

Coordinate System: Universal Transverse Mercator, Zone 11N North American Datum 1927 Topographic base from U.S. Geological Survey Black Mountain 7.5-minute Quadrangle, 1991 Shaded relief image derived from USGS 1/3 arc-second National Elevation Dataset (NED).

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Dotted Lines Represent 20-Foot Contours National Geodetic Vertical Datum of 1929

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California Geological Survey Preliminary Geologic Map 21-02, v. 2.0, scale 1:24,000".

Publication Title: "Preliminary geologic map of the Black Mountain 7.5' Quadrangle, Los Angeles and Ventura counties, California:

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Authorship Documentation and Product Limitations.

	SURFICIAL UNITS
af	Artificial fill and disturbed areas (Holocene, historic)—Consists of anthropogenic deposits of earth-fill soils derived from local sources. Mapped primarily along Interstate 5 and near the Pyramid Lake reservoir, including the dam embankment fill overlying Posey Canyon Shale at Piru Gorge.
Qw	Wash deposits (late Holocene) —Unconsolidated sand, gravel, cobbles, and boulders deposited in recently active stream channels. Deposits are generally derived from local bedrock or reworked from other local Quaternary sources.
Qf	Subject to localized reworking and new sediment deposition during storm. Modern alluvial fan deposits (late Holocene) —Unconsolidated to weakly consolidated, poorly sorted, sand, gravel, cobble, and boulder deposits with intermixed silt forming active, essentially undissected, alluvial fans, Includes small
	to large cones at the mouths of stream canyons and broad aprons of coarse debris adjacent to mountain fronts. Clasts are derived from local up-slope sources and typically unweathered with little to no oxidation. Unit includes local poorl
Qa	Modern alluvium (late Holocene)—Unconsolidated to weakly consolidated, mostly undissected, sand, silt, and pebble to cobble gravel recently deposited parallel to localized stream valleys and/or spread more regionally onto alluvial
Qpa	plains of larger river valleys. Ponded alluvium (Holocene)—Unconsolidated to weakly consolidated, moderately sorted and bedded sand and silt
Qls	with minor gravel ponded upstream of multiple landslide failures. Landslide deposits (Holocene to late Pleistocene) —Unconsolidated to moderately well-consolidated jumbled rock debris consisting of surficial failures resulting from soil and rock creep, debris flows, and large-scale rotational
	rockslides generally sourced from underlying material. Recognizable by topographic expression or chaotic internal structure; queried where landslide existence is questionable.
Qya	Younger alluvium (Holocene to late Pleistocene)—Unconsolidated thin- to thick-bedded gravel. Deposited in canyou areas, below the distal ends of Qyf and in point bar and overbank settings associated with active stream channels. Locally more than one level of younger alluvium is present.
Qyf	Younger alluvial fan deposits (middle Holocene to late Pleistocene) —Unconsolidated to weakly consolidated, silty and coarse- to very coarse-grained sand with pebbles and cobbles; moderately to well-stratified. Surfaces are
Qof	 Older fan deposits (late to middle Pleistocene)—Slightly to moderately consolidated, poorly sorted, silty pebbly san to coarse gravel and boulder fan deposits. Fan surfaces are typically moderately dissected.
Qoa	Older alluvium (late to middle Pleistocene)—Unconsolidated to moderately consolidated, fluvial pebbly fine- to coarse-grained sand and silt along stream valleys and alluvial flats of larger stream drainages; exhibits weak
Qoa ₂ Qoa ₁	rubification. Unit is massive to moderately stratified and is moderately gullied to deeply dissected, commonly forming isolated deposits with terrace surfaces. Qoa likely includes alluvial deposits of several different ages, but individual levels are only differentiated where two different terrace levels (defined as upper older Qoa ₁ and lower younger Qoa ₂)
	occur step-wise immediately adjacent to each other above Piru Creek in Hardluck Canyon. Note that previous mapping suggested the two levels may have been the same unit offset by a splay of the San Gabriel Fault; however, field observations suggest they are two separate levels.
Qopa	Older ponded alluvium (late to middle Pleistocene) —Unconsolidated to moderately consolidated, fluvial, weakly stratified, fine- to coarse-grained sand with pebbles and cobbles and silt in hanging valley along San Gabriel fault in headwaters of Tin Cup Convon west of Puramid Lake. Unit is interpreted to be pended unstream of large older
	landslide that failed across the San Gabriel fault in the headwaters of Beartrap Canyon and blocked southeastern drainage from the hanging valley tributary. Alluvium accumulated until headward erosion generated a new drainage
Qols	 Bailey Homestead. Older Landslide deposits (late to middle Pleistocene)—Moderately consolidated jumbled rock debris and breccia.
	Recognizable by topographic expression or chaotic internal structure; Pleistocene age derived from degree of incision and cross-cutting relationships. Includes large landslide in headwaters of Beartrap Canyon that likely blocked drainage from hanging valley to northwest and buried older alluvium at toe (TQIs-12 of Weber, 1988, modified based on lidar).
Qvoa	Very old alluvium (early Pleistocene)—Moderately to well-consolidated, highly dissected silt, sand, and gravel with minor cobbles and clay along high ridgelines in the northeastern corner of the quadrangle; original alluvial surface
	degraded due to erosion and only weak to moderate rubification observed. TERTIARY SEDIMENTARY ROCKS OF RIDGE BASIN GROUP
	The Ridge Basin Group is comprised of four interrelated, late Miocene formations, the Castaic Formation, Violin Breccia, Peace Valley Formation, and Ridge Route Formation, and the latest Miocene to Pliocene Hungry Valley Formation, which cans deposition in Ridge Basin (Crowell 2003b). The late Miocene strata were deposited on the
	northeast side of the San Gabriel Fault as the basin sagged during progressive movement along a transtensional bend in the fault, forming a persistent basin northeast of the Frazier Mountain area. Sediment accumulated in the basin from a local source of dominantly Proterozoic gneissic basement rock southwest of the fault and more extensively
	from highlands to the northeast of the basin, and then migrated to the southeast away from the fault-rejuvenated depocenter during right-lateral-normal oblique slip along the San Gabriel Fault (Crowell, 2003c). The migratory
	it was not laid down in a single vertical stratigraphic pile. The basin strata are organized into a basal marine section (Castaic Formation), coarse basin-margin sediments along the San Gabriel Fault (Violin Breccia), fine-grained basin
	of and interfingering with the Peace Valley strata (Ridge Route Formation), and a capping terrestrial section (Hungry Valley Formation).
	The Castaic Formation, named by Crowell (1954a), is the oldest formation of the group and consists largely of marine turbidite sequences that began accumulating at about 11 Ma (Crowell, 2003b). It interfingers with Violin Breccia to the southwest and conformably underlies the nonmarine Ridge Route and Peace Valley Formations but is not exposed
	at the surface within the Black Mountain Quadrangle. Breccia and conglomerate of the Violin Breccia are exposed all along the northeast side of the San Gabriel Fault and interfinger to the northeast with both the Peace Valley and Ridge Route Formations. Clasts within the Violin Breccia are composed dominantly of gneiss with subordinate granite
	and diorite, and localized gabbro and anorthosite derived from the basement rock southwest of the San Gabriel Fault. Locally, the Violin Breccia also contains coeval landslide deposits that failed across the San Gabriel Fault and are now interleaved with breccia deposits, and two informal subunits of the Violin Breccia have been differentiated within the
	Black Mountain Quadrangle based on clast composition and grain size. The Violin Breccia was formally named by Crowell (1954a; 1955) and a nomenclature summary is provided in Link (1982a).
	The Peace Valley Formation consists dominantly of lacustrine basin shale and mudstone deposited along the axis of the basin that interfinger with the Violin Breccia to the southwest and with the coarser-grained Ridge Route Formation to the northeast (Link, 1982a; Crowell, 2003b). The Peace Valley Formation consists of five members distinguished either
	by intervening fingers of the Ridge Route Formation and/or by lithologic characteristics. The three upper members- the Cereza Peak Shale, Posey Canyon Shale, and Alamos Canyon Siltstone-are exposed within the Black Mountain Quadrangle. Peace Valley "beds" were initially described by Crowell (1950), informally raised to formational status by
	Crowell (1964) and formalized by Dibblee (1967), as summarized by Link (1982a). The Cereza Peak Shale was first described by Shepard (1961) and subsequently by Smith (1981), and then formally defined by Link (1982a). The Pose Canyon Shale was described in theses by Shepard (1961) and Irvine (1975) and then formally defined by Link (1982a).
	The Alamos Canyon Siltstone was formally defined by Link (1982a). The Ridge Route Formation is composed primarily of about 9,000 m of terrestrial to shallow lacustrine/shoreline facie
	basin and locally extending southwestward across the basin axis to the Violin Breccia. The Violin Breccia was named by Crowell (1954a) for coarse beds of breccia and conglomerate with clasts up to 2 m in diameter and composed almo
	Ridge Route Formation consist dominantly of crystalline basement rock derived from the northeast. Fingers that exten to the southwest all the way to the Violin Breccia are formally named members where they are separated by members of the Peace Valley Formation but are lithologically indictinguishable from strate on strike to the northeast within
	undifferentiated Ridge Route Formation. Two of the five formally defined members, the Piru Gorge Sandstone and the Apple Canyon Sandstone, and two informally defined units, the Liebre sandstone (which interfingers with the upper portion of the Apple Canyon Sandstone) and a distinctive local breecia unit, are exposed within the Black Mountain
	Quadrangle. The term Ridge Route Formation was first named in a thesis by Clements (1929) and formally published by Clements (1937), with the type section located east of the Black Mountain Quadrangle along the Old Ridge Route from south of Templin Highway to Liebre Mountain (Liek, 1982a). The Piru Gorge Sandstone was initially defined
	as a formation of the Ridge Basin Group by Axelrod (1950) but was re-defined as a member of the Ridge Route Formation by Link (1982a). The Apple Canyon Sandstone Member of the Ridge Route Formation was described in datail by Wood (1981) and Wood and Osherre (1982) and formally defined as a member of the Ridge Route Formation
	by Link (1982a). Faggioli (1952) informally defined the Liebre sandstone "formation" in his thesis and Sexton (1990) informally recommended lowering the status of this unit to member of the Ridge Route Formation in his thesis, and the usage is followed herein. Weber (1988) manued a distinctive coarse broasis unit near the base of the Liebre and the lower status of
	and this informal subunit is also adopted herein. The package of Violin Breccia, Peace Valley Formation, and Ridge Route Formation is capped by the Hungry Valley
	Formation, which in part extends southwest of the San Gabriel Fault. Hungry Valley strata are composed primarily of well sorted sandstone and interbedded conglomerate that were deposited primarily in fluvial and alluvial flood plain environments. The formation includes exotic clasts originally sourced dominantly from areas to the north and northeas
	which are now displaced many kilometers to the southeast along the San Andreas Fault. The lower member of the Hungry Valley Formation and two informal members of the lower member are mapped within the Black Mountain Quadrangle. Hungry Valley strata were first described briefly by Eaton (1939), and then formally described and named
	by Crowell (1950) based on a stratigraphic section exposed in Freeman Canyon. Crowell (1950) and Weber (1988) subdivided the Hungry Valley Formation based on various criteria including clast content. For the current map, two sub-units (Thlc and Thls) are locally recognized in the lower member following the mapping of Weber (1988)
	Hungry Valley Formation, lower member (Pliocene to late Miocene) —At the type section at Freeman Canyon in Ridge Basin, the nonmarine lower member of the Hungry Valley Formation has an approximate maximum thickness
	derived from elevated terrain to the north, now displaced to the southeast by the San Andreas Fault (Crowell 1982a; 1982b; Link, 1982; 1983; 2003; Ramirez, 1983; 1984; Weldon and others, 1993; Cohen, 2016). The Hungry Valley
	rormation was deposited dominantly in a fluvial to alluvial floodplain environment with local overbank deposition (Loeffler and Bennett (1990). The lower member overlies members of the Ridge Route Formation in the type area; the contact is typically conformable and locally interfingering but may locally be unconformable and overlap some folds
	to the east in the Apple Canyon Sandstone Member. Unlike the underlying Peace Valley and Ridge Route Formations, a younger section of the lower Hungry Valley Formation extends to the southwest side of the San Gabriel Fault, overlapping an interpreted paleo-erosion/weathering surface. Crowell (1982a; 1982b) initially interpreted this section
	to overlap and cap movement on the San Gabriel Fault; however, Weber (1988) maps the fault cutting the formation and the map by Crowell (2002) illustrates the fault as cutting part of the formation. Deposition of the Hungry Valley Formation has been associated temporally with the transition of plate boundary movement from the San Gabriel Fault
	to the Mojave Strand of the San Andreas Fault (e.g. Crowell, 1982a; 2003c). Crowell assigned a Pliocene age for the Hungry Valley Formation based on interpreted ages of a few fragmented fossil
	Kinsey Ranch mammalian fauna collected from the upper portion of the underlying Peace Valley Formation (Miller an Downs, 1974), magnetostratigraphy of the Ridge Route Group (Ensley and Verosub, 1982), and estimated depositional rates of Hungry Valley Formation strate (Crease 1, 1082b). How are a filler and the strate of the strate of Hungry Valley Formation strate (Crease 1, 1082b).
	in the Lebec Quadrangle to the north was reportedly sourced from the 6.1 ma Silver Peak volcanic field in Nevada (Nourse and others, 2020; pers. com. Elmira Wan, USGS Tephrochronology Lab, 2018). This correlation indicates the
ThI	base of the lower member extends down into late Miocene time. Deposition of the upper member of the formation may extend into Pleistocene time, but this member is not exposed in the Black Mountain Quadrangle. Hungry Valley Formation, undivided lower member — The Hungry Valley Formation is composed of white-
	to light pinkish-gray, fine- to coarse-grained, poorly to moderately sorted arkosic sandstone and conglomeratic sandstone with local interbeds and lenses of pebble to cobble conglomerate with uncommon boulders; contains local interbeds of pale reddish-brown and olive-gray mudstone and local claystone; the olive-gray mudstone
	interbeds are more prominent in the basal Thic portion of the member; weakly to locally well cemented. Conglomerate clasts range from rounded to subangular, and composition is variable laterally and stratigraphically, however, clasts are composed primarily of felsic intrusive rock and felsic to intermediate value intermedintermediate value intermediate value intermediate
	rock with subordinate, but widespread, gneiss and weakly indurated, pink to light-purple tuff; locally diagnostic lithologies including gray and tan quartzites, vesicular basalt, metamorphosed gabbro, hornfels, schist, and anorthosite are reported as well (e.g. Crowall, 1982b; Loeffler and Romott, 1990)
This	Hungry Valley Formation, fine-grained facies of lower member —Pale-brown to olive clayey siltstone, sandstone, and conglomeratic sandstone (TQhs of Weber, 1988). Clasts are commonly subangular and derived
	primarily from local granitic sources to the west in contrast with common exotic clasts in typical lower member conglomerates. Section along northwestern segment of the San Gabriel fault contain distinctive beds of bluish/ olive-gray to reddish-gray clayey siltstone and fine-grained sandstone; interpreted by Weber (1988) to be offset
Thic	right laterally along the San Gabriel Fault to exposures southwest of the fault on the Alamo Mountain Quadrangle Hungry Valley Formation, basal facies of lower member —Basal member of formation (TQhc of Weber, 1088), transitional facies
	1988); transitional factes consisting of white sandstone typical of the Hungry Valley Formation interbedded with olive-gray to brown silty sandstone, siltstone, and mudstone typical of the underlying Apple Canyon Sandstone member of the Ridge Route Formation. Basal contact interfingers downward stratigraphically to the east with the Apple Canyon Sandstone and is many lot to the sand stratigraphically to the east with
	up Aury Carryon Sangstone and is mapped at lowest significant white sandstone bed: contact is likely locally

DESCRIPTION OF MAP UNITS

unconformable to the east where folds in the Apple Canyon Sandstone terminate westward into a homoclinal structure in the Hungry Valley Formation. The lower beds interfinger to the west with finer-grained strata assigned to the Tvbc member described below.

PRELIMINARY GEOLOGIC MAP OF THE BLACK MOUNTAIN 7.5' QUADRANGLE LOS ANGELES AND VENTURA COUNTIES, CALIFORNIA

VERSION 2.0

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> 2021 (Revised 2024)





	MAP SYMBOLS
	Contact between map units—Solid where accurately located; long dash were approximately located; short dash where inferred; dotted where concealed; queried where identity or existence is uncertain
?	Fault—Solid where accurately located; long dash were approximately located; short dash where inferred; dotted where concealed; queried where identity or existence is uncertain. Arrow and number indicate direction and angle of dip of fault plane.
▲▲▲.▲.?.▲.	Thrust Fault—Barbs on upper plate; solid where accurately located; long dash where approximately located; dotted where concealed; queried where identify or existence is uncertain. Arrow and number indicate direction and angle of dip of fault plane
	Syncline (sedimentary rock) or synform (gneiss)—Solid where accurately located, long dash where approximately located, dotted where concealed; queried where identity or existence is uncertain; arrow showing plunge direction
	Anticline—Solid where accurately located, long dash where approximately located, dotted where concealed; queried where identity or existence is uncertain; arrow showing plunge direction
	Tuff Marker Bed
	Shale/Siltsone Marker Bed
	Sandstone Marker Bed
	Conglomerate Marker Bed
	Landslide—Arrows indicate principal direction of movement. Where mapped as a landslide complex, adjacent defined slides have different relative ages and/or failure types
٠	U-Pb Geochronology point (one sample)
	Reservoir
	Strike and dip of geologic structure; number indicates dip angle in degrees. 25 Bedding, top direction inferred 45 Upright bedding, top direction known 70 Approximate bedding 40 Igneous foliation \oplus Horizontal bedding 50 Metamorphic foliation 85 Overturned bedding 10 Shear



ilmenite clusters, and coronas of biotite around garnet and magnetite. The rock has a complex history, suggesting metamorphism from an older gneiss and has been correlated with Mendenhall Gneiss of the western San Gabriel Mountains (Ehlig and Crowell, 1982; Crowell, 2003a); Powell (1993) correlated gneisses in the Frazier Mountain area with his Hexie Mountains assemblage. Silver (1971) reported a U-Pb isotopic age of 1,750 to 1,680 Ma from zircons in the type area of the Mendenhall gneiss and Barth and others (2001) reported an age of $1,789 \pm 61$ Ma; Nourse and others (2020) reported U-Pb isotopic ages from zircons of 1.737 ± 35 Ma for biotite paragnesis on the west side of Frazier Mountain and $1,634 \pm 33$ Ma for the splotchy banded, granulitic gneiss on the east side of Frazier Mountain (both upper intercept dates). New U-Pb dating on zircons from the gneiss exposed west of Hardluck Canyon produced an upper intercept age of $1,809 \pm 36$ Ma (with 2% external error), within the range reported for Mendenhall Gneiss and somewhat older than gneisses at Frazier Mountain; the lower intercept produced an age of 99.2 ± 4 Ma, which may be indicative of metamorphism during Cretaceous plutonism (pers. com. Josh Schwartz, CSUN Geochronology Lab, May, 2021). Gneiss in the Black Mountain Quadrangle is locally intruded by gabbro and anorthosite (Ygn), Late Cretaceous granitoids (Kgr), numerous thin, gently inclined felsic dikes, and possibly by Proterozoic augen gneiss, but no mappable bodies of augen gneiss were recognized within the quadrangle. Contact with Kgr in Buck Canyon area is

gneiss contains diagnostic cream- to bluish-colored feldspars, perthite, sphene mantling titaniferous magnetite and

complexly intruded and gneiss is locally migmatized.

of the San Gabriel Fault in the area south of the Tlga gabbro-anorthosite landslide was mapped by Weber (1988) and Crowell (2002) as intact bedrock; both maps invoke a cross fault in this area to explain the apparent deflection in the fault trace to encompass this bedrock southwest of the main trace. Based on confirmation of the Piru strand west of the Tlga mass to the north and subdued topographic expression of the gneiss in this area, it is reinterpreted as a second slide mass composed of gneiss that failed across the fault in late Miocene time prior to Tlga and is also interleaved with

Landslide composed of gneiss, interleaved with Tvbp —Gneissic rock along the northeast side of the Piru strand

Violin Breccia.

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Preliminary Geologic Maps available from:



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High Resolution Orthoimagery: DWR, 2020: 2015 November 6-7, San Gabriel Fault zone and Castaic Reservoir. Lidar 1 meter DEM mosaic: OCM Partners, 2020: 2015 - 2016 LARIAC Lidar DEM: Los Angeles region, CA, https:// www.fisheries.noaa.gov/inport/item/55257 and OCM Partners, 2020: 2018 USGS Lidar: Southern CA Wildfires, https://www.fisheries.noaa.gov/inport/item/58709 Lidar 30cm DEM mosaic: DWR, 2020: Pyramid Lake Reservoir bathymetry (2017) and airborne lidar (2015). Lidar 30cm DEM mosaic: DWR, 2020: 2015 November 6-7, San Gabriel Fault zone and Castaic Reservoir. U.S. Department of Agriculture, 2018 (2020), Farm Service Agency–Aerial Photography Field Office, National

Agriculture Imagery Program (NAIP), 60cm, resolution. http://datagateway.nrcs.usda.gov/ U.S. Geological Survey, Digital Orthophoto Quarter Quadrangle photos. (DOQQ and information concerning them can be obtained at http://earthexplorer.usgs.gov/)



scale: 1:12.000.



SOURCES OF MAP DATA 1. Crowell and others, 1982 2. Crowell, 2003 3. Sexton, 1990 4. Weber, 1988 5. Weber, 1991 Data sources that cover entire quadrangle Dibblee, 2002 Swanson and Valencia, 2024



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