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Sheet 2 of 2
Pamphlet accompanies map

Geologic Map Of Southwestern Sequoia National Park, Tulare County, California

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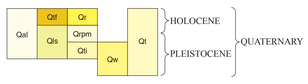
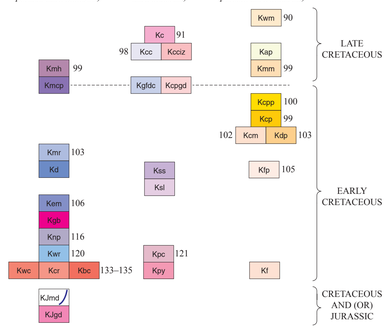
CORRELATION OF MAP UNITS

SURFICIAL DEPOSITS

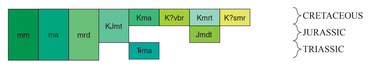


GRANITIC ROCKS
(U-Pb ages in Ma)



METAMORPHIC ROCKS

Metavolcanic Rocks



Metasedimentary Rocks

DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS

Qal **Alluvial deposits (Holocene and Pleistocene)**—Alluvium underlying meadows; gravel, sand, and boulders in stream valleys

Qtf **Tufa (Holocene)**—Porous travertine deposited from soda springs

Qr **Rock glaciers (Holocene)**—Small active rock glaciers in cirques northwest of Florence Peak and southeast of Rainbow Mountain

Qt **Talus and colluvium, undivided (Holocene and Pleistocene)**—Steep slopes of angular talus blocks with little or no interstitial soil, commonly above 7,000 ft elevation; intermixed soil and rock fragments (colluvium) on gentler slopes, commonly forested

Qls **Landslide deposits (Holocene and Pleistocene)**—Bouldery and hummocky landslide debris on south slope of Ash Peaks Ridge

Qrpm **Recess Peak and Matthes Tills, undivided (Holocene and late Pleistocene)**—Small, non-vegetated tills with small, sharp moraine crests in cirques above ~10,000 ft elevation

Qti **Tioga Till (Pleistocene)**—Innermost of large nested tills having well-defined moraine crests

Qw **Tioga and Tahoe Tills, undivided (Pleistocene)**—Tills generally with large, well-defined moraine crests

GRANITIC ROCKS

DARK-COLORED ROCKS

[Generally more than 15 percent dark minerals]

Kmh **Granodiorite of Mountain Home (Late Cretaceous)**—Medium-grained hornblende-biotite granodiorite near southwest corner of map area. U-Pb zircon age of 98.8±0.9 Ma

Kmcp **Diorite associated with granite of Coyote Pass (Late Cretaceous)**—Fine- and medium-grained hornblende diorite and quartz diorite intrusive into granite of Coyote Pass (Kccp, Kcp); commonly includes angular granite blocks

Kmr **Granodiorite of Milk Ranch Peak (Early Cretaceous)**—Dark and very dark, medium-grained granodiorite with conspicuous hornblende crystals and abundant mafic inclusions; locally with plagioclase phenocrysts as large as 1.5 cm. U-Pb zircon age of 103.2±1.5 Ma

Kd **Diorite (Cretaceous)**—Small intrusions of fine- and medium-grained hornblende diorite and quartz diorite associated with the granite of Ash Peaks Ridge near the northwest corner of the map area, as well as isolated dioritic intrusions elsewhere

Kem **Quartz diorite of Empire Mountain (Early Cretaceous)**—Medium-grain quartz diorite cut by sparse mafic dikes. U-Pb zircon age of 107±1 Ma (Busby-Spera, 1983) and 106±1.1 Ma (this study)

Kgb **Hornblende gabbro (Early Cretaceous)**—Medium- and coarse-grained hornblende gabbro and diorite at Black Rock Pass and a sill intrusive into Mineral King metamorphic pendant. Mineral King sill is vuggy and finer grained to the west, and may be sub-volcanic equivalent of similar appearing Cretaceous meta-andesites (Kma) near Timber Gap

Knp **Granodiorite of "Nev Point" (Early Cretaceous)**—Medium-grained, equigranular hornblende-biotite granodiorite with consistent north-northwest striking, near vertical post-magmatic foliation. U-Pb zircon age of 115.9±1.7 Ma

Kwr **Granodiorite of Windy Ridge (Early Cretaceous)**—Fine-grained hornblende-biotite granodiorite with sheared mafic dikes. U-Pb zircon age of 120.1±2.1 Ma

Kwc **Granodiorite of White Chief Mine (Early Cretaceous)**—Sheared, medium-grained hornblende-biotite granodiorite with sheared and offset mafic and aplitic dikes. Contact with granodiorite of Castle Creek (Kcc) locally indistinct. Part of volcano-plutonic suite of Mineral King. U-Pb zircon age of 135±1 Ma

Kcr **Granodiorite of Camelback Ridge (Early Cretaceous)**—Sheared, medium-grained hornblende-biotite granodiorite with sparse sheared mafic dikes. Locally developed porphyry texture. Part of volcano-plutonic suite of Mineral King. U-Pb zircon age of 133±1 Ma

Kbc **Granodiorite of Burnt Camp Creek (Early Cretaceous)**—Locally sheared, medium-grained hornblende-biotite granodiorite with sparse sheared mafic dikes. Part of volcano-plutonic suite of Mineral King. U-Pb zircon age of 134.8±1.5 Ma

KJmd **Mafic dikes (Cretaceous and (or) Jurassic)**—Fine-grained, dark-colored mafic dikes of indeterminate age that cut metamorphic and granitic rocks

KJgd **Sheared granodiorite (Cretaceous or Jurassic)**—Schistose dark granodiorite near northeast corner of map area; cut by schistose mafic dikes. Unit is correlative with Jurassic-Triassic sheared granodiorite in the Triple Divide Peak 15′ quadrangle (Moore and Sisson, 1987), but unit has been here reassigned to Cretaceous or Jurassic on the basis of the discovery of Cretaceous-aged sheared, diked granodiorites

MEDIUM-COLORED ROCKS

[Generally 8–15 percent dark minerals]

Kc **Granodiorite of Chagoopa (Late Cretaceous)**—Fine- to medium-grained hornblende-biotite granodiorite with indistinct plagioclase phenocrysts. U-Pb zircon age of 91.5±0.7 Ma

Kcc **Granodiorite of Castle Creek (of Mitchell Intrusive Suite [Moore and Sisson, 1987]) (Late Cretaceous)**— Medium-grained hornblende-biotite granodiorite that has prominent grains of hornblende and titanite (sphene); locally contains indistinct plagioclase phenocrysts. Includes domains zoned to light-colored granodiorite. U-Pb zircon ages of 98±2 Ma (Busby-Spera, 1983), 97.8±0.7, and 98.4±1.3 Ma (this study)

Kcciz **Injection zone along margin of the granodiorite of Castle Creek (of Mitchell Intrusive Suite [Moore and Sisson, 1987]) (Late Cretaceous)**—Steeply dipping sheets of fine-grained granodiorite, 1–3 m thick, closely interleaved with metamorphic rocks along eastern contact with the granodiorite of Castle Creek (Kcc)

Kgfdc **Dome Creek facies of the Giant Forest Granodiorite (of Sequoia Intrusive Suite [Moore and Sisson, 1987]) (Early Cretaceous)**—Medium-grained, weakly gneissic granodiorite and granite. Interpreted as southward-narrowing extension of the Giant Forest Granodiorite north of map area

Kcpgd **Granodiorite dikes associated with the granite of Coyote Pass (Early Cretaceous)**—Fine-grained, medium- and light-colored granodiorite dikes associated with dioritic intrusions into the granite of Coyote Pass (Kcpp, Kcp). Interpreted to be diorite-granite hybrids

Kss **Granodiorite of Shepherds Saddle (Cretaceous)**—Medium-grained, equigranular hornblende-biotite granodiorite in northwestern part of map area; undated, but possibly darker-colored facies of the granite of Frys Point (Kfp)

Ksl **Granodiorite of Spring Lake (Cretaceous)**—Medium- to fine-grained granodiorite with sparse mafic dikes; undated, but possibly lighter-colored facies of the quartz diorite of Empire Mountain (Kem)

Kpc **Granodiorite of Pecks Canyon (Early Cretaceous)**—Medium- to coarse-grained granodiorite that contains indistinct potassium-feldspar phenocrysts. U-Pb zircon age of 121.6±1.6 Ma; probably younger than the nearby granodiorite of Windy Ridge (Kwr)

Kpy **Granodiorite porphyry dikes (Early Cretaceous)**—Fine-grained porphyry dikes with abundant plagioclase phenocrysts intrusive into metamorphic rocks of the southern part of Mineral King pendant; probably correlative to the granodiorite of Camelback Ridge (Kcr) of the volcano-plutonic suite of Mineral King

LIGHT-COLORED ROCKS

[Generally less than 8 percent dark minerals]

Kwm **Granite of White Mountain (Late Cretaceous)**—Medium-grained, coarsely porphyritic biotite granite that contains abundant, well-formed, potassium feldspar megacrysts (4–8 cm), and lacks mafic inclusions. U-Pb zircon age of 89.9±1.0 Ma

Kap **Aplite (Late Cretaceous)**—Fine-grained, very light colored aplitic granite that has conspicuous blue-black tourmaline; intruded between the granodiorite of Castle Creek (Kcc) and the Mineral King pendant; lack of deformation and mafic dikes indicate Late Cretaceous age. Unit also includes aplite dike swarm that intruded metavolcanic roof rocks of the granodiorite of Spring Lake (Ksl)

Kmm **Granite of Maggie Mountain (Late Cretaceous)**—Coarse-grained, very light colored biotite granite that lacks mafic inclusions. U-Pb zircon age of 98.8±0.7 Ma

Kcpp **Porphyritic core facies of the granite of Coyote Pass (Early Cretaceous)**—Coarse-grained biotite granite that contains indistinct potassium-feldspar phenocrysts and lacks mafic inclusions. Forms a central domain within the equigranular facies of the granite of Coyote Pass (Kcp). Contacts the surrounding equigranular facies both gradationally and as sills and dikes, hence porphyritic unit is younger. Foliation and layering in the equigranular facies dip beneath the porphyritic core facies. U-Pb zircon age of 100.3±0.6 Ma

Kcp **Equigranular facies of the granite of Coyote Pass (Early Cretaceous)**—Medium- and coarse-grained biotite-hornblende granite and alaskite. Mafic inclusions and igneous mineral layering dip shallowly inward and define a northwest-trending magmatic synform cored by the porphyritic core facies of the granite of Coyote Pass (Kcpp). Mafic inclusions are rare and mineral layering is absent north of Lost Canyon and Cyclamen Lake where the rock is nonfoliated alaskite. U-Pb zircon ages of 98.9±1.2 Ma (this study) and 97±2 Ma. (Busby-Spera, 1983); field relations indicate unit is older than porphyritic core facies (100.3±0.6 Ma)

Kcm **Granite of Case Mountain (Early Cretaceous)**—Medium- and coarse-grained biotite granite, generally lacking in mafic inclusions; locally contains indistinct potassium-feldspar phenocrysts. Weathers to broad slabs and domes; also forms extensive grus. U-Pb zircon ages of 101.6±1.6 and 102.3±2.1 Ma

Kdp **Granite of Dennison Peak (Early Cretaceous)**—Medium-grained biotite-hornblende granite with sparse mafic inclusions (0–3 per square meter). Probably correlative with the granite of Case Mountain (Kcm). U-Pb zircon age of 102.8±2.0 Ma

Kfp **Granite of Frys Point (Early Cretaceous)**—Medium- and coarse-grained, equigranular biotite granite that lacks mafic inclusions but is locally cut by dioritic and hybrid granodioritic dikes containing diorite blocks. U-Pb zircon age of granite is 105 Ma; late granodioritic intrusions are as young as 103 Ma (Holland and others, 2010)

Kf **Felsite (Early Cretaceous)**—Intrusion of fine-grained, very light colored granite or hypabyssal rhyolite exposed at outlet of lower Franklin Lake; cut by mafic dikes. Undated but probably correlative with metarhyolite tuffs of volcano-plutonic suite of Mineral King

METAMORPHIC ROCKS

METAVOLCANIC ROCKS

mm **Mafic metavolcanic rocks (Mesozoic)**—Amphibolite derived from basalt and basaltic andesite

ma **Meta-andesite (Mesozoic)**—Metamorphosed andesitic lava flows and breccias, commonly schistose

mrd **Felsic metavolcanic rocks (Mesozoic)**—Chiefly metarhyolite and metadacite tuffs, but also includes metarhyolite and metadacite lava flows

KJmt **Metarhyolite and metadacite tuffs, undivided (Cretaceous and Jurassic)**—Northern continuation of Cretaceous metarhyolite and Jurassic metadacite tuffs across Cliff Creek. Shown as Jurassic or Triassic metarhyolite on geologic map of Triple Divide Peak 15′ quadrangle (Moore and Sisson, 1987)

Kma **Meta-andesite (Early Cretaceous)**—Metamorphosed andesitic lava flows and breccias to the west of Timber Gap. U-Pb zircon lower-intercept concordia model age from included felsic tuff, 111 Ma (revised from Busby-Spera, 1983). Possibly correlative with similar-appearing hornblende gabbro sill (Kgb) to south

K?vbr **Metarhyolite and metadacite breccia (Early Cretaceous?)**—Lenses and beds of felsic volcanic breccia that contain well preserved relict angular clasts

Kmrt **Metarhyolite tuff (Early Cretaceous)**—Chiefly massive metarhyolite with relict pyroclastic texture; includes some interstratified metasedimentary rocks. U-Pb zircon lower-intercept concordia model ages of 131–140 Ma (revised from Busby-Spera, 1983); part of volcano-plutonic suite of Mineral King

K?smr **Schistose metarhyolite (Cretaceous?)**—Felsic schist that contains relict quartz and plagioclase phenocrysts (or coarse relict detrital grains) on west side of Farewell Gap. Foliation intensity decreases to the north, and unit passes along strike into bedded volcaniclastic metasandstones (vss)

Jmdt **Metadacite tuff (Jurassic)**—Massive metadacite with relict pyroclastic texture between Timber Gap and Empire Mountain, and metadacite tuff and breccia above Spring Lake. Distinguished from metarhyolite tuff (Kmrt) by more abundant biotite and hornblende, and by absence of relict quartz phenocrysts. U-Pb zircon lower-intercept concordia model ages of 171 and 189 Ma (revised from Busby-Spera, 1983)

Tma **Meta-andesite (Triassic)**—Metamorphosed andesitic lava flows and breccias to the west of Mineral Peak in upper Crystal Creek and in adjacent basins. U-Pb zircon lower-intercept concordia model ages of 214 and 236 Ma (revised from Busby-Spera, 1983)

METASEDIMENTARY ROCKS

m **Marble (Mesozoic)**—Coarsely crystalline, schistose to gneissose, white to blue-gray marble. Thin calc-silicate layers locally constitute as much as 50 percent of exposures. Blue lines on map denote location of marble bands too thin to show at map scale

ccgl **Calc-silicate conglomerate (Mesozoic)**—Dark-weathering, well-bedded calc-silicate conglomerate and pebbly sandstone with white felsite clasts. Underlies Cretaceous metarhyolite tuff and marks nose of synclinorium through Vandever Mountain

cs **Calc-silicate hornfels and schist (Mesozoic)**—Bedded, light-colored calc-silicate hornfels and schist derived from calcareous quartzofeldspathic siltstone and sandstone. Commonly interstratified with subordinate argillaceous hornfels and schist derived from mudstone (not resolvable at map scale)

q **Quartzite (Mesozoic)**—Medium- to coarse-grained quartzite; massive to medium bedded

qb **Quartz-biotite schist and hornfels (Mesozoic)**—Encompasses quartzofeldspathic micaceous schist, phyllite, slate, and hornfels

qbcs **Quartz-biotite and calc-silicate schist and hornfels (Mesozoic)**—Undivided quartzofeldspathic micaceous and calc-silicate schist and hornfels

slp **Slate and phyllite (Mesozoic)**—Fissile slate, phyllite, and dark-colored argillaceous hornfels derived from mudstone

slhf **Siliceous hornfels (Mesozoic)**—Thin-bedded, fine-grained siliceous hornfels with subordinate interstratified meta-argillite derived from quartzofeldspathic siltstone and fine-grained sandstone

vss **Volcaniclastic metasandstone (Mesozoic)**—Medium- to thin-bedded metasandstone and rare interstratified lenses of volcaniclastic breccia, on the west side of Mineral King pendant; metasandstone contains relict detrital grains of felsite and of phenocryst fragments

ss **Metasandstone (Mesozoic)**—Rhythmically bedded arkosic metasandstones derived from turbidity current strata (Busby-Spera, 1985) on east side of Mineral King pendant

lc **Tactite (Mesozoic)**—Dark brown, coarse-grained rocks consisting of calcic garnet, epidote, diopside, and idocrase, developed along contacts between granite and marble or calc-silicate rocks

EXPLANATION OF MAP SYMBOLS

Contact—Solid where located accurately, long-dashed where located approximately, short-dashed where inferred, dotted where concealed by surficial deposits (some not shown); arrow shows dip and dip direction

Fault—Solid where located accurately, dashed where located approximately, dotted where concealed by surficial deposits; arrow shows dip and dip direction

Strike and dip of foliation or cleavage in granitic and metamorphic rocks

Inclined

Vertical

Bearing and plunge of lineation

Horizontal lineation

Strike of foliation or bearing of lineation, dip unknown

Strike and dip of mineral layering in granitic rocks

Strike and dip of relict bedding in metamorphic rocks—Use restricted to well-preserved sedimentary structures, no distinction between overturned and upright bedding

Strike and dip of cleavage and parallel relict bedding

Anticline

Syncline—Includes primary igneous synform defined by layering and foliation in granite of Coyote Pass; queried where uncertain

Moraine crest

Base from U.S. Geological Survey, Case Mountain, 1987, Dennison Peak, 1986, Kaweah, 1986
Lambert Conformal Conic, North American Datum 1927

APPROXIMATE MEAN DECLINATION, 2013

SCALE 1:24 000
1 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 0 1 KILOMETER
CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

MAP LOCATION

Geology mapped by T.W. Sisson, 1979, 1981, 1987, 1991-92, 2004-12; J.G. Moore, 1976-77, 1981, 1987, 1991-92, 2004-07; A. Van Dyne, 2009; E.A. du Bray, 1976-77; M.G. Sawlan, 1981; and K.M. Ort, 1981

GIS database and digital cartography by Thomas W. Sisson and Joel E. Robinson

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