRANGLE

GEOLOGIC MAP OF THE RIVERSIDE WEST QUADRANGLE, RIVERSIDE COUNTY, CALIFORNIA

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1994

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