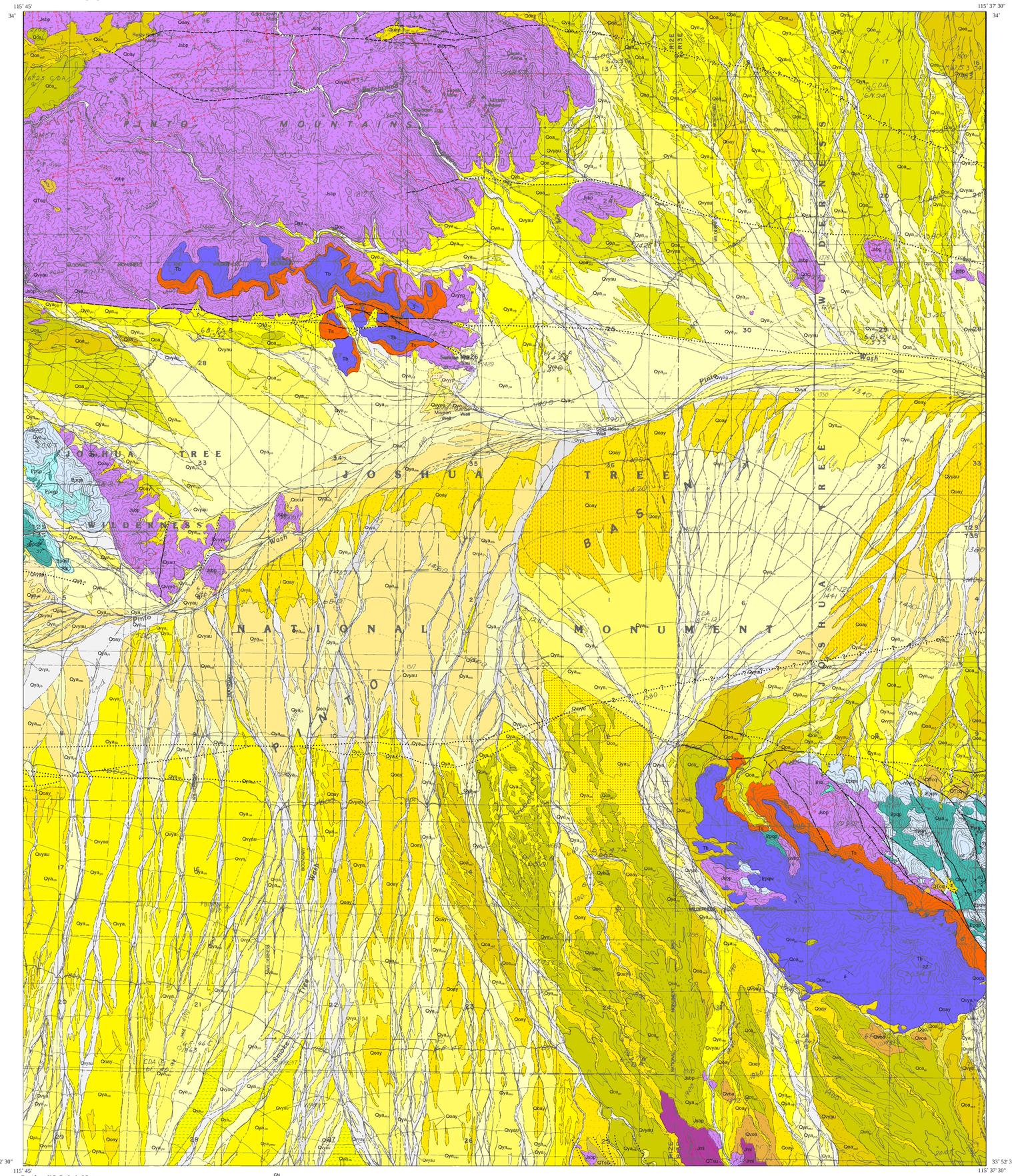
Prepared in cooperation with the
NATIONAL PARK SERVICE
and
CALIFORNIA GEOLOGICAL SURVEY

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

OPEN-FILE REPORT
02-498, Version 1.0



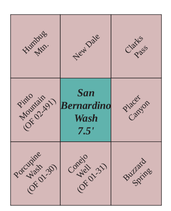
Base from U.S. Geological Survey
7.5' San Bernardino Wash quadrangle, 1986
Lambert conformal conic projection

SCALE 1:24,000

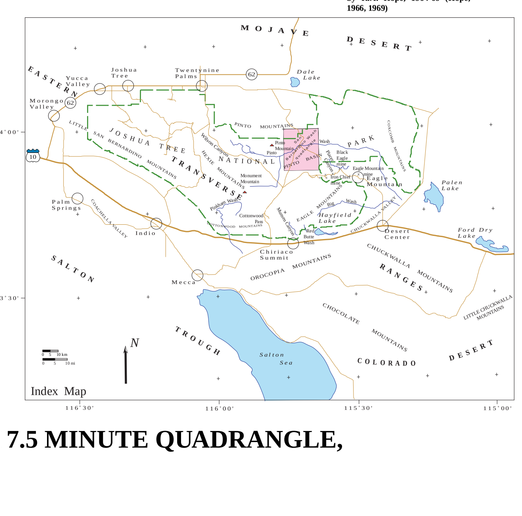
1 0 1 MILE

1 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET



SURROUNDING 7.5' QUADRANGLES



Geology mapped by R.E. Powell, 1975-85; 1998-2000; structural point data collected by Powell and by R.A. Hope, 1964-69 (Hope, 1966, 1969)

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards or with the North American Stratigraphic Code. Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

GEOLOGIC MAP AND DIGITAL DATABASE OF THE SAN BERNARDINO WASH 7.5 MINUTE QUADRANGLE, RIVERSIDE COUNTY, CALIFORNIA

Version 1.0

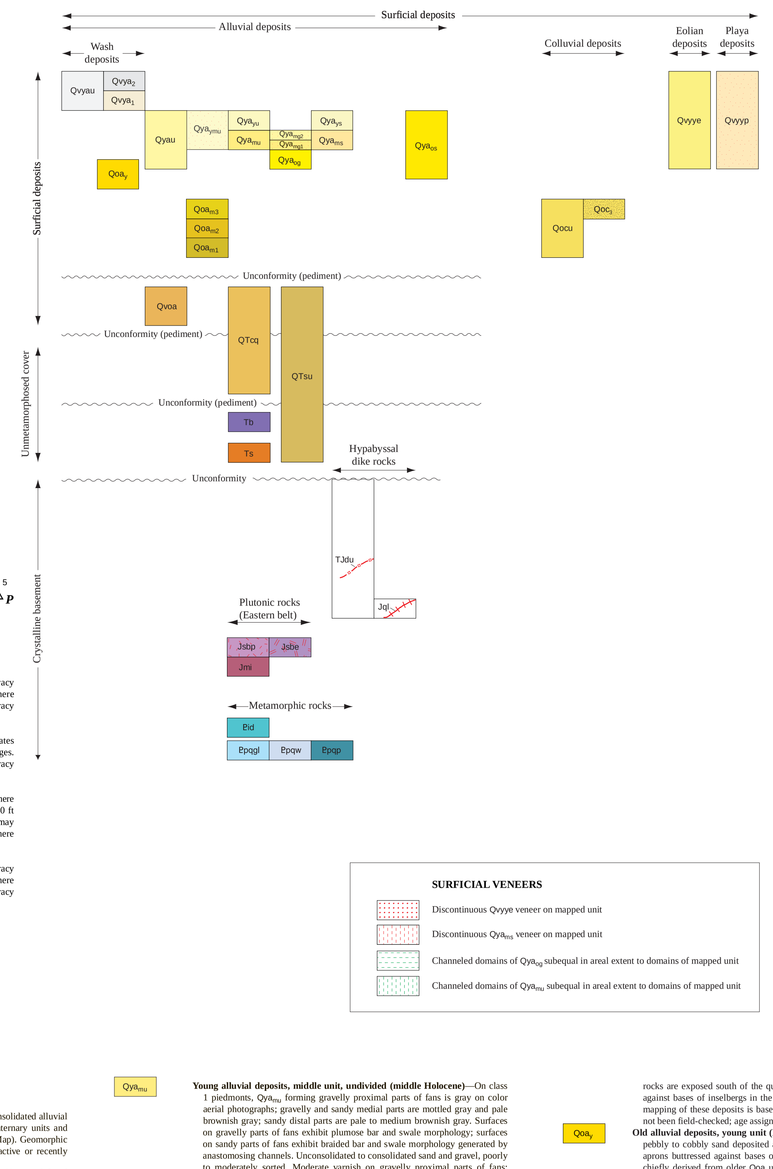
by

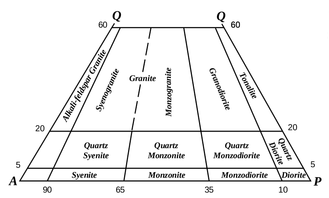
Robert E. Powell[1]

Digital preparation by Pamela M. Cossette[1]

[1] U.S. Geological Survey
904 W. Riverside Avenue, Room 202
Spokane, WA 99201

CORRELATION OF MAP UNITS[1]





Classification of plutonic rock types (from Streckeisen, 1976).
A, alkali feldspar; P, plagioclase feldspar; Q, quartz.

The matrix color of surficial materials and their pedogenic soils is classified according to the Munsell soil-color charts (Munsell, 1975).

Contact—Solid where location meets map accuracy standard (within 40 ft or 12 m); dashed where approximately located, may not meet map accuracy standard; dotted where concealed

Facies boundary—Intra-unit boundary that separates alluvial deposits derived from different drainages. Approximately located, may not meet map accuracy standard

Fault—High angle, observed or inferred. Solid where location meets map accuracy standard (within 40 ft or 12 m); dashed where approximately located, may not meet map accuracy standard; dotted where concealed

Fault scarp—Solid where location meets map accuracy standard (within 40 ft or 12 m); dashed where approximately located, may not meet map accuracy standard

Fault-line scarp

Strike and dip of bedding in volcanic strata

5 **Inclined**

Strike and dip of foliation and layering in metamorphic rocks

30 **Inclined**

Vertical

SURFICIAL VENEERS

Discontinuous Qyvye veneer on mapped unit

Discontinuous $Qyfa_{ny}$ veneer on mapped unit

Channeled domains of $Qyfa_{sg}$ subequal in areal extent to domains of mapped unit

Channeled domains of $Qyfa_{ms}$ subequal in areal extent to domains of mapped unit

DESCRIPTION OF MAP UNITS[1]

VERY YOUNG SURFICIAL DEPOSITS—Loose to slightly consolidated alluvial deposits in washes incised both into bedrock and into other Quaternary units and graded to base-level playa deposits in Chuckwalla Valley (Index Map). Geomorphic surfaces undissected to slightly dissected and characterized by active or recently active sediment accumulation

Qvyau

Very young alluvial deposits, undivided (late Holocene)—Unconsolidated medium- to coarse-grained sand and sandy gravel, including subordinate fine sand and silt; bar and swale morphology; unvarnished clasts. Sparsely to moderately vegetated; prominent riparian shrub lines. Chiefly degradational. Includes:

$Qvyfa_{fl}$

Very young alluvial deposits, Unit 2—White on color aerial photographs; no soil profile development. Mostly sand in washes developed on slopes flanking granite inselbergs. Transported and deposited in most recently active channels; inset into $Qvyfa$ and older deposits. Unit surfaces correlative with Q4b surfaces of Bull (1991)

$Qvyfa_{fl}$

Very young alluvial deposits, Unit 1—Light gray (2.5YR 7/2) to pale yellow; gray on color aerial photographs; little or no soil profile development. Transported and deposited in channels or parts of channels less recently active than those in which unit $Qvya_f$ deposited; incised into young alluvial and older deposits. Unit surfaces correlative with Q4a and (or) Q4b surfaces of Bull (1991)

VERY YOUNG AND (OR) YOUNG SURFICIAL DEPOSITS

Qvyye

Very young and (or) young eolian deposits (Holocene)—Windblown sand, unconsolidated. Occurs in central part of quadrangle. Where it occurs in discontinuous surficial veneers, Qvyye is represented by a red-dot overlay pattern. As mapped, may include old eolian deposits

Qvyyp

Very young and (or) young playa deposits (Holocene)—Micaceous silt and clay containing mine sand and scattered granules and pebbles; very pale brown to pale brown. Light-colored surface on aerial photographs. Sparsely to moderately vegetated. Occurs in two small areas along Pinto Wash, one on west-central edge of quadrangle and one in center. Older parts of this unit overlain locally by windblown sand and distal fan deposits

YOUNG SURFICIAL DEPOSITS—Loose to moderately consolidated alluvial and eolian deposits on piedmont slopes. Alluvial deposits exhibit slightly to strongly dissected geomorphic surfaces characterized by AvCox or AvBwCox soil profiles typical of Holocene surfaces (McFadden, 1988; Bull, 1991). Deposits form a thin mantle spread across landscape inherited from Pleistocene

Qyau

Young alluvial deposits, undivided (Holocene)—Loose to moderately consolidated alluvium deposited in canyon bottoms and on piedmont slopes. Fans spread out as aggradational aprons across inherited Pleistocene landscape, back-filled drainage washes from which they emanated, and grew progressively down-piedmont in nested complexes; oldest fans are proximal to range-front and youngest fans occur on lower piedmont. Successively younger fans are inset into older fans at their apices and either bury or feather out onto older fans distally. Abandoned surfaces are characterized by pedogenic Av horizon of loess-like, vesicular light brown (10YR 6/4) calcareous silt. Fan surfaces are not dissected by streams that originate on the surfaces. Piedmont alluvial deposits comprise two classes associated with geomorphically distinct piedmont settings: Class 1—Deposits forming alluvial aprons characterized by prominently cone-shaped, multi-lobed fans that coalesce into bajadas down-piedmont. Typically occur along bases of steep, fault-controlled mountain escarpments developed in resistant rocks having weathering and denudation characteristics that are relatively insensitive to climatic change (see Bull, 1991, p. 161-167). Class 2—Deposits that accumulated on broad piedmont slopes developed on less resistant rocks along deeply embayed mountain fronts. Weathering and denudation of these less resistant rocks are relatively sensitive to climatic change. Piedmonts are punctuated with inselbergs, rimmed with pediments, and exhibit broad, multi-faceted slopes that drain via small intra-piedmont valleys between slope facets. Alluvium on slope facets originates as fans distributed from feeder drainage-channels and as sheet wash on slopes between drainage channels. Fans in class 2 piedmont settings are characterized by low-convexity transverse profiles, and by surfaces having low-relief morphology. Fans and sheetwash on slopes between fans commonly merge imperceptibly. Down-piedmont, distributary slope drainage re-collects into intra-piedmont tributary valleys that, in turn, debouch onto fans farther down-piedmont. Deposits are formed by channelized flow and by unconfined overland flow in distributed network of branching and coalescing washes, fans, and thin slope-blanketing sheets. Young alluvial deposits are divided into old, middle, and young subunits roughly equivalent to Q3a,c units of Bull (1991). These units are further subdivided as needed. Consists of:

$Qyfa_{ymu}$

Young alluvial deposits, young unit, and middle units, undivided (Holocene)—Unconsolidated to slightly consolidated aggradational piedmont alluvial deposits; medium- to coarse-grained sand and pebbly sand, poorly to moderately sorted. Light to very light gray on color aerial photographs. Comprise class 2 piedmont deposits that occur in: (1) small fans that debouch from small canyons in mountains or inselbergs, are inset proximally into Qya_{ms} and spread out distally to merge with the surface of Qya_{sg2} proximal surfaces exhibit braided bar and swale micromorphology; (2) pediment veneer over saprolite. Little or no desert varnish. Includes:

$Qyfa_{yu}$

Young alluvial deposits, young unit, undivided (late and (or) middle Holocene)—On class 1 piedmonts, unit shows pale brownish gray to pale gray on color aerial photographs; surfaces exhibit braided bar and swale morphology generated by anastomosing channels. Unconsolidated sand and gravel, poorly to moderately sorted; more sand and less gravel than older Qya units. Little or no desert varnish. Surfaces correlative with Q3c and (or) Q4b surfaces of Bull (1991). On class 2 piedmonts, unconsolidated sand and pebbly sand, poorly to moderately sorted. Proximally, deposits are inset into older Qya units; distally, they feather out onto surfaces of $Qyfa_{ms}$ units. Surfaces correlated with Q3c surfaces of Bull (1991). Consists of:

$Qyfa_{ys}$

Young alluvial deposits, young unit, sandy facies—Sandy alluvium forming valley-bottom deposits, fans and fan-skirts distal to steep range fronts on class 1 piedmonts, and alluvial-apron deposits on class 2 piedmonts deeply embayed into mountain fronts

$Qyfa_{mu}$

Young alluvial deposits, middle unit, undivided (middle Holocene)—On class 1 piedmonts, $Qyfa_{mu}$ forming gravelly proximal parts of fans is gray on color aerial photographs; gravelly and sandy medial parts are mottled gray and pale brownish gray; sandy distal parts are pale to medium brownish gray. Surfaces on gravelly parts of fans exhibit plumose bar and swale morphology; surfaces on sandy parts of fans exhibit braided bar and swale morphology generated by anastomosing channels. Unconsolidated to consolidated sand and gravel, poorly to moderately sorted. Moderate varnish on gravelly proximal parts of fans; swales exhibit pebbly pavements underlain by Av horizon. Surfaces correlative with Q3b surfaces of Bull (1991). On class 2 piedmonts, unconsolidated sand and gravel, poorly to moderately sorted. Surfaces tentatively correlated with Q3b surfaces of Bull (1991). Includes:

$Qyfa_{mg}$

Young alluvial deposits, middle unit, gravelly facies—Gravelly alluvium forming feeder-channel deposits in canyon-bottoms and fans proximal to steep range fronts. In quadrangle, fan deposits occur in class 1 piedmont setting. Locally, divided into:

$Qyfa_{mg2}$

Young alluvial deposits, middle unit, gravelly facies 2—Younger gravelly alluvial deposits of middle unit; form fans that debouch from channels incised into older gravelly deposits of middle unit

$Qyfa_{mg1}$

Young alluvial deposits, middle unit, gravelly facies 1—Older gravelly alluvial deposits of middle unit

$Qyfa_{ms}$

Young alluvial deposits, middle unit, sandy facies—Sandy alluvium forming valley-bottom deposits, fans and fan-skirts distal to steep range fronts on class 1 piedmonts, and alluvial-apron deposits on class 2 piedmonts deeply embayed into mountain fronts

$Qyfa_{og}$

Young alluvial deposits, old unit (Holocene)—Consolidated coarse gravel and sand forming fans adjacent to mountain-front escarpments. On color aerial photographs, unit shows as dark brownish gray to dark gray to black surfaces characterized by plumose anastomosing channels indicative of bar and swale morphology. Locally, unit includes cobbly and bouldery debris flow deposits. Moderate to strong varnish on rocky surfaces. Proximally, unit is inset into Pleistocene deposits (Qoa_{ls2}; Qoa_u); distally, it overlaps them. Inferred stratigraphic position, strong desert varnish, and bar and swale morphology suggest early Holocene age. Surfaces correlative with Q3a surfaces of Bull (1991). Extent of unit interpreted largely from aerial photographs. Includes:

$Qyfa_{mu}$

Young alluvial deposits, old unit, gravelly facies (middle and (or) early Holocene)—Gravelly alluvium forming feeder-channel deposits in canyon-bottoms and fan deposits proximal to steep range fronts on class 1 piedmonts. On some fans west of quadrangle, two sequences can be distinguished morphologically (Powell, 2002)

YOUNG AND OLD(?) SURFICIAL DEPOSITS

$Qyfa_{ou}$

Young alluvial deposits, old oxidized sandy unit (middle and (or) early Holocene and late Pleistocene?)—Sand and pebbly to cobbly sand forming aprons on mountain-front and inselberg piedmonts where source terrane consists of Cretaceous granitic rocks. Thickest where buttressed against inselbergs or range-front; tapers down-piedmont into thin veneers on Pleistocene deposits. Where unit is exposed in arroyo walls high on piedmont slopes, loose surficial sediment passes down-section into firmer slope wash and alluvial deposits. Deposits of this unit redden with depth and probably contain one or more buried soil horizons. In places, reddened sediment contains scattered equant blebs of filamentous calcite, indicating an incipient (Stage I) calcic soil. Unit surfaces are smooth, sandy, and characterized by oxidized grains of potassium feldspar that range in color from reddish yellow (5YR 6/6 to 7/6) to yellowish red (5YR 5/6) to pink (5YR 7/4); appear orange on color aerial photographs. These grains occur as veneer underlain by pedogenic Av horizon of loess-like, vesicular very pale brown (10YR 7/3) calcareous silt, typically 1 to 4 cm thick. Av horizon underlain by pale-brown (10YR 6/3 to 6.5/3) to light yellowish-brown (10YR 6/4) sand. Unit inferred to include latest Pleistocene and (or) early to middle Holocene aggradational alluvial deposits as well as younger alluvial deposits that have accumulated as a result of sheet floods originating either as drainage basin discharge or as surface run-off across the older deposits. Proximal parts of unit are incised by channels in which more recent young ($Qyfa_{ou}$ units and $Qyfa_y$ units) and very young (Qvya units) alluvial deposits have accumulated. Down-piedmont, where more recent young deposits feather out onto $Qyfa_{ou}$, $Qyfa_{ou}$ surfaces are slightly dissected by anastomosing network of braided channels surrounding small islands of $Qyfa_{ou}$. Unit typically occurs as thin alluvial apron deposited on weathered granitic basement high on piedmont slopes and spread down-slope across older surficial deposits. As mapped, unit may include more recent young deposits

OLD SURFICIAL DEPOSITS—Consolidated deposits in alluvial fans, on piedmont slopes, and in colluvial debris aprons. Old deposits exhibit slightly to strongly dissected geomorphic surfaces; gravelly deposits have well-developed and strongly varnished pavements; granitic debris characterized by AvBt/Bk/Cox soil profiles; Stage III-IV carbonate morphology. These deposits merge with one another to form a thin mantle that rests on an evolving Pleistocene landscape

Qoa$_y$

Old alluvial deposits (Holocene? and Pleistocene)—Consolidated alluvium deposited in canyon and arroyo bottoms and on piedmont slopes. As with young alluvial deposits (Qya units), old piedmont alluvial deposits comprise two classes: (1) Deposits that occur in alluvial aprons characterized by prominently cone-shaped, multi-lobed fans that coalesce into bajadas down-piedmont. Sediments generally have a source in resistant rocks having weathering and denudation characteristics that are relatively insensitive to climatic change (see Bull, 1991, p. 161-167). Sand and gravel. Unit surfaces consist of very well-developed pavements of strongly varnished pebbles and cobbles; dark and smooth. Pavements underlain by pedogenic Av horizon of very pale brown (10YR 7/3), loess-like, vesicular silt. Relict pavements and underlying old alluvial deposits are more deeply dissected with increasing age. (2) Deposits that occur on broad piedmont slopes developed on relatively less resistant rocks along deeply embayed mountain fronts. Weathering and denudation characteristics of these less resistant rocks are relatively sensitive to climatic change. In southwestern San Bernardino Wash quadrangle and in adjoining quadrangles to south and west, class 2 piedmont deposits consist of consolidated alluvium and slope wash that accumulated as thin aprons on piedmonts beveled onto Mesozoic granitic rocks, Proterozoic granite gneiss of Joshua Tree and Quaternary and (or) Tertiary strata. The underlying crystalline rocks are exposed south of the quadrangle, where alluvial units are buttressed against bases of inselbergs in the Eagle Mountains (see Index Map). Much of mapping of these deposits is based on aerial photograph interpretation and has not been field-checked; age assignments are tentative. Consists of:

Qoa$_{ls}$

Old alluvial deposits, young unit (Holocene? and late Pleistocene)—Sand and pebbly to cobbly sand deposited as alluvial fill in canyons and arroyos and in aprons buttressed against bases of inselbergs and mountain massifs. Deposits chiefly derived from older Qoa units and from exposures of granite gneiss of Joshua Tree and monzodiorite of Munsen Canyon south of quadrangle (see Powell, 2001a, 2001b). Pavements are light-colored, smooth, and moderately incised by dendritic networks of closely spaced gullies generated by surface run-off. Deposits partially bury older erosional landscape on which pediment flatirons had developed on earlier alluvial-slope aprons. Deposits inset into Qoa_u units. As mapped, may include older Qoa_{ls} units having atypically light-colored pavement

Old alluvial deposits, middle unit (Pleistocene)—Sand and gravel. Surfaces consist of very well-developed pavements of strongly varnished pebbles and cobbles; surfaces are dark and smooth. Pavements underlain by pedogenic Av horizon of very pale brown (10YR 7/3), loess-like, vesicular silt. Relict pavements and underlying old alluvial deposits are more deeply dissected with increasing age. Includes:

Qoa_{ls3}

Middle unit 3 (late Pleistocene)—Sand and gravel. Pavements are generally continuous over broad relict surfaces; slightly to moderately incised by dendritic network of scattered to closely spaced gullies. Deposits are inset into extant old and very old alluvial deposits (Qoa_{ls2}-Qoa)

Qoa_{ls2}

Middle unit 2 (middle? Pleistocene)—Sand and gravel. Pavements extremely dark; moderately to deeply incised by dendritic network of gullies. Pavement and Av horizon underlain by reddened pedogenic B-horizon, in turn underlain by pervasively chalky-cemented sand and gravel. Deposits are inset into extant old and very old alluvial deposits (Qoa_{ls2}-Qoa)

Qoa_{ls1}

Middle unit 1 (middle and early Pleistocene)—Sand and boulder gravel. Very well developed pavement with strongly varnished pebbles and cobbles. Prominent ridge-and-ravine (hallena) morphology; pavements extremely dark, deeply incised by dendritic network of ravines, and preserved only in discontinuous remnants along ridge crests. Moderately to well-cemented pedogenic K-horizon. Where pavement has been completely removed, erosional ridges are rounded and surface is littered with calcrete fragments. Pavement underlain by pedogenic Av horizon of very pale brown (10YR 7/3), loess-like, vesicular silt. Deposits beheaded from channels incised into bedrock. Erosional morphology of unit exhibits three markedly different surficial settings, each providing a distinct microenvironment: (1) dark pavement as chiscontinuous relics on ridge crests; (2) colluvial debris on ridge slopes, including lighter-colored young(?) slope wash derived from parent rock and dark-colored slope-wash (Qoc) shed from the varnished pavement surface; and (3) ravine-bottom alluvium

Qoa_{ls}

Old colluvial deposits, undivided (Pleistocene)—Varnished aprons of colluvial debris shed from granite inselbergs north of Pinto Wash. Well-developed pavements on colluvial deposits are very dark and smooth, consist of strongly varnished pebbles and cobbles, and are underlain by pedogenic Av horizon of very pale brown (10YR 7/3), loess-like, vesicular silt. Includes:

Qoc_y

Unit 3 (late Pleistocene)—In southeastern corner of quadrangle, varnished aprons of colluvial debris shed from flat-topped, pavemented surfaces of Qoa_{ls} and Qoa_{ou} down steep banks eroded into the underlying deposits. Aprons connected with source rock outcrops. Units 1 and 2 crop out west of quadrangle (Powell, 2002)

VERY OLD SURFICIAL DEPOSITS—Deposits in alluvial fans and on piedmont slopes. Very old deposits exhibit strongly dissected geomorphic surfaces characterized by truncated Av/K soil profiles; carbonate morphology in K horizon is consistent with pedogenesis in the range of Stage IV-VI; pervasive hard to very hard chalky cementation is typically accompanied by abundant veins of laminar calcrete

Qvoa

Very old alluvial deposits (early Pleistocene)—Moderately to well-cemented sand and boulder gravel; unit exhibits ridge-and-ravine (hallena) morphology. Ridges are rounded and littered with calcrete fragments; no remaining pavement

QUATERNARY AND (OR) TERTIARY SURFICIAL DEPOSITS

QTcg

Conglomerate, quartzite-clast (Quaternary and (or) Tertiary)—Boulder conglomerate and sandstone shed in coarse alluvial apron from quartzite outcrops on Pinto Mountain and in northwestern Eagle Mountains. As mapped, may include very old alluvial deposits (Qvoa) in Eagle Mountains

QTsu

Sedimentary deposits, undivided (Quaternary and (or) Tertiary)—Interpreted from aerial photographs. Deposits are reddened and beveled by pediment. Just south of quadrangle, deposits overlie an older bedrock pediment. Restricted to small areas of exposure south of quadrangle; may include deposits equivalent to sandstone unit of sedimentary strata of Pinto Basin (QTpbs) mapped west of quadrangle (Powell, 2002), to oxidized old alluvial deposits (Qoa_{ls}) and very old alluvial deposits (Qvoa) in eastern Eagle Mountains mapped south of quadrangle (Powell, 2001a), or to Tertiary sedimentary deposits (Ts) and (or) saprolite

COVER ROCKS

Tb

Basalt (late and middle Miocene)—Basalt flows; olivine-bearing, massive, black. Microphenocrysts include euhedral laths of labradorite, euhedral olivine partially altered to iddingsite, and clinopyroxene. South of quadrangle, forms pipes and (or) near-vent flows on small inselbergs rising above pediment that forms south slope of Pinto Basin. Similar flows in Eagle Mountains east and southeast of quadrangle yield whole-rock conventional K-Ar ages of 7.8 and 10.2 Ma (Carter and others, 1987)

Ts

Sedimentary deposits (late? and middle Miocene)—Arkosic sandstone and siltstone; minor conglomerate. As mapped, may include Tertiary weathering regolith

CRYSTALLINE BASEMENT ROCKS

TJdu

Dike rocks, undivided (Tertiary, Cretaceous, and (or) Jurassic)—Dacite porphyry, microdiorite, and quartz latite or rhyodacite dikes. Names are based on phenocryst percentages. Dacite dikes are gray hornblende-feldspar porphyry containing abundant to sparse phenocrysts of zoned euhedral plagioclase (labradorite to andesine) as large as 1 cm, subordinate euhedral brown hornblende and brown biotite, and rare embayed quartz set in a gray microcrystalline groundmass of plagioclase, alkali feldspar, quartz, sphene, apatite, and zircon. Dacite dikes trend northeast and are typically a few meters thick, several hundred meters long, and dip steeply. They form resistant ribs and exhibit dark brown patina of desert varnish. Similar dacite dikes intrude Cretaceous granodiorite and monzogranite in Eagle Mountains southeast of quadrangle. Microdiorite dikes are medium- to dark-greenish gray, fine- to very fine-grained, and composed primarily of hornblende and plagioclase; typically altered propylitically to epidote, chlorite, and calcite. Quartz latite dikes typically trend north. Along southern margin of quadrangle, subdivided into:

Jqlt

Quartz latite dike (Late Jurassic)—Light to medium gray, siliceous, aphanitic rocks containing microphenocrysts of quartz, microcline, plagioclase, and biotite. Quartz latite dikes comprise swarms in eastern Chuckwalla, Eagle, and Pinto Mountains (Index Map). Quartz latite dike in Big Wash in east-central Eagle Mts. yields zircon U-Pb intercept age of 145 Ma and sphene U-Pb age of 142 Ma (James, 1989)

JSbp

Quartz monzonite, monzogranite, and granodiorite of San Bernardino Wash (Middle Jurassic)—Ranges from diorite to granite; predominantly quartz monzonite, monzogranite, and granodiorite. Extensively exposed in eastern Pinto and southeast of quadrangle in northeastern Eagle Mountains (Index Map). Typically contains less than 25 percent quartz; porphyritic rocks are characterized by lavender-tinted phenocrysts of alkali feldspar. Mafic minerals consist of hornblende, biotite, and locally clinopyroxene; abundant sphene. Rocks show widespread propylitic alteration. Includes:

Porphyritic unit—Medium- to coarse-grained porphyritic plutonic rocks; vary in composition from quartz monzonite to monzogranite and granodiorite. Unfoliated to foliated. Hornblende-biotite to biotite-hornblende; phenocrysts are lavendar-tinted to pinkish-gray alkali feldspar; propylitically altered. Yields biotite conventional K-Ar age of 167 Ma (Bishop, 1963) in Pinto Mountains north of quadrangle and zircon U-Pb ages of about 165 Ma (Silver, 1978, oral communication; Wooden and others, 1994) in Pinto Mountains northwest of quadrangle and in Eagle Mountains southeast of quadrangle

JSbe

Equigranular quartz monzonite, quartz monzodiorite, monzogranite, and granodiorite—Mineralogically similar to porphyritic unit, but is nonporphyritic and ranges in composition to quartz monzodiorite. Equigranular unit is typically mafic-rich and grades into porphyritic unit

Jmi

Mafic and intermediate intrusive suite, undivided (Jurassic)—Intermingled mafic and mafic intermediate rocks of varied composition and texture. Color index ranges from 50 to >95. Includes coarse- to very coarse-grained hornblendite and hornblende gabbro, medium- to coarse-grained biotite-hornblende diorite, fine-grained, dark-colored diorite to quartz diorite, medium-grained diorite and quartz diorite, and coarse- to extremely coarse-grained gabbro-dioritic pegmatite. Intruded by porphyritic quartz monzonite, monzogranite, and granodiorite of San Bernardino Wash (Jsbp)

Ehd

Quartzite of Pinto Mountain (Middle or Early Proterozoic)—Regionally, consists of three interfingering lithofacies: (1) gray to bluish gray quartzite, coarse- to very coarse-grained, vitreous, thin bedded to massive, containing granule and pebble conglomerate beds; (2) white quartzite, coarse- to very coarse-grained, vitreous, massive; and (3) pelitic rocks. In San Bernardino Wash quadrangle, consists of:

Epqgl

Light gray unit—Light-gray to gray quartzite (>95% quartz). As mapped, may include domains of remobilized quartz

Epqw

White unit—Very coarse-grained, vitreous, white to light-gray quartzite (98-99% quartz) having interlocking grains as large as 1 cm; grains are strongly recrystallized and have sutured boundaries; no evidence of relict rounded sedimentary grains; massive; bedding obscure or obliterated. As mapped, may include domains of remobilized quartz

Epqc

Pelitic unit—Dark metamorphosed pelitic rocks, containing very abundant aluminosilicate minerals; chiefly composed of quartz, muscovite, sillimanite and (or) andalusite; biotite-bearing in places. Porphyroblastic to granoblastic; schistose in Eagle Mountains; schistose to unfoliated in Pinto Mountains. Unit also contains dark-colored quartzite; as mapped, may include bodies of Jurassic mafic and intermediate intrusive suite (Jmi). Well developed patina of desert varnish makes unit show as dark on color aerial photographs

[1] *NOTE: This geologic map is one representation of rock units contained in the digital database. The database also describes a hierarchical array of stratigraphic parents of the mapped units. The parent units aggregate the rock units shown on this map and can be used to generate and display more generalized geologic maps. Some of the parent units are described here in this Description of Map Units; all are described in the Description of Database Units in the summary pamphlet that accompanies this Open-File Report.*

REFERENCES CITED

Bishop, C. C., compiler, 1963, Geologic map of California; Needles sheet: California Division of Mines and Geology, scale 1:250,000.

Bull, W.B., 1991, Geomorphic responses to climatic change: New York, Oxford University Press, 326 p.

Carter, J.N., Luyendyk, B.P., and Terres, R.R., 1987, Neogene clockwise tectonic rotation of the eastern Transverse Ranges, California, suggested by paleomagnetic vectors: Geological Society of America Bulletin, v. 98, p. 199-206.

Hope, R. A., 1966, Geology and structural setting of the eastern Transverse Ranges, southern California [Ph.D. thesis]: Los Angeles, University of California, 158 p.

Hope, R.A., 1969, The Blue Cut fault, southeastern California, in Geological Survey Research 1969: U.S. Geological Survey Professional Paper 650-D, p. D116-D121.

James, E.W., 1989, Southern extension of the Independence dike swarm of eastern California: Geology, v. 17, no. 7, p. 587-590.

McFadden, L.D., 1988, Climatic influences on rates and processes of soil development in Quaternary deposits of southern California, *in* Reinhardt, J. and Sigleo, W.R., eds., Paleosols and weathering through geologic time: Principles and applications: Geological Society of America Special Paper 216, p. 153-177.

Munsell Color, 1975, Munsell soil color charts, 1975 edition: Baltimore, Maryland, Macbeth Division of Kollmorgen Corporation.

Powell, R.E., 2001a, Geologic map and digital database of the Conejo Well 7.5 minute quadrangle, Riverside County, California, version 1.0: U.S. Geological Survey Open-File Report 01-31, 18 p., scale 1:24,000, http://geopubs.wr.usgs.gov/open-file/of01-31/.

Powell, R.E., 2001b, Geologic map and digital database of the Porcupine Wash 7.5 minute quadrangle, Riverside County, California, version 1.0: U.S. Geological Survey Open-File Report 01-30, 18 p., scale 1:24,000, http://geopubs.wr.usgs.gov/open-file/of01-30/.

Powell, R.E., 2002, Geologic map and digital database of the Pinto Mountain 7.5 minute quadrangle, Riverside County, California, version 1.0: U.S. Geological Survey Open-File Report 02-xxx, 34 p., scale 1:24,000, http://geopubs.wr.usgs.gov/open-file/of02-xxx/.

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

Wooden, J.L., Tosdal, R.M., Howard, K.A., Powell, R.E., Matti, J.C., and Barth, A.P., 1994, Mesozoic intrusive history of parts of the eastern Transverse Ranges, California: preliminary U-Pb zircon results: Geological Society of America Abstracts with Programs, v. 26, no. 2, p. 104-105.