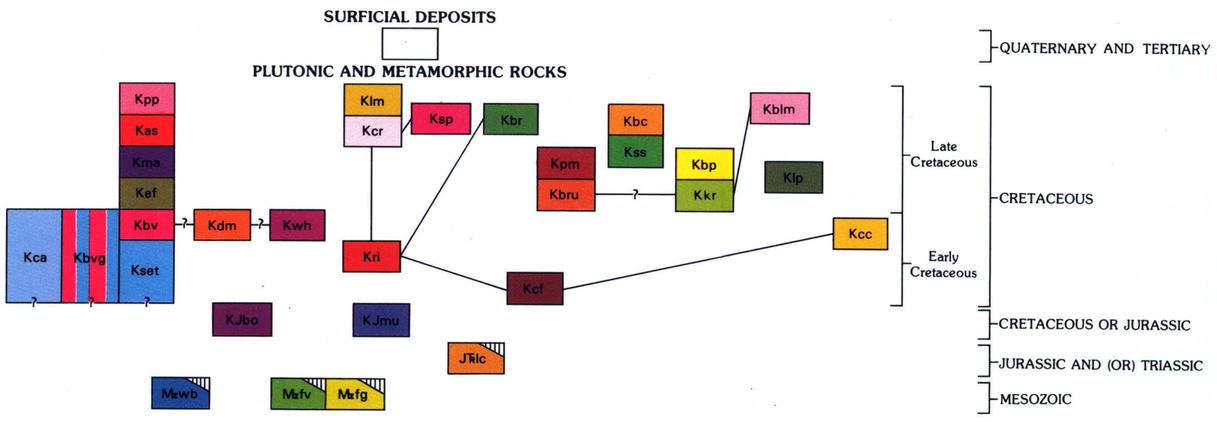
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

BULLETIN 1651
PLATE 1

CORRELATION OF MAP UNITS



Stacked boxes and solid connecting lines indicate relative age on the basis of intrusive relations
Queried horizontal lines indicate uncertain, but probable, correlations
Queried base of units **Kca**, **Kbvg** and **Kset** indicates the possibility of Jurassic rocks within these three units

DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS

ALLUVIUM, LAKE DEPOSITS, NONMARINE SEDIMENTARY DEPOSITS (FANGLOMERATE), AND VOLCANIC ROCKS, UNDIVIDED (QUATERNARY AND TERTIARY)

PLUTONIC ROCKS

Fine-grained granite

Kbp GRANITE OF BAKER POINT (LATE CRETACEOUS)—A dikelike intrusion of felsic peppery biotite granite that intrudes the granite of Kern River. K-Ar age on biotite, about 92 m.y. (Jenkins, 1961)

Kss GRANITE OF SADDLE SPRING ROAD (LATE CRETACEOUS)—Varicolored granite containing several percent of biotite and minor hornblende. Abundant inclusions and darker "dioritic" gradations suggest that this unit may be a contaminated, hybrid variation of the granite of Bodfish Canyon

Klm GRANITE OF LONG MEADOW (LATE CRETACEOUS)—An ovoid plug, largely within the granodiorite of Castle Rock, of fine- to medium-grained felsic rock containing as much as 6 percent biotite

Medium- to coarse-grained granite

Kkr GRANITE OF KERN RIVER (LATE CRETACEOUS)—An unusual medium- to dark-gray rock containing abundant K-feldspar and common small inclusions and centimeter-size rounded clots of mafic minerals. Blocky chalky plagioclase crystals set in a finer grained groundmass reflect a bimodal "quench" texture in some specimens. K-Ar biotite ages, 87, 87, and 89 m.y. (Evernden and Kistler, 1970); Rb/Sr whole-rock age 90 m.y. (Kistler and Peterman, 1973)

Kbc GRANITE OF BODFISH CANYON (LATE CRETACEOUS)—Felsic granite containing a few percent of biotite and local traces of hornblende

Kbr GRANITE OF BOB RABBIT CANYON (LATE CRETACEOUS)—Felsic biotite granite containing minor hornblende

Kpp GRANITE OF PORTUGUESE PASS (LATE CRETACEOUS)—Coarse-grained biotite granite, with accessory hornblende in about half of specimens; local minor orthopyroxene

Ksp GRANITE OF SHERMAN PASS (LATE CRETACEOUS)—Felsic rock containing minor biotite; several specimens also contain hornblende. North of Sherman Pass, just outside the map area, large bodies of mafic rocks are present in this unit. To the north in the Golden Trout Wilderness area (du Bray and Dellinger, 1981), the unit probably correlates with the alaskite of Coyote Pass. In the same area to the north, the unit is modally similar to and may correlate with the alaskite of Hells Hole. Large mafic bodies are also present in both of these alaskite units

Kcc GRANITE OF CANNELL CREEK (EARLY CRETACEOUS)—A strongly foliated (cataclastically or protoclastically deformed) rock containing varying amounts of biotite. Rb/Sr whole-rock ages, 108±5 m.y. on four samples (R. W. Kistler, written commun., 1983). K-Ar biotite ages of 50 m.y. (Evernden and Kistler, 1970) and 55 m.y. (Jenkins, 1961) suggest a possible deformation age, because no known 50- to 55-m.y.-old intrusive rocks are known in the region that could have reset the biotite

Kblm GRANITE OF BLACK MOUNTAIN (LATE CRETACEOUS)—Small, nearly circular plug containing a few percent of biotite

Fine-grained granodiorite

Kas GRANODIORITE OF ALTA SIERRA (LATE CRETACEOUS)—Characterized by scattered coarse biotite crystals in a fine-grained matrix. Dikes of unit intrude the granodiorite of Mount Adelaide, and textural gradations between these two masses suggest that the Alta Sierra mass represents a slightly younger, finer grained pulse of the Mount Adelaide mass. K-Ar ages on biotite, 89 and 90 m.y. (Evernden and Kistler, 1970)

Klp GRANODIORITE OF LIME POINT (LATE CRETACEOUS)—A small, undistinguished plug of biotite granodiorite along the south shore of Isabella Lake east of Lime Point, and a smaller plug (too small to show on the map) across the lake to the north

Medium- to coarse-grained granodiorite

Kcr GRANODIORITE OF CASTLE ROCK (LATE CRETACEOUS)—Mostly porphyritic containing pink to salmon K-feldspar phenocrysts (max 5 cm diam). Modal average is close to the granite field. Strong protoclastic or cataclastic deformation occurs locally along the west margin of the body, particularly near the north boundary of the map area. The unit forms part of a larger body that is probably continuous, across an unmapped area, with the granite of White Mountain to the north (du Bray and Dellinger, 1981). Rb/Sr whole-rock ages, 86±5 m.y. (R. W. Kistler, written commun., 1983) and 90 m.y. (Kistler and Peterman, 1978). K-Ar age on biotite, 81±2 m.y. (Bergquist and Nitkiewicz, 1982)

Kbru GRANODIORITE OF BRUSH CREEK (LATE CRETACEOUS)—Varying, but generally dark, in part contaminated granitic rock containing abundant biotite and hornblende. Dark ovoid inclusions are common, and centimeter-size clots of dark minerals are locally conspicuous which are reminiscent of the granite of Kern River. May correlate with the granodiorite of Loggy Meadow to the north (du Bray and Dellinger, 1981). K-Ar biotite age, 92 m.y. (Evernden and Kistler, 1970)

Kdm GRANODIORITE OF DUNLAP MEADOW (EARLY CRETACEOUS)—Medium gray rock containing abundant biotite and hornblende and minor clinopyroxene and orthopyroxene. Modally and physically similar to the tonalite of Bear Valley Springs, and possibly continuous with it west of the map area

Kma GRANODIORITE OF MOUNT ADELAIDE (LATE CRETACEOUS)—Characterized by discrete (in part subhedral to euhedral) coarse crystals of hornblende and biotite. Modal field ranges from tonalite to granodiorite (much like the tonalite of Bear Valley Springs). The type mass near Caliente is tonalite; the bodies farther north are dominantly granodiorite

Kef GRANODIORITE OF EVANS FLAT (LATE CRETACEOUS)—Peppered with abundant biotite crystals and weakly porphyritic, containing distinctive blue-gray anhedral quartz masses (max 1 cm diam). Local gradation with finer grained and more felsic rocks of the tonalite of Bear Valley Springs suggests that the Evans Flat body may be a later facies of the Bear Valley Springs body

Kpm GRANODIORITE OF PEPPERMINT MEADOW (LATE CRETACEOUS)—Biotite granodiorite containing some hornblende. Modal similarity with the granodiorite of Pecks Canyon to the north (du Bray and Dellinger, 1981) suggests a possible correlation

Kri GRANODIORITE OF RABBIT ISLAND (EARLY CRETACEOUS)—A relatively dark rock containing abundant mafic minerals, but generally much less hornblende than in the tonalite of Bear Valley Springs and the granodiorite of Dunlap Meadow. Rb/Sr whole-rock ages on four samples, 113±3 m.y. (R. W. Kistler, written Commun., 1983); K-Ar biotite age (reset?), 81 m.y. (Evernden and Kistler, 1970)

Tonalite

Kbv TONALITE OF BEAR VALLEY SPRINGS (EARLY CRETACEOUS)—A large body of hornblende-biotite tonalite to granodiorite, containing abundant mafic ovoid inclusions, that extends as far southward as the Garlock fault. Modal average in the map area is just inside the granodiorite field at the tonalite boundary, but the total unit so far mapped averages tonalite. Pb-U zircon ages on several samples south of the map area (Sams and others, 1983), about 100 m.y.; K-Ar ages, also to the south: 86±3 m.y. on biotite and 88±3 m.y. on hornblende (J. L. Morton, written commun., 1979), both probably reset

Kwh TONALITE OF WOFFORD HEIGHTS (EARLY? CRETACEOUS)—Dark rocks of varying grain size that are rich in biotite and hornblende. Probably correlative with the tonalite of Bear Valley Springs. K-Ar ages of 88 m.y. on biotite and 90 m.y. on hornblende (Evernden and Kistler, 1970) are identical to a pair of presumably reset ages for the tonalite of Bear Valley Springs 25 km south of Caliente (Ross, 1983)

Quartz diorite

Kcf QUARTZ DIORITE OF CYRUS FLAT (EARLY CRETACEOUS)— Varying dark rocks rich in biotite and hornblende and commonly containing several percent of clinopyroxene and orthopyroxene, but also containing an average of 5 percent K-feldspar and 11 percent quartz. Fox (1981) mapped a small body of gabbronorite and gabbro within the unit just north of Cyrus Flat and identified an inclusion of olivine-hornblende melagabbro in the unit. An Rb/Sr age, 120±5 m.y. on eight whole-rock samples (R. W. Kistler, written commun., 1983)

Kca QUARTZ DIORITE OF CALIENTE (EARLY CRETACEOUS)—A varying body of quartz diorite, tonalite, and lesser quartzofeldspathic and mafic gneiss, amphibolite, coarse, knobby hornblendite and gabbro, and olivine-hypersthene-bearing ultramafic rocks. The unit has affinities to both the tonalite of Bear Valley Springs and the gneiss, amphibolite, and granulite of San Emigdio-Tehachapi Mountains

Gabbro and ultramafic rocks

KJbo OLIVINE GABBRO AND RELATED ROCKS OF BODFISH (CRETACEOUS OR JURASSIC)—Olivine gabbro, gabbro, anorthositic gabbro, and lesser dunite and wehrlite, in part serpentinized. Conspicuous locally is gabbro containing abundant rounded olivine crystals that are mantled by alteration products. The unit generally weathers to distinctive spheroidal piles ("cannonballs"). Presumably correlative gabbro, containing mantled olivine crystals, is found south of the Wofford Heights marina and, as a large inclusion, near the west end of the tonalite of Wofford Heights

KJmu MAFIC ROCKS, UNDIVIDED (CRETACEOUS OR JURASSIC)—Small bodies of gabbroic or amphibolitic rocks in the Bull Run Basin, northeast of the Walker Basin, south of Weldon, and east of Big Meadow

MIXED PLUTONIC AND METAMORPHIC ROCKS

Kbvg GNEISS, OTHER METAMORPHIC ROCKS, AND TONALITE OF BEAR VALLEY SPRINGS, UNDIVIDED (EARLY CRETACEOUS)—A wide, diffuse, poorly defined zone of gneiss, tonalite, and migmatite. Somewhat similar to the quartz diorite of Caliente, which has a higher proportion of plutonic rocks

METAMORPHIC ROCKS[1]

Metasedimentary rocks

JTrlc METASEDIMENTARY ROCKS OF LONG CANYON (JURASSIC AND (OR) TRIASSIC)[2]—A generally well layered (bedded?) sequence of siliceous to pelitic schist (in part coarse and containing andalusite and sillimanite), pure to impure quartzite, marble, and calc-hornfels. The unit exposed immediately south and north of Isabella Lake resembles lower Paleozoic rocks of the Cordilleran miogeocline, but about 6 km southwest of Weldon, in the midst of these "Paleozoic appearing" rocks, bivalves have been recovered that are Late Triassic to Early Jurassic in age (Saleeby and others, 1978)

Mzwb METASEDIMENTARY ROCKS OF WALKER BASIN (MESOZOIC)[2]—Thin- to thick-layered (bedded?) sequence of siliceous and pelitic schist, quartzite, marble, and calc-hornfels. The unit resembles the metasedimentary rocks of Long Canyon, but contains minor metavolcanic layers

Mzfv QUARTZITE OF FAIRVIEW (MESOZOIC)[2]—Dark, fine-grained to pebbly, quartz-rich, thick-bedded to massive quartzite and lesser schist. Locally, marble is abundant, and some banded chert(?) is present. Angular to subrounded clasts, largely unsorted, suggest turbidity-current deposition for these rocks. Some tuffaceous layers are present, and local chlorite-rich layers also suggest volcanic parentage

Metavolcanic rocks

Mzfg METAVOLCANIC ROCKS OF FRENCH GULCH (MESOZOIC)[2]—Various felsic to intermediate volcanic rocks and tuff. The unit contains local layers of marble and metachert(?). Conspicuous both north and south of Isabella Lake are felsic layers with strong fluxion structure that probably represent ash-flow layers

Metamorphic rocks of both igneous and sedimentary protoliths

Kset GNEISS, AMPHIBOLITE, AND GRANULITE OF SAN EMIGDIO-TEHACHAPI MOUNTAINS (EARLY CRETACEOUS)—The northernmost exposures of an extensive hornblende-rich mafic terrane to the south and west. There, quartzofeldspathic gneiss dominates, with lesser fine- to medium-grained amphibolite, dark gneiss, migmatite, and minor amounts of impure quartzite and calc-hornfels

[1] South of lat 35°30′ N., both the Long Canyon and Walker Basin belts of metasedimentary rocks are referred to as the metasedimentary rocks of the Keene area. The metavolcanic rocks of French Gulch lens out southward at about lat 35°25′ N., and the quartzite of Fairview is absent south of lat 35°30′ N.

[2] Mappable marble is shown by vertical lined pattern in these metamorphic units.

CONTACT—Dotted where concealed.

FAULT—Dotted where concealed. Arrows show relative horizontal displacement

STRIKE AND DIP OF FOLIATION—In plutonic rocks (in part may be protoclastic deformation)
Inclined
Vertical

STRIKE AND DIP OF FOLIATION—In metavolcanic rocks
Inclined
Vertical

STRIKE AND DIP OF BEDS—In metasedimentary rocks
Inclined
Vertical

STRIKE AND DIP OF CATACLASTIC DEFORMATION, INCLUDING MYLONITE—In the Breckenridge-Kern Canyon fault zone
Inclined
Vertical

TRAVERTINE AND TUFA DEPOSITS

FOSSIL LOCALITY (6 km southwest of Weldon)

RECONNAISSANCE GEOLOGIC MAP OF BASEMENT ROCKS ALONG THE WHITE WOLF-BRECKENRIDGE-SOUTHERN KERN CANYON FAULT ZONE, SOUTHERN SIERRA NEVADA, CALIFORNIA

SCALE 1:125 000

2 1 0 2 4 6 8 10 MILES

2 1 0 2 4 6 8 10 KILOMETERS

CONTOUR INTERVAL 100 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

15°
TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 1986

CALIF
AREA OF MAP

Base from U.S. Geological Survey
Bakersfield 1:250,000, 1962

Geology by D. C. Ross, 1980–83

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