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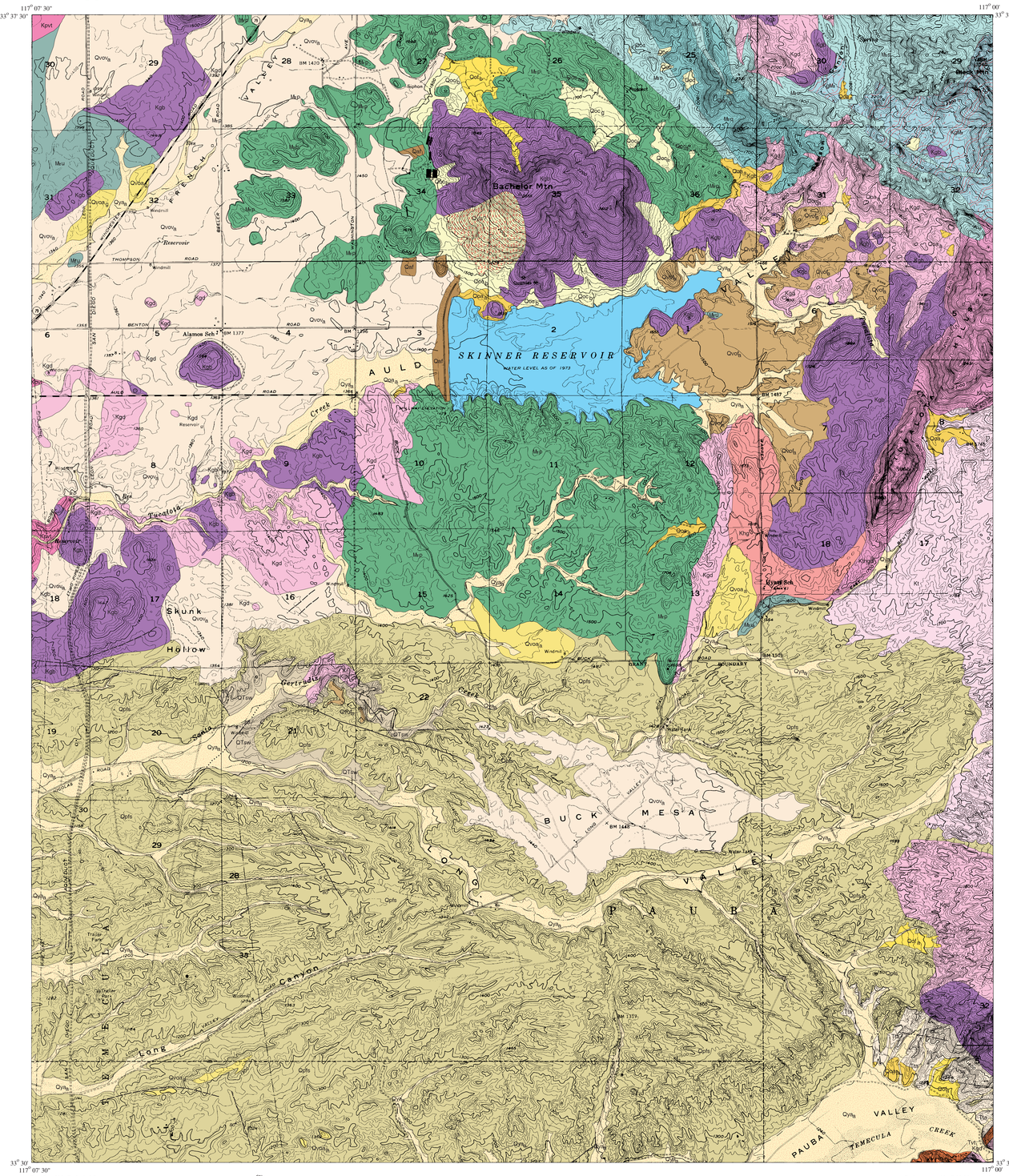


Base from U.S. Geological Survey
7.5' Bachelor Mountain quadrangle, 1973
Polyconic projection

GN MN ← 14.5°

SCALE 1:24,000
1 0 1 MILE
1 .5 0 1 KILOMETER
CONTOUR INTERVAL 20 FEET

Geology mapped by D.M. Morton and M.P. Kennedy, 1991, 1995-98

# GEOLOGIC MAP OF THE BACHELOR MOUNTAIN 7.5' QUADRANGLE, RIVERSIDE COUNTY, CALIFORNIA

**Version 1.0**

**By**

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## CORRELATION OF MAP UNITS

## DESCRIPTION OF MAP UNITS

**VERY YOUNG SURFICIAL DEPOSITS**—Sediment recently transported and deposited in channels and washes, on surfaces of alluvial fans and alluvial plains, and on hillslopes. Soil-profile development is non-existent. Includes:

Qaf — **Artificial fill (late Holocene)**—Deposits of fill resulting from human construction, activities; includes compacted engineered and noncompacted nonengineered fill. Most large deposits are mapped, but in some areas, no deposits are shown. Chiefly related to dam at Skinner Reservoir

**YOUNG SURFICIAL DEPOSITS**—Sedimentary units that are slightly consolidated to cemented and slightly to moderately dissected. Younger surficial units have upper surfaces that are capped by slight to moderately developed pedogenic-soil profiles (A/C to A/AC/$B_{kmbk}$/$C_{ca}$ profiles). Includes:

Qya — **Young alluvial channel deposits (Holocene and latest Pleistocene)**—Fluvial deposits along canyon floors. Consists of unconsolidated sand, silt, and clay-bearing alluvium

Qyls — **Young landslide deposits (Holocene and latest Pleistocene)**—Restricted to coherent, probable landslide on southwest side of Bachelor Mountain. Unit is monolithologic, composed of anomolously broken gabbro. Has poorly developed slide morphology

**OLD SURFICIAL DEPOSITS**—Sedimentary units that are moderately consolidated and slightly to moderately dissected. Older surficial deposits have upper surfaces that are capped by moderately to well-developed pedogenic soils (A/AB/B/$C_{ca}$ profiles and Bt horizons as much as 1 to 2 m thick and maximum hues in the range of 10YR 5/4 and 6/4 through 7.5YR 6/4 to 4/4 and mature Bt horizons reaching 5YR 5/6). Includes:

Qof — **Old alluvial fan deposits (late to middle Pleistocene)**—Reddish brown, gravel and sand alluvial fan deposits; indurated, commonly slightly dissected. In places, includes thin alluvial fan deposits of Holocene age

Qoa — **Old alluvial channel deposits (late to middle Pleistocene)**—Fluvial sediments deposited on canyon floors. Consists of moderately indurated, generally slightly dissected gravel, sand, silt, and clay-bearing alluvium. Locally capped by thin, discontinuous alluvial deposits of Holocene age

Qoc — **Old colluvial deposits (late to middle Pleistocene)**—Colluvial deposits on hillsides and at the bases of slopes. Ranges from rubble to sand; mostly cobble-sized clasts. Unconsolidated to slightly indurated. Restricted largely to Bachelor Mountain area

**VERY OLD SURFICIAL DEPOSITS**—Sediments that are slightly to well consolidated to indurated, and moderately to well dissected. Upper surfaces are capped by moderate to well developed pedogenic soils (A/AB/B/$C_{ca}$ profiles having Bt horizons as much as 2 to 3 m thick and maximum hues in the range 7.5YR 6/4 and 4/4 to 2.5YR 5/6)

Qvof — **Very old alluvial fan deposits (middle to early Pleistocene)**—Mostly well-dissected, well-indurated, reddish-brown alluvial fan deposits. Grain size chiefly sand and gravel. Extensively developed in upper part of Auld Valley

Qvoa — **Very old alluvial channel deposits (middle to early Pleistocene)**—Fluvial sediments deposited on broad canyon floors. Consists of moderately to well-indurated, reddish-brown, mostly very dissected gravel, sand, silt, and clay-bearing alluvium. In places, includes thin, discontinuous alluvial deposits of Holocene age

Qvov — **Very old alluvial valley deposits (middle to early Pleistocene)**—Fluvial sediments deposited on broad canyon floors. Consists of moderately to well-indurated, reddish-brown, mostly very dissected gravel, sand, silt, and clay-bearing alluvium. In places, includes thin, discontinuous alluvial deposits of Holocene age

**Pauba Formation (Pleistocene)**—Siltstone, sandstone, and conglomerate. Named by Mann (1955) for exposures of in Rancho Pauba area about 3.2 km southeast of Temecula. Vertebrate fauna from Pauba Formation are of late Irvingtonian and early Rancholabrean ages (Reynolds and Reynolds, 1990a; 1990b). Includes two informal members; a sandstone member and a fanglomerate member; only the sandstone member occurs in quadrangle

Qpfs — **Sandstone member**—Brown, moderately well-indurated, cross-bedded sandstone containing sparse cobble- to boulder-conglomerate beds

**Sandstone and conglomerate of Wildomar area (Pleistocene and Pliocene)**—Sandstone and conglomerate unit unconformably overlain by Pauba Formation (Kennedy, 1977). Informally designated Sandstone and conglomerate of Wildomar area by Morton (1999). Lower part yields vertebrate fauna of late Blancan age, 2 to 3 Ma; upper part yields fauna of Irvingtonian-age, less than 0.85 Ma (Reynolds and Reynolds, 1990a, 1990b; Reynolds and others, 1990). At Chaney Hill in Murrieta area, unit contains 0.7 Ma Bishop ash (Merriam and Bishoff, 1975). Estimated maximum thickness is 75 m. Includes informal subdivisions, only upper unit, sandstone unit occurs in quadrangle:

QTsw — **Sandstone unit**—Restricted here to small area along Santa Gertrudis Creek. Friable, pale yellowish-green, medium-grained, caliche-rich sandstone. Correlation with unit in Murrieta area is probable but not positive

Tta — **Temecula Arkose (Pliocene)**—Mainly pale greenish-yellow, medium- to coarse-grained, indurated sandstone. Includes thin discontinuous beds of tuffaceous sandstone, siltstone, and claystone, and some pebble and coarser conglomerate beds having locally derived clasts. Named by Mann (1955) for exposures of nonmarine fluvial sandstone exposed southeast of Temecula. Kennedy (1977) assigned unit late Pliocene Blancan IV-V mammal age (2.2 to 2.8 My) based on vertebrate assemblages collected in the Vail Lake quadrangle. Assemblages include *Nannippus*, *Hypolagus*, *Tetramerys*, *Equus*, and *Odocoileus* (Golz, and others, 1977). Later work establishes first occurrence of Tetramers as Irvingtonian I rather than late Blancan (Woodburne, 1987), placing Temecula Arkose age nearer 1.9 Ma (late Pliocene) than 2.2 Ma. Microtine fauna from unit in Radec area, about five miles east of Santa Ana quadrangle, is considered to have age of 4.6 Ma (Blancan I) (Repenning, 1987). Thickness of the Temecula Arkose ranges from 90 to over 550 m (Kennedy, 1977). In Batchelor Mountain quadrangle, restricted to north side of Pauba Valley

Tvt — **Basalt of Temecula area (Miocene)**—Vesicular basalt underlies small area in southeast corner of quadrangle on both sides of Temecula Creek. Extends to scattered exposures of basalt northeast of Temecula, and a small exposure of vesicular basalt within valley area of Elsinore Fault zone near in the Murrieta quadrangle (Mann, 1955; Kennedy, 1977; Hull, 1990). East of Temecula scattered exposures of vesicular basalt include apparent dissected cinder cone and scattered volcanic bombs (Mann, 1955)

***Rocks of the Peninsular Ranges batholith***

Kfhgd — **Granodiorite of Tucalota Hills (Cretaceous)**—Elongate pluton comprised of massive, light-colored biotite granodiorite. Informally named here for Tucalota Hills in eastern part of quadrangle. Erosionally resistant compared to nearby plutons; forms prominent ridge. Included within Woodson Mountain granodiorite by Larsen (1948)

**Paloma Valley Ring Complex (Cretaceous)**—Composite ring dike intrusion. Named and described by Morton and Baird (1976) for exposures in Paloma Valley area. Here found only at western edge of quadrangle. Main part of composite body lies to west and northwest. Included within Woodson Mountain granodiorite and San Marcos gabbro by Larsen (1948). Zircon ages of rock from atypical hornblende-bearing granodiorite from western part of older dike is 121 $Ma_{id}$ and 118.5 $Ma_{ip}$ (pers comm W. Premo). $^{40}Ar/^{39}Ar$ age of hornblende 117.7 Ma and biotite 118.8 Ma (pers comm L. Snee). In Bachelor Mountain quadrangle, includes:

Kpvt — **Tonalite**—Foliated biotite-hornblende tonalite. Small areas underlain by foliated tonalite of the easternmost part of the ring complex is located in the northwestern corner of the quadrangle

***Generic Cretaceous granitic rocks of the Peninsular Ranges batholith***

Kgd — **Granodiorite, undifferentiated (Cretaceous)**—Biotite and hornblende-biotite granodiorite, undifferentiated. Most is massive and medium grained

Kt — **Tonalite, undifferentiated (Cretaceous)**—Gray, medium-grained biotite-hornblende tonalite, typically foliated. Western edge of large body is exposed along the eastern margin of the quadrangle and small area along Tucalota Creek at west margin of quadrangle is underlain by tonalite

Kgb — **Gabbro (Cretaceous)**—Mainly hornblende gabbro. Includes San Marcos gabbro of Larsen (1948). Typically brown-weathering, medium-to very coarse-grained hornblende gabbro; very large poikilitic hornblende crystals are common, and very locally gabbro is pegmatitic. Much is quite heterogeneous in composition and texture. Includes noritic and dioritic composition rocks

Khg — **Heterogeneous granitic rocks (Cretaceous)**—Includes a wide variety of heterogeneous granitic rocks. Mostly of granodioritic and tonalitic composition. Limited in quadrangle to southeast of Skinner Reservoir.

***End of rocks of the Peninsular Ranges batholith***

Mzu — **Mesozoic metasedimentary rocks, undifferentiated (Mesozoic)**—Wide variety of low-to high-metamorphic grade metasedimentary rocks. Most occurrences include biotite schist

Mzq — **Quartz-rich rocks (Mesozoic)**—Quartzite and quartz-rich metasandstone. Most is massive, but where present, layering represents extreme transposition

Mzp — **Phyllite (Mesozoic)**—Fissle black phyllite. Commonly has sheen produced by very fine-grained white mica on s-surface; locally contains small elongate prisms of fine-grained white mica, which may be pseudomorphs after chiastolite

Mzs — **Schist (Mesozoic)**—Biotite schist, in part gradational with phyllite. Lower metamorphic-grade rocks, consist of andalusite-biotite schist. Higher metamorphic-grade rocks, include cordierite biotite schist, and highest metamorphic-grade rocks are sillimanite schist, and less commonly garnet bearing schist

KgMz — **Intermixed Mesozoic schist and Cretaceous granitic rocks (Mesozoic)**—Wide variety of Mesozoic schist and related metamorphic rocks mixed with granitic rocks ranging in composition from monzogranite to quartz diorite. Most granitic rocks are tonalite composition

On some SCAMP geologic map plots, including the Bachelor Mountain 7.5' quadrangle, characteristic grain size information is displayed using subscripted alpha characters (e.g., $Qyf_g$, $Qov_{ls}$, after the unit label), where the characters conform to the following definitions:

a - arenaceous; sand or sand bearing (very coarse sand through very fine sand)
b - boulders or containing boulders (>25mm)
g - gravel or containing gravel (cobble through granule gravel)
s - silt or silty
c - clay or clay bearing
m- marl
p - peat

Where a unit label has more than one subscripted character, in all cases, the first character modified the second (e.g., $Qyf_{ag}$ indicates arenaceous gravel).

In the **Description of Map** Units, the Ma following U/Pb ages has an attached subscript; $Ma_{id}$ for isotope dilution analyses, and $Ma_{ip}$ for ion probe analyses.

**Contact**—Generally located within ±15 meters

70 — **Fault**—High angle. Solid where located within ±15 meters, dashed where located within ±30 meters, dotted where concealed. Arrow and number indicate measured dip of fault plane.

**Strike and dip of beds**

70 — **Inclined**

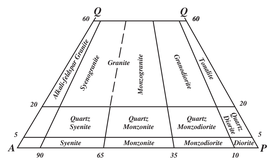
**Strike and dip of metamorphic foliation**

70 — **Inclined**

**Vertical**




***SURROUNDING 7.5' QUADRANGLES***




Classification of plutonic rock types (from IUGA, 1973, and Streckeisen, 1973). A, alkali feldspar; P, plagioclase feldspar; Q, quartz.

LOCATION MAP

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, firm, or product names in this publication is for descriptive purposes only and does not imply endorsement by the U.S. Government.

This map was printed on an electronic plotter directly from digital files. Dimensional calibration may vary between electronic plotters and between X and Y directions on the same plotter, and paper may change size due to atmospheric conditions; therefore, scale and proportions may not be true on plots of this map.

Digital files available on World Wide Web at http://geopubs.wr.usgs.gov/open-file/of03-103/

## GEOLOGIC SUMMARY

The Bachelor Mountain quadrangle is located in the southern Perris block area of the Peninsular Ranges Province (see location maps). Internally, the Perris block is a relatively stable area located between the Elsinore and San Jacinto Fault zones.

In contrast to the rest of the quadrangle, the southern half is underlain almost entirely by young sedimentary units, chiefly the Pauba Formation of Pleistocene age. The Pauba Formation largely consists of well-indurated sandstone containing sparse cobble-to boulder conglomerate beds. It is eroded into a gentle badlands topography in most of its extent. Remnants of scattered, discontinuous alluvial deposits suggest the Pauba Formation was covered by relatively thin younger Pleistocene sediments. The most extensive remnant of these younger deposits forms a surface of low relief at Buck Mesa, just north of Long Valley.

The northern half of the quadrangle is underlain by Mesozoic metasedimentary rocks that are intruded by plutonic rocks of the Cretaceous Peninsular Ranges batholith. The western part of these metamorphic rocks are mainly phyllite, grading eastward into quartzitic and schistose rocks. Metamorphic grade increases eastward also, to biotite, cordierite-biotite, and sillimanite schist.

The oldest batholithic rocks in the quadrangle are massive hornblende gabbro including the large body underlying Bachelor Mountain. Large masses of gabbro are included in granodiorite and tonalite plutons east of Bachelor Mountain. In the northwestern part of the quadrangle is the southeastern part of the Paloma Valley Ring complex. This complex makes up much of the northern part of the Murrieta quadrangle and the southern part of the Romoland quadrangle. In the Bachelor Mountain quadrangle, rocks of the complex are limited to foliated tonalite which is the most mafic part of the complex. East of Skinner Reservoir (Lake Skinner) underlying the Tucalota Hills, is a series of north-trending massive-textured granodiorite plutons informally termed the granodiorite of Tucalota Hills (Morton, 1999).

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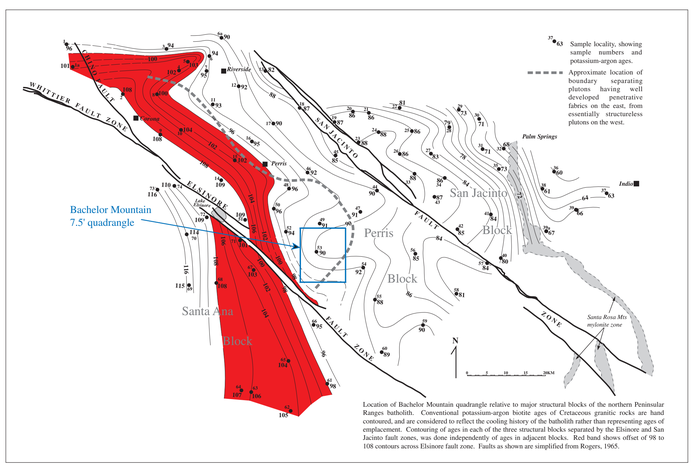


Location of Bachelor Mountain quadrangle relative to major structural blocks of the northern Peninsular Ranges batholith. Conventional potassium-argon biotite ages of Cretaceous granitic rocks are hand contoured, and are considered to reflect the cooling history of the batholith rather than representing ages of emplacement. Contouring of ages in each of the three structural blocks separated by the Elsinore and San Jacinto fault zones, was done independently of ages in adjacent blocks. Red band shows offset of 98 to 108 contours across Elsinore fault zone. Faults as shown are simplified from Rogers, 1965.