

Topographic base from the U.S. Geological Survey Kenwood 7.5-minute Quadrangle, 1980 UTM Projection, Zone 10, North American Datum 1927

02 MIL

UTM GRID AND 1980 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

Scale 1:24,000

Contour Interval 40 Feet

Dotted Lines Represent 20 Foot Contours National Geodedic Vertical Datum of 1929



This geologic map was funded in part by the U.S. Geological Survey National Cooperative Geologic Mapping Program, STATEMAP Award no. 06HQAG0036

Note: The digital database for this project was compiled utilizing the best, readily available photogrammetric data for horizontal control. The County of Napa provided color orthophotos and digital topographic maps covering the northeast portion of the quadrangle from a 2002 survey by Towill, Inc. at a map scale of 1:2,400. The County of Sonoma provided B&W orthophotos covering the remainder of the quadrangle from a 2000 survey by Merrick & Company at a map scale of 1:2,400. Because the location of geologic contacts are tied to these surveys, they may not precisely fit with stream lines, contours, or other features shown on the less accurate digital raster graphic of the 1:24,000-scale USGS quadrangle used as the base for this presentation.



ł	Artificial fill (Holocene, historic) – May be engineered and/or non-engineered.
,	Artificial dam fill (Holocene, historic) – Earth dams, rock-fill dams, and embankments constructe
M	Infound water. Iodern stream channel deposits (Holocene <150 years) – Fluvial deposits within active, natural channels. Consists of loose alluvial sand, gravel, and silt.
E	Basin deposits (Holocene) – Sediment accumulated in topographic basins from slow-moving or s water. Consists of horizontally stratified sand, silt, and clay; may be interbedded with lobes of coarser alluvial deposits.
ŀ	Alluvial fan deposits (Holocene) – Sediment deposited by streams emanating from canyons onto valley floors. Consists of poorly to moderately sorted sand, silt, gravel, and occasionally clay.
ŀ	Alluvium, undivided (Holocene) – Alluvium deposited in fan, terrace, or basin environments which could not be readily separated for mapping. Typically consists of poorly to moderately so sand, silt, and gravel that form smooth geomorphic surfaces with little to no dissection.
S	Stream terrace deposits (Holocene) – Moderately well-sorted and bedded sand, gravel, silt, and deposited along creeks.
4	Alluvial fan deposits (latest Pleistocene to Holocene) – Moderately to poorly sorted deposits of gravel, silt, and clay mapped on gently sloping, fan-shaped, relatively undissected alluvial surfa
	gravel, silt, and minor clay mapped on relatively flat, undissected terraces where absolute age i uncertain.
ŀ	Alluvium, undivided (latest Pleistocene to Holocene) – Sand, gravel, silt and clay mapped in small valleys where separate fan, basin, terrace, and active stream channel units could not b delineated at the scale of mapping.
F	Fluvial gravels (Pleistocene) – Boulder gravel composed of predominantly Sonoma Volcanics, alt clasts of Franciscan debris do occur. Unit has distinctive reddish soil.
ŀ	Alluvial fan deposits (Pleistocene) – Sand, gravel, silt, and clay derived predominantly from Sond Volcanics. Mapped on gently sloping surfaces where Pleistocene age is indicated by greater dissection. Includes some deposits with reworked tuff and obsidian pebbles, lithologically simila to Glen Ellen Formation, but with morphological expression suggestive of more localized alluvia fan origins.
L	andslide deposits (Pleistocene to historic) – Includes deep-seated rock slides, earth flows, and debris flow deposits. Arrows indicate direction of movement; queried where existence is questi
	Dider alluvial deposits, undivided (early to late Pleistocene) – Moderately to deeply dissected a fan, stream terrace, or basin deposits. Topography often consists of gently rolling hills with little of the original planar alluvial surface preserved.
C	Glen Ellen Formation (Pliocene to Pleistocene) – Light-brown to yellowish-brown, interstratified y sand, silt, and reworked tuff. Sediments are mostly derived from Sonoma Volcanics, though per of Franciscan rock are common. Obsidian pebbles are characteristic of this unit. Tephra from to Glen Ellen Formation range from 3.2 Ma to slightly older than 2.5 Ma (Andrei Sarna-Wojcicki, w communications, 2003-2006).
ι	Jnnamed fluvial deposits (Pliocene to Pleistocene) – Cobbly gravels interstratified with sand, si minor clay. Previously mapped as Glen Ellen Formation (Weaver, 1949; Cardwell, 1958; Huffm Armstrong, 1980) and/or Huichica Formation (Fox and others, 1973; Fox and others, 1985). In some reworked tuff and sparse obsidian pebbles, but less than typical for the type locality of the Ellen Formation. Differentiated by the generally coarser composition and greater proportion of derived from Franciscan basement rocks, including cobbles and occasional boulders of chert si to that mapped along upper Santa Rosa Creek.
F	Fluvial and lacustrine sediments (Pliocene to latest Miocene) – Light-gray to brownish-gray and yellowish-brown weathered, poorly indurated sandstone, mudstone, pebble gravel. Clasts are from Franciscan basement and Tertiary volcanic sources. Distinctive clasts of laminated, siliced from the Claremont shale member of the Monterey Formation are present in some outcrops. To interbedded with this unit include the Pinole tuff (5.2 Ma), Mark West Springs tuff (<5 Ma to >4.3 Lawlor tuff (4.83 Ma), and Tuff of Napa (4.65 Ma). Earlier maps and reports (Weaver, 1949; Fo others, 1973; Huffman and Armstrong, 1980) show these sediments as Petaluma Formation or Formation (Fox and others, 1985); however, these sediments are probably unconformable with much younger than the Petaluma Formation in its type locality near Petaluma. Ts is interbedded to some Volcanics.
	Sedimentary deposits of uncertain age – Friable deposits of sandy gravel derived from volcanics interbedded tuffaceous sand, clay, and diatomite.
	Sandstone, gravel, mudstone, and diatomite (Pliocene?) – Only limited exposures observed alc Alamos Road. Sandstone and gravel is predominantly derived from pre-Tertiary basement. Dia is light brown, laminated, and fissile where weathered. Sediments underlay/interfinger(?) with t andesite of Sonoma Volcanics. May correlate with the Pliocene Fluvial and Lacustrine Deposit Humbug Creek of McLaughlin and others (2004).
5	Sonoma Volcanics (Pliocene to Miocene)
F	Putah Tuff (Pliocene) – Pumiceous ash-flow tuff and reworked tuff dated at 3.3 Ma.
1	Fuff of Napa (formerly called Healdsburg tuff) (Pliocene) – Pumiceous ash-flow tuff dated at 4.6 Commonly is a distinctive chocolate brown color with gray pumice fragments up to 2.5 cm in dia
	ntrusive rhyolite plugs and breccias
r	Mafic flows , undivided – Andesite, basaltic andesite, and basalt in massive flows and breccias, w
	intercalated tuff. May be in part equivalent to Tsmb or Tsms.
V	Velded tuff – Welded ash-flow tuff, with subordinate unwelded or partly welded tuff.
ŀ	Air-fall tuff – Fine-grained, interbedded air-fall and water-laid tuff and diatomaceous tuff. Light-gra white, and brown stained locally.
1	Tuff breccia – Tuff breccia with intercalated agglomerate and tuff.
S	Soda rhyolite of Sugarloaf Ridge – Light-gray, fine-grained or porphyritic, with phenocrysts of sar and anorthoclase. Frequently finely vesicular. Appears in part intrusive. Includes minor interla tuff and tuff-breccia.
2	Ash-flow tuff and flows – Ash-flow tuff, tuff breccia, water-lain tuff and agglomerate thinly interlaye mafic lava flows.
1	Fuff and breccia – Andesitic to dacitic ash-flow tuff, tuff breccia and some water-lain tuff. Includes deposits of agglomerate, and minor lava flows.
F	Rhyolite of Bennett Mountain – Massive flows and flow breccias of rhyolite and rhyodacite. Typic banded, with perlitic zones and some obsidian locally. Includes local deposits of silicic tuff and intrusions. In Annadel State Park, Ar-Ar dating of obsidian yielded an age of 4.51 to 4.54 ± 0.07 (McLaughlin and others, in press).
	Mafic flows of Bennett Mountain – Andesite, basaltic andesite, and basalt in massive flows and I with intercalated tuff and more silicic deposits locally. Mapping of Annadel State Park by Higgin includes subunits Tsbb - basaltic andesite flows and flow breccias distinguished by phenocrysts and augite; and Tsab - andesite flows and flow breccias distinguished by phenocrysts of hypers absence of olivine. Ar-Ar dating of flow rock in Annadel State Park yielded an age of 4.7 ± 0.03 (McLaughlin and others, in press).

GEOLOGIC MAP OF THE KENWOOD 7.5' QUADRANGLE SONOMA AND NAPA COUNTIES, CALIFORNIA: A DIGITAL DATABASE

Marc P. Delattre¹, David L. Wagner¹, Chris T. Higgins¹, Robert C. Witter², and Janet M. Sowers²

VERSION 1.0

Digital Database

Carlos I. Gutierrez¹ and Karen Toman-Sager¹

1. California Geological Survey 2. William Lettis & Associates, Inc., Walnut Creek, CA

DESCRIPTION OF MAP UNITS

- Earth dams, rock-fill dams, and embankments constructed to

locene <150 years) – Fluvial deposits within active, natural stream sand, gravel, and silt. t accumulated in topographic basins from slow-moving or standing

diment deposited by streams emanating from canyons onto alluvial noderately sorted sand, silt, gravel, and occasionally clay. vium deposited in fan, terrace, or basin environments

d for mapping. Typically consists of poorly to moderately sorted both geomorphic surfaces with little to no dissection. - Moderately well-sorted and bedded sand, gravel, silt, and clay

ene to Holocene) - Moderately to poorly sorted deposits of sand, ently sloping, fan-shaped, relatively undissected alluvial surfaces. ocene to Holocene) - Moderately to well-sorted and bedded sand, on relatively flat, undissected terraces where absolute age is

gravel composed of predominantly Sonoma Volcanics, although Unit has distinctive reddish soil. Sand, gravel, silt, and clay derived predominantly from Sonoma g surfaces where Pleistocene age is indicated by greater with reworked tuff and obsidian pebbles, lithologically similar

orphological expression suggestive of more localized alluvial storic) – Includes deep-seated rock slides, earth flows, and te direction of movement; queried where existence is questionable.

arly to late Pleistocene) – Moderately to deeply dissected alluvial sits. Topography often consists of gently rolling hills with little or none preserved.

sistocene) – Light-brown to yellowish-brown, interstratified gravel, ents are mostly derived from Sonoma Volcanics, though pebbles osidian pebbles are characteristic of this unit. Tephra from the 2 Ma to slightly older than 2.5 Ma (Andrei Sarna-Wojcicki, written

Pleistocene) – Cobbly gravels interstratified with sand, silt, and Glen Ellen Formation (Weaver, 1949; Cardwell, 1958; Huffman and ormation (Fox and others, 1973; Fox and others, 1985). Includes idian pebbles, but less than typical for the type locality of the Glen the generally coarser composition and greater proportion of clasts rocks, including cobbles and occasional boulders of chert similar Rosa Creek.

cene to latest Miocene) – Light-gray to brownish-gray and ndurated sandstone, mudstone, pebble gravel. Clasts are derived ary volcanic sources. Distinctive clasts of laminated, siliceous shale of the Monterey Formation are present in some outcrops. Tephra e Pinole tuff (5.2 Ma), Mark West Springs tuff (<5 Ma to >4.83 Ma), apa (4.65 Ma). Earlier maps and reports (Weaver, 1949; Fox and ong, 1980) show these sediments as Petaluma Formation or Huichica nowever, these sediments are probably unconformable with and ormation in its type locality near Petaluma. Ts is interbedded with

age – Friable deposits of sandy gravel derived from volcanics, with and diatomite.

atomite (Pliocene?) – Only limited exposures observed along Los avel is predominantly derived from pre-Tertiary basement. Diatomite where weathered. Sediments underlay/interfinger(?) with tuff and correlate with the Pliocene Fluvial and Lacustrine Deposits of others (2004).

burg tuff) (Pliocene) – Pumiceous ash-flow tuff dated at 4.65 Ma. brown color with gray pumice fragments up to 2.5 cm in diameter.

with intercalated rhyolitic tuff. May be in part equivalent to Tsrb. altic andesite, and basalt in massive flows and breccias, with

d air-fall and water-laid tuff and diatomaceous tuff. Light-gray to

ght-gray, fine-grained or porphyritic, with phenocrysts of sanidine vesicular. Appears in part intrusive. Includes minor interlayered

, tuff breccia, water-lain tuff and agglomerate thinly interlayered with

ash-flow tuff, tuff breccia and some water-lain tuff. Includes local lava flows.

sive flows and flow breccias of rhyolite and rhyodacite. Typically flow me obsidian locally. Includes local deposits of silicic tuff and possible Ar-Ar dating of obsidian yielded an age of 4.51 to 4.54 ± 0.01 Ma

ndesite, basaltic andesite, and basalt in massive flows and breccias, c deposits locally. Mapping of Annadel State Park by Higgins (1983) ndesite flows and flow breccias distinguished by phenocrysts of olivine ows and flow breccias distinguished by phenocrysts of hypersthene and flow rock in Annadel State Park yielded an age of 4.7 ± 0.03 Ma

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	af adf <mark>Qhc</mark>	Qhb (Qhf	Qha	Qht	Qf	Qt	Qa	Ols			
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			1501	Tsra	m Tsr	f						
								KJgv	sp – A fgc – K	Jfm	KJfs	S
Tsvt	Pumiceous ash-flow an lain tuff and agglome the Lawlor Tuff with a tephra from near top indicating ages betwe Bennett Valley Road, (Mankinen, 1972).	d minor a i rate. Teph in age of 4 of unit nort een 4.83 ai K-Ar datin	ir-fall to ra colle .83 Ma th of Be nd 5.02 ng of tul	uff – Le ected fr (McLa ennett \ 2 Ma (N if lower	ocally w rom a qu ughlin a Valley R IcLaugh r in the u	elded or larry nor nd other oad corr lin and o Init yield	partially thwest c rs, in pre relates w others, ir ed an ap	welded f Los Ala ss). So ith the tu press). pproxima	. Also ind amos Ro uth of An uff of Mar In the s ate age o	cludes s ad corre nadel St rk West ame vici f 5.66 ±	ome wa elates wi tate Par Springs inity nea 0.33 Ma	ater- ith k, ar a
Tsms	Mafic lava flows and int from vents along Sug and volcanic bombs.	rusions o arloaf Rido	f Suga ge. Inc	rloaf R ludes i	tidge (a nterbed	ge unce s of red-	e rtain) – and bro	Basaltic wn-stain	andesite ed tuff, s	e and ba coriace	salt eru ous bred	pted ccia,
Tsts	Lithic tuff breccia – Yelle some interbeds of we predominantly flow-ba several meters in dia andesitic flow rock lo	owish-gray ell-bedded anded rhyo meter and cally. Com	y to whi water-la blite. Lo vitroph monly v	te, mas ain tuff ower po ere to weathe	ssive or and age ortion of 1 meter. ers to for	crudely glomerat unit incl Also in m knobb	graded a te with o udes blo cludes th by outcro	ash-flow bsidian p cks of ba nin interk ps and p	tuff and to bebbles. anded rh beds/disp binnacles	tuff brec Lithics a yolite ex placed bl s.	cia, with are cceeding locks(?)	ו g ⊨of
Tsra	Rhyolite of Adobe Canyon – Glassy, gray to white rhyolite lava flows with well-developed, folded and contorted flow banding. K-Ar dated at 5.3 ± 0.2 Ma (Mankinen, 1972).											
Tsrf	Rhyolite flows – Pinkish quartz; usually with w	-purple to vell-develo	bluish-ç ped flov	gray, po w band	orphyriti ling. Ove	c rhyolite erlies or	e flows w interbed	vith pher ded with	ocrysts o Tsram.	of sanidi	ne and	
Tsram	Rhyolite of Arrowhead I breccias, and plugs. and/or silicified, inclu- Also includes scatter	Mountain(Along Trin ding rhyolit ed thin ma	?) – Hig ity Roa tic brec fic flows	ghly va d and l cias th s.	ariable so Nunns C at have	equence Canyon, been lar	e of light- most exp gely rep	colored, posures laced by	rhyolitic are seve opal and	flows, tu erely wea d chalce	uffs, athered dony.	
KJgv	Great Valley Sequence (I State Park, where it co mudstone, and occasi bedding.	Early Creta onsists of g onal sands	aceous iray to g stone.	s and L greenis Typical	_ate Jur sh-gray, lly broke	assic) – light-bro n and sł	- Limited wn weat neared, v	exposu hered, r with little	res in Su nicaceou or no pe	garloaf l is siltstoi ersistent	Ridge ne,	
	Franciscan Complex, Ce	ntral Belt	(Late C	Cretaco	eous to	Early J	urassic)					
KJfm	Franciscan mélange – To that forms a matrix arc map. Intact blocks and serpentinite, coherent with little trees or brus landslides, and has a o matrix.	ectonic mix ound more d slabs wit graywacke h. The sur characteris	cohere cohere hin the e, and e face is stic topo	onsistir nt rock matrix exotic r freque ograph	ng largel c masses include metamor ently disr y produc	y of pen s of vary altered phic roc upted by ced by re	etratively ring lithol mafic vo ks. The y soil cre esistant l	y sheare logy that lcanic rc unit is ty ep, shal plocks p	d argillite are mos ock (gree /pically g low earth rotruding	e and gra stly too s nstone), rass cov nflows, a from the	aywacke mall to chert, vered and large e sheare	∍ er ed
KJfs	Franciscan graywacke (L sandstone and occasion larger bodies of which similar to KJfm, it lacks mélange matrix.	Late Creta onal congle have beer s the abune	ceous omerate n mapp dance e	to Ear e. May ed sep of sma	ly Juras / also in/ arately. ller tecto	s sic) – C clude int Althoug onic bloc	Compose ercalate h structu ks and p	ed chiefly d chert a urally bro penetration	/ of thick- and greer oken and ve shear	-bedded nstone, s lithologi ing of th	lithic some ically e	
sp	Coherent rock masses that have been mapped separately Serpentinite – Variably serpentinized ultramafic rocks, including coarse bastite (pseudomorph after pyroxene) locally. Includes blocks within KJfm and larger fault-bounded bodies likely derived from the Coast Range Ophiolite.											
fgs	Greenstone – Variably altered basalt and other mafic volcanic rocks. Predominantly massive, occasionally vesicular, with pillow structure preserved at a few locations. Typically dark gray fresh; weathered dark brown to orange or reddish brown. Around Bald Mt., weathered a dark maroon.											
fgc	Chert and Greenstone – Greenstone is similar to fgs, but in close association with chert that could not be distinguished at map scale. Chert is typically red, and occasionally green or yellow. Quartz veins are common. Along Santa Rosa Creek in Mt. Hood County Park, includes large sections of highly folded ribbon chert with shale interbeds.											
fgw	Graywacke and metagra	ywacke										
		N	1AP S	YMBO	OLS							

	approximately located, queried where uncertain, dotted where concealed.
<u>† 27</u> ?.	Fault - Solid where accurately located, dashed where approximately located, dotted where concealed, queried where uncertain. Arrow and number indicate direction and angle of dip of fault plane.
	Thrust fault - barbs on upper plate; dashed where approximately located, dotted where concealed.
	Syncline - Dashed where approximately located, dotted where concealed.
	Anticline - Dashed where approximately located, dotted where concealed.
25	Strike and dip of inclined bedding.
25 	Strike and dip of volcanic flow.
	Landslide - Arrows indicate principal direction of movement, queried where existence is questionable.

Contact between map units - Solid where accurately located, dashed where

Preliminary Geologic Map available from: http://www.conservation.ca.gov/cgs/rghm/rgm/preliminary_geologic_maps.htm



CORRELATION OF MAP UNITS



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