California Geological Survey
in collaboration with the U.S. Geological Survey

Geologic Map of the Sierra Nevada

California and Western Nevada

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by

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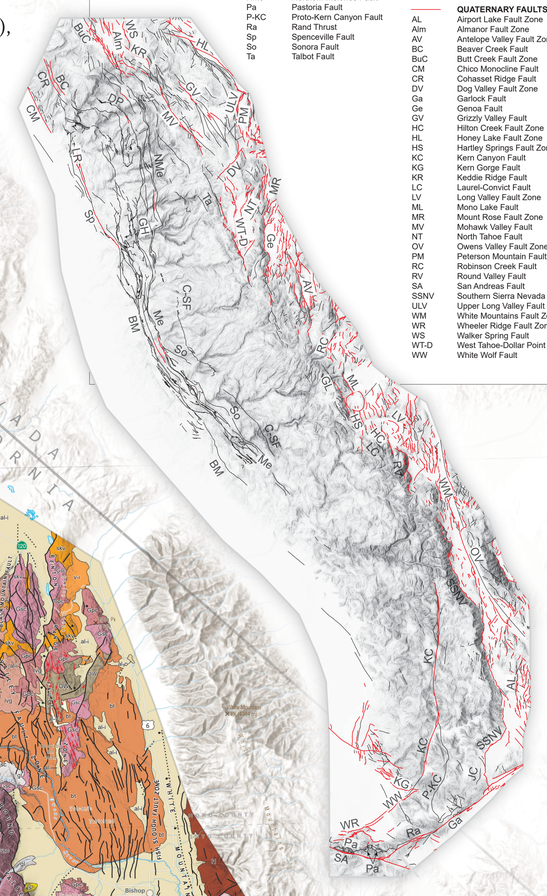
Dedicated to Warren Nokleberg

THE GEOLOGIC MAP OF THE SIERRA NEVADA is a core component of the Sierra Nevada Earth Science Atlas, which also includes geophysical, neotectonic, economic, and geochronologic data.

The map illustrates the distribution of geologic units across the Sierra Nevada and related adjacent areas. Geologic units are grouped by type and age into three categories: Principally Paleozoic and Mesozoic metasedimentary and metavolcanic wall rocks, most of which are grouped into terranes; Paleozoic and Mesozoic plutons and intrusive suites, which intrude the wall rocks and form the core batholith of the range; and Late Cretaceous and Cenozoic sedimentary and volcanic rocks and surficial deposits that unconformably overlap the older units. Related rock units were combined and simplified for presentation at a scale of 1:400,000, as shown in the list of map units and associated correlation of map units (Plate 1B) and description of map units (Appendix A). Tectonic faulting, folding and uplift have overprinted the rocks and have strongly influenced the spatial distribution of units and the distinct morphology of the Sierra Nevada as we see it today.

The Atlas is the result of collaborative work by scientists and mapmakers from the California Geological Survey and the U.S. Geological Survey. The Atlas was originally envisioned by the late geologist Warren Nokleberg (1939-2021), who contributed much to the initial geologic map compilation.

Fault Index Map



List of Map Units

The following list of geologic map units depicts the bedrock and surficial deposits of the Sierra Nevada, grouped by type and general location. Within each grouping, the list order indicates relative age; i.e., younger rocks are listed before older rocks. For unit descriptions and detailed stratigraphic relationships, consult Appendix A, *Description of Map Units* and Plate 1B, *Correlation of Map Units*.

Explanation of unit symbol formatting:
all lowercase = cover strata units
Gxx = intrusive units
UPPERCASE = metamorphic units

For the purpose of this unit list, California Highway 140 serves as the approximate boundary between the northern and southern Sierra Nevada.

Late Cretaceous and Cenozoic Cover Strata

SIERRA NEVADA (RANGEWIDE)

Undifferentiated Pliocene to Quaternary Sedimentary Rocks and Surficial Deposits

- aft — Artificial fill and mine tailings
- al-y — Alluvium, young
- ba-y — Basinal deposits, young
- lc-y — Lacustrine deposits, young
- eol — Eolian deposits, undifferentiated
- ba — Basinal deposits, undifferentiated
- gl — Glacial deposits, undifferentiated
- ls — Landslide deposits, undifferentiated
- al-i — Alluvium, intermediate age
- lc-i — Lacustrine deposits, intermediate age
- al-o — Alluvium, old
- al-vo — Alluvium, very old

EASTERN SIERRA NEVADA

LONG VALLEY CALDERA REGION
- v-y — Volcanic deposits, young, undifferentiated
- mic — Rhyolites of the Mono-Inyo Chain
- mmv — Mammoth Mountain volcanic rocks
- lvmy — Moat Rhyolites, young
- lvmi — Moat Rhyolites, intermediate
- lvmo — Moat Rhyolites, old
- lve — Early Rhyolite
- bt — Bishop Tuff
- rvg — Glass Mountain rhyolite

BROADER EASTERN SIERRA AND HIGH SIERRA REGIONS
- bpv — Big Pine volcanic field
- gtv — Golden Trout volcanic field
- auv — Aurora volcanic field
- v-i — Volcanic deposits, intermediate
- inf — Inyo Mountains fanglomerate

COSO REGION
- covy — Coso Volcanics, young
- cov — Coso Volcanics
- cos — Coso Formation
- dpb — Darwin Plateau basalts

NORTHERN SIERRA NEVADA
- mcy — Modern Cascade arc rocks, young
- v-i — Volcanic deposits, intermediate
- olb — Olivine tholeiitic basalt
- ttv — Tahoe-Truckee volcanic field
- v-vo — Volcanic and shallow intrusive deposits, very old
- mco — Modern Cascade arc rocks, old
- shc — Sandstone of Hunter Creek
- mlmd — Mokelumne Hill domes
- tus — Tuscan Formation
- aca — Ancestral Cascade arc rocks
- sg — Stanislaus Group
- tml — Table Mountain Latite
- ljb — Lovejoy Basalt
- ivs — Ignimbrite Flareup volcanic and sedimentary rocks
- pvg — Tertiary pre-volcanic gravels
- io — Ione Formation
- chi — Chico Formation

SOUTHERN SIERRA NEVADA
- krf — Kern River Formation
- v-vo — Volcanic and shallow intrusive deposits, very old
- cpf — Cache Peak Formation
- oso — Oso Canyon Formation of Dibblee [1967]
- skv — Southern Sierra high-K volcanics
- dos — Dove Springs Formation
- ms — Monterey Shale and similar-age marine units
- ben — Bena Gravel
- rd — Trachyandesite of Kennedy Table
- bop — Bopesta Formation
- cuv — Cudahy Camp formation of Loomis and Burbank [1988]
- tuv — Tunis volcanics
- cpv — Cache Peak Volcanics
- kin — Kinnick Formation
- bob — Bobtail Quartz Latite Member of the Gem Hill Formation
- nev — Neenach Volcanics
- tmb — Temblor Formation
- teo — Tecuya Formation
- wlk — Walker Formation
- sep — San Emigdio and Pleito Formations
- tej — Tejon Formation
- wit — Witnet Formation
- gol — Goler Formation

Map Symbols

- **Contact between map units** – Solid where accurately located; long dash where approximately located; queried (?) where uncertain.
- **Fault** – Solid where accurately located; long dash where approximately located; short dash where inferred; dotted where concealed; queried (?) where uncertain.
- **Normal fault** – Ball and bar symbols on upper plate; solid where accurately located; long dash where approximately located; short dash where inferred; dotted where concealed; queried (?) where uncertain.
- **Thrust fault** – Barbs on upper plate; solid where accurately located; long dash where approximately located; dotted where concealed; queried (?) where uncertain.
- **Detachment fault** – Hachures on upper plate; sense of slip unspecified; solid where accurately located; long dash where approximately located; short dash where inferred; dotted where concealed; queried (?) where uncertain.
- **Mega-landslide (probable)**
- **Mega-landslide (questionable)**

Plutons and Intrusive Suites

WESTERN METAMORPHIC BELT
- Gu — Undifferentiated granitic plutons
- Ggu — Unnamed gabbroic plutons
- Gbr — Bald Rock plutonic complex
- Gmm — Merrimac plutonic complex
- Gbl — Bucks Lake plutonic complex
- Gco — Concow pluton
- Gc — Coloma pluton
- Grp — Rocklin-Penryn plutons
- Ggb — Granite Basin pluton
- Gca — Cascade plutonic complex
- Gscm — Santa Cruz Mountain pluton
- Gpal — La Paloma pluton
- Gg — Guadalupe igneous complex
- Gcr — Cosumnes River pluton
- Ghor — Hornitos pluton
- Giv — Indian Valley pluton
- Givg — Gabbro member
- Glu — Lumpkin pluton
- Gyr — Yuba Rivers pluton
- Gyrd — Diorite member
- Ghb — Hartman Bar pluton
- Gsj — San Juan Ridge pluton
- Gsjg — Granodiorite member
- Gpp — Pilot Peak pluton
- Gbg — Banner Grange pluton
- Gspm — Sugar Pine Mountain pluton
- Gsf — Swedes Flat pluton
- Ggv — Grass Valley pluton
- Gph — Pine Hill pluton
- Gby — Bloody Run pluton
- Gscp — Scales pluton
- Gsjd — Tonalite at Deer Creek of Day and Bickford (2004)
- Gcc — Chinese Camp igneous complex

WESTERN SIERRA NEVADA
- Gfg — Fine Gold Intrusive Suite
- Gsm — Stokes Mountain intrusive suite
- Gmo — Mill Creek and Owens Mountain intrusive suite
- Gsl — Stanislaus River intrusive suite
- Gdp — Don Pedro intrusive suite

SOUTHERN SIERRA NEVADA
- Gm — Granitic rocks, undivided
- Gps — Pastoria intrusive suite
- Gnm — Northernmost Mojave intrusive suite
- Gop — Owens Peak intrusive suite
- Gbv — Bear Valley intrusive suite
- Gte — Tehachapi-San Emigdio intrusive suite
- Gbm — Buck Meadow intrusive suite
- Gse — San Emigdio intrusive suite
- Gep — El Paso intrusive suite

SOUTH-CENTRAL SIERRA NEVADA
- Gjm — John Muir Intrusive Suite
- Gwh — Mount Whitney Intrusive Suite
- Gso — Sonora Pass intrusive suite
- Glu — Tuolumne Intrusive Suite
- Gks — Kaweah-Sequoia intrusive suite
- Gmg — Mount Givens pluton
- Gmw — Merced Peak and Washburn Lake intrusive suite
- Gyo — Yosemite intrusive suite
- Gsl — Shaver Intrusive Suite
- Gbvc — Buena Vista Crest intrusive suite
- Gid — Independence dike swarm
- Gdo — Osa ring complex
- Ggg — Gabbroic complexes
- Gpc — Palisade Crest Intrusive Suite
- Gwc — Window Cliffs intrusive suite
- Gsc — Scheelite Intrusive Suite

NORTHERN AND NORTH-CENTRAL SIERRA NEVADA
- Gm — Granitic rocks, undivided
- Glkt — Lake Tahoe intrusive suite
- Gja — Jack Main Canyon intrusive suite
- Gjam — Mafic plutonic member
- Gdm — Diamond Mountains intrusive suite
- Gtt — Tuttle intrusive complex
- Gegg — Emigrant Gap intrusive suite, granitic units
- Gegm — Mafic units
- Gsb — Sierra Buttes intrusive complex

EASTERN SIERRA NEVADA, WESTERN NEVADA, AND WHITE-INYO MOUNTAINS
- Gpa — Papoose Flat intrusive suite
- Gwa — Walker Lake intrusive suite
- Gsp — Soldier Pass Intrusive Suite

Metasedimentary and Metavolcanic Wall Rocks

WESTERN METAMORPHIC BELT (NORTHERN SIERRA NEVADA)

COSUMNES TERRANE

Western Belt subterrane
- CWCH — Copper Hill Volcanics
- CWCG — Gabbro, intrusions?
- CWSS — Salt Spring Slate
- CWSV — Volcanic member
- CWGR — Gopher Ridge Volcanics

Mother Lode subterrane
- CMMS — Mariposa Formation
- CMMB — Brower Creek Volcanic Member
- CMFM — Sierra foothills mélange of Duffield and Sharp (1975)
- CMFG — Gabbro bodies
- CMFL — Limestone blocks
- CMFS — Metasedimentary bodies
- CMFU — Ultramafic bodies
- CMFV — Volcanic bodies
- CMLM — Mariposa and Logtown Ridge Formations, undivided
- CMLR — Logtown Ridge Formation
- CMBS — Brandon formation

Moccasin Peak subterrane
- CPPB — Penon Blanco Volcanics
- CPJP — Jasper Point Formation
- CPTG — Tuolumne ophiolite-mélange
- CPTG — Gabbro member
- CPTL — Limestone member
- CPTS — Metasedimentary member
- CPTV — Metavolcanic member

YUBA RIVER SUPERTERRANE

Overlap strata
- YOMO — Monte de Oro Formation
- YOOC — Oregon City Formation
- YOBV — Smartville volcanic complex
- YOBD — Diabase member
- YOBG — Gabbro member
- YOBU — Ultramafic member
- YOCF — Colfax Formation

American River terrane
- YACG — Clipper Gap Formation
- YACC — Chert blocks
- YACL — Limestone blocks
- YACGb — Gabbro blocks
- YACGv — Volcanoclastic member
- YACV — Volcanic member
- YACU — Serpentinite lens
- YALC — Lake Combie complex
- YALV — Volcanic member
- YALD — Diabase member
- YALG — Gabbro member
- YALU — Ultramafic member

Mount Aranal complex
- YAMD — Basalt and chert member
- YAAM — Serpentinite-matrix mélange member

Cool Quarry complex
- YACM — Marble member
- YACB — Basalt member
- YALO — Lake Oroville olistostrome

Slate Creek terrane
- YSSS — Shingle Springs complex
- YSSM — Metasedimentary member
- YSSG — Gabbro member
- YSSU — Ultramafic member

French Creek complex
- YSFB — Metabasalt member
- YSFC — Metachert member
- YSFS — Serpentinite member
- YSFV — Metavolcanic and metasedimentary member
- YSSC — Slate Creek Complex
- YSSCI — Marble member
- YSSCm — Metasedimentary member
- YSSCv — Metavolcanic member
- YSSCd — Diorite member
- YSSCg — Gabbro member
- YSSCu — Ultramafic member
- YSJO — Jarbo Gap ophiolite
- YSJC — Metachert member
- YSJD — Metadiabase member
- YSJG — Metagabbro member
- YSJL — Marble member
- YSJM — Metasedimentary member
- YSJV — Metavolcanic member

Fault Zone rocks
- FZML — Fault zone mélange
- FZMg — Gabbro blocks
- FZMl — Limestone and marble blocks
- FZMs — Slate and metasandstone blocks
- FZMu — Serpentinite blocks
- FZMv — Volcanic blocks
- FZS — Fault zone serpentinite

WESTERN SIERRA NEVADA

Merced River terrane
- MRGP — Goldstein Peak Formation
- MRGPH — Phyllite member
- MRDGS — Greenschist member
- MRDGG — Gabbro
- MRSM — Serpentinite mélange with ultramafic and mafic igneous rocks
- Calaveras Complex
- MRCG — Greenstone member
- MRCC — Marine carbonate member
- MRCS — Marine sedimentary member
- MRKA — Serpentinite mélange member
- MRKI — Kings River ophiolite belt

Feather River terrane
- FRS — Red Ant Schist
- FRM — Mafic igneous member
- FRU — Ultramafic member

SOUTHERN SIERRA NEVADA, TEHACHAPI-SAN EMIGDIO AND EL PASO MOUNTAIN

Pelona-Rand Schist
- PS — Pelona-Rand Schist and related units

Kernville terrane
- KT — Kernville terrane

Bean Canyon terrane
- BCT — Tylerhorse Canyon schist
- BCB — Bean Canyon Formation

Tehachapi-San Emigdio terrane
- TSS — Grapevine Canyon paragneiss and Grapevine Peak migmatite of Chapman and Saleeby (2012)

El Paso terrane
- EPS — El Paso terrane

Eagle Rest Peak terrane
- ERP — Eagle Rest Peak terrane - western San Emigdio Mountains

Pastoria terrane
- PAS — Pastoria terrane - western Tehachapi Mountains

SOUTH-CENTRAL SIERRA NEVADA

Sierra Crest-High Sierra-Kings terrane overlap
- SHKOV — Younger metavolcanic rocks
- SHKOG — Metamorphosed hypabyssal intrusive bodies and metagranitic rocks

Kings terrane
- KSM — Marble layers in metasedimentary and metavolcanic rocks
- KSV — Metasedimentary rocks, metavolcanic rocks, and minor shallow metagranitic plutons

Sierra Crest terrane
- SCGG — Shallow-level metagranitic rocks, medium-level granodiorite and lesser diorite and gabbro
- SCGV — Older metavolcanic rocks

High Sierra terrane
- HSV — Volcanic and sedimentary rocks, and small, shallow-level granitic plutons
- HSO — Oceanic and continental-rise sedimentary and volcanic rocks

Snow Lake terrane
- SL — Snow Lake terrane

Twin Lakes terrane
- TTL — Twin Lakes terrane

Owens terrane
- OW — Owens terrane

NORTHERN AND NORTH-CENTRAL SIERRA NEVADA

Kettle Rock terrane
- KR — Kettle Rock terrane – Eastern Mesozoic belt

Northern Sierra terrane
- NSTT — Tuttle Lake Formation and upper Lake Tahoe sequence
- NSST — Volcanic and sedimentary rocks
- NSTS — Sailor Canyon Formation and associated units
- NSRO — Permian volcanic sequence
- NSSB — Taylorsville sequence and lower Lake Tahoe sequence
- Shoo Fly Complex
- NSSM — Sierra City mélange
- NSSA — Coherent units
- NSSR — Marine sedimentary rocks

EASTERN SIERRA NEVADA, WESTERN NEVADA, AND WHITE-INYO MOUNTAINS

Walker Lake terrane
- WLV — Marine volcanic rocks
- WLS — Deep-marine sedimentary rocks

White-Inyo craton margin formations
- I4 — Sequence 4
- I3 — Sequence 3
- I2 — Sequence 2
- I1 — Sequence 1

SCALE 1:400,000

0 10 20 30 MILES

0 10 20 30 40 50 KILOMETERS

Coordinate system: Universal Transverse Mercator, Zone 11N, North American Datum 1983.

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