

DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Geologic map of the Redding 1X2 degree quadrangle, Shasta, Tehama,
Humboldt, and Trinity Counties, California

by

Luis A. Fraticelli,¹

John P. Albers,¹

William P. Irwin,¹

Milton C. Blake, Jr.¹

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This report (map) is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards (and stratigraphic nomenclature).

¹Menlo Park, CA

SUPERJACENT ROCKS

Surficial Deposits

- t **Man-made materials (Holocene)**--Dredge tailings and other disturbed ground.
- Qsc **Stream Channel Deposits (Holocene)**--Light tan and gray, unweathered deposit of open, active stream channels. Deposits are transported under modern hydrologic conditions, usually in contact with modern surface waters
- Qa **Alluvium and Colluvium (Holocene)**--Unconsolidated silt, sand, and gravel in modern stream channels and on associated low terraces
- Qo **Overbank Deposits (Holocene)**--Sand, silt, and minor lenses of gravel deposited by floods and during high water stages
- Qao **Alluvial and Overbank Deposits, Undivided (Holocene)**
- Qt **Terrace Deposits (Holocene)**--Unconsolidated sand and gravel; closely associated with modern stream channels but generally higher than normal modern high-water level; also may include remnants of high-level terraces not necessarily related to present streams
- Qls **Landslide Deposits (Holocene)**--Slumped, rotated chaotic mixtures of underlying bedrock units and colluvium. Many landslides in areas of the Rattlesnake Creek terrane, Pickett Peak terrane, and in the Franciscan rocks of the Coastal and Central terranes are not shown although these areas are exceptionally unstable, and downslope movement is widespread
- Qg **Glacial Deposits (Pleistocene and or Holocene)**--Numerous moraines and debris flows that extend down glacial valleys, primarily in the Trinity Alps, north-central part of the quadrangle
- Qm **Modesto Formation(Pleistocene)**--Consists of tan and light-gray gravely sand, silt, and clay, except where derived from volcanic rocks of the Tuscan formation. It then is distinctly red and black with minor brown clasts. The Modesto Formation is the youngest unit comprising the Pleistocene alluvium. It borders existing stream channels in the southeast quarter of the quadrangle
- Qr **Riverbank Formation (Pleistocene)**--Weathered reddish gravel, sand, and silt, forming alluvial terraces and fans. Differentiated from the younger Modesto Formation by (a) its geomorphic position in terraces topographically above the terraces of Modesto age and (b) the degree of post-depositional soil-profile development
- Qrb **Red Bluff Formation (Pleistocene)**--Thin veneer of distinctive, highly weathered bright-red gravels overlying the Tehama, Tuscan, and Laguna Formations. Interpreted as a sedimentary cover on a pediment surface

QTog Older Gravel Deposits (Pleistocene and (or) Pliocene)--Moderately well indurated, coarse to very coarse gravel with minor sand resting unconformably on a truncated soil profile developed on the Tuscan Formation in the southeast part of the quadrangle. In the Rattlesnake Creek and the Hayfork terrane it consists of unconsolidated gravels in patches as much as 700 feet higher than modern stream levels

Volcanic Rocks

Qip Basalt flows of Paynes Creek (Pleistocene)--Thin, black to dark-gray basalt flows with scattered yellowish-brown phenocrysts of olivine and glassy-green phenocrysts of clinopyroxene, in a matrix of fine-grained plagioclase, clinopyroxene and glass. Age uncertain but less than 26,000 yr and possibly less than 12,000 yr because it overlies upper member of the Modesto Formation

Qiu Undifferentiated Basalt Flows of Inskip Hill (Pleistocene)

Qbbb Cinder blanket deposits (Pleistocene)--Black, well-bedded basaltic cinder deposits forming a dissected ejecta blanket ranging in thickness from 10 m to 1.5 m. Remaining volume of cinder blanket and cone deposit is estimated at about $6 \times 10^6 \text{ m}^3$

Qbbf Basalt flow of Black Butte (Pleistocene)--Dark-gray to black basalt, similar in texture and mineralogy to the Paynes Creek flows; olivine and clinopyroxene phenocrysts scattered in a diktytaxitic matrix of clinopyroxene and plagioclase. Age of the basalt of Black Butte is unknown

Qvu Volcanic rocks of the Millville quadrangle (Pleistocene)--Dark-gray, moderately diktytaxitic, high-alumina basalt (Al_2O_3 , 18.4 to 19.1 percent), composed of openwork plagioclase laths, fine-grained clinopyroxene, and magnetite with small scattered phenocrysts of brownish-green olivine

Qbs Basalt of Shingletown Ridge (Pleistocene)--Composed of three subunits (not differentiated on map) of dark-gray, fine-grained, diktytaxitic, and locally porphyritic basalt with rounded phenocrysts of brownish-green olivine scattered in an openwork mesh matrix of plagioclase and clinopyroxene. High-alumina basalts containing about 47.6 percent SiO_2 , 18.09 percent Al_2O_3 , and 0.19 percent K_2O

Qba Olivine basalt of Devils Half-Acre (?)--Gray, glomeroporphyritic, vesicular olivine basalt. Maximum thickness 15 m, source unknown

Qab Andesite of Brokeoff Mountain (Pleistocene)--Porphyritic hypersthene andesite with abundant white plagioclase phenocrysts, minor amounts of hypersthene, and sparse augite phenocrysts in a fine-grained matrix of plagioclase microlites and brown glass

Qcb Basalt of Coleman Forebay (Pleistocene)--Dark-gray olivine basalt with pronounced diktytaxitic texture and scattered large vesicles and voids. Weathers light-rusty gray. The unit is undated but is older than the Red Bluff Formation and has a maximum thickness of 10 m

- Ta **Andesite (Pliocene)**--Undivided flows of predominantly two pyroxene andesite; commonly platy, medium to light gray, rarely dark gray, locally pink, greenish gray, or mottled; locally overlies hornblende-bearing pyroxene andesite containing abundant plagioclase phenocrysts and less abundant, smaller hornblende phenocrysts
- Tva **Andesite (Pliocene)**--Breccia and tuff breccia in area east of Shasta Lake; may be correlative with the Tuscan Formation
- Tvb **Basalt (Pliocene)**--Undivided basaltic flows east of Shasta Lake

Sedimentary Rocks

- Tte **Tehama Formation (Pliocene)**--Pale-green, gray and tan sandstone and siltstone with lenses of crossbedded pebble and cobble conglomerate. Interfingers with the Tuscan Formation north of Red Bluff. Clastic debris is more andesitic in composition and Tuscan-like in appearance eastward in area of interfingering. The Tehama and Tuscan Formations are considered coeval since both contain the Nomlaki Tuff member at or near their stratigraphic bases. Maximum thickness is about 600 m
- Ttn **Nomlaki Tuff (Pliocene)**--White, light-gray, locally reddish-tan to salmon dacitic pumice tuff and pumice lapilli tuff exposed in widely separated areas at or very near the bases of the Tuscan and Tehama Formations. Varies from massive nonlayered ash flow at Tuscan Springs, Gas Pointe, and Antelope Creek to bedded and crossbedded, reworked pumiceous sediment at Richardson Springs. Thickness varies from 1 to 30 m. Evernden and others (1964) obtained a K-Ar date of 3.4 Ma on a welded ash flow tuff at Bear Creek Falls, which Anderson and Russell (1939) correlated with the type Nomlaki
- Tt **Tuscan Formation (Pliocene)**--Undivided; includes interbedded lahars, volcanic conglomerate, volcanic sandstone, siltstone, and pumiceous tuff. The Tuscan Formation is divided into four subunits
- Ttd **Fragmental deposits**--Characterized by large monolithologic masses of gray hornblende andesite, augite-olivine basaltic andesite, black pumice, and smaller fragments of black obsidian and white and gray hornblende-bearing pumice in a grayish-tan pumiceous mudstone matrix. Thickness ranges from 10 to 50 m
- Tth **Tuff of Hogback Road**--Discontinuous thin lapilli tuff, pumiceous sandstone, and conglomerate composed of rounded white hornblende-bearing dacitic pumice fragments up to 3 cm in diameter and smaller gray and black pumice fragments admixed with varying amounts of andesitic tuff about 2.5 m thick at the hogback on Hogback Road
- Ttc **lahars with minor interbedded volcanic conglomerate and sandstone**--North of Antelope Creek, separated from overlying units by partially stripped soil horizons. This unit is about 80 m thick near Tuscan Springs

- Tti Ishi Tuff member**--White to light-gray, fine-grained, pumiceous air-fall tuff commonly reworked with variable amounts of volcanic sandstone and silt, distinguished by abundant black to bronze biotite flakes about 1 mm in diameter. A fission-track age of 2.7 Ma obtained from zircons separated from the pumice clasts is the best current estimate age of the Ishi Tuff member (Blake and others, 1984)
- Twg Wildcat Group (Late Miocene-Pliocene)**--Weakly consolidated mudstone, siltstone, sandstone, and conglomerate and minor interbeds of limestone, tuff, and lignite. Abundant fossils of a molluscan and foraminiferal fauna indicate a Pliocene age, but the oldest part (not differentiated on the map) may be as old as late Miocene (Irwin, 1960). Includes the Falor Formation in the northeast corner of the quadrangle
- Tw Weaverville Formation (Oligocene-Miocene)**--Nonmarine sedimentary rocks including conglomerate, sandstone, and thinly laminated light-colored clay and tuff; lignitic coal beds present locally. Fossil plants previously indicated Oligocene age (MacGinitie, 1937) but more recent study of pollen and spores indicates late Oligocene and/or Miocene age (Barnett, 1982)
- Tmc Montgomery Creek Formation (Eocene)**--Gray, yellowish-orange-weathering, arkosic sandstone with conglomerate and shale; commonly massive to thick-bedded nonmarine sandstone with scattered lenses of pebble conglomerate and shale. The unit is about 80 m thick at its southern limit and thickens to the north to about 200 m (Anderson and Russell, 1939) in Montgomery Creek
- Kc Chico Formation (Upper Cretaceous)**--Tan, yellowish-brown to light-gray, fossiliferous marine sandstone with lenticular beds of pebble to fine cobble conglomerate and minor siltstone. Clasts in conglomerate include rounded to well-rounded, red, green, and black chert, white vein quartz, quartzite, granite, and greenstone
- Ks Sedimentary Rocks (Lower Cretaceous)**--Mostly marine sedimentary rocks; well-indurated, buff-weathering sandstone, mudstone, and conglomerate. Contains ammonites and other marine fossils; rocks are similar to those of equivalent age in the Great Valley sequence. Includes some minor non-marine rocks in western part of quadrangle near Glade Creek and Big Bar
- Kqd Shasta Bally Batholith (Early Cretaceous)**--Quartz diorite and granodiorite of Shasta Bally is dated by K-Ar analysis at 135 Ma by Lanphere and others (1978). Unit includes other small plutonic bodies of similar composition and age. In the extreme northeast part of the quadrangle small bodies of coarse-grained quartz diorite yielded radiometric ages of 123 Ma (Paul Renne, oral commun., May 1986)

SUBJACENT ROCKS

Kings Range Terrane

- krt Turbidites and pillow lava (Upper Cretaceous ?)**--Pillow lava overlain by thin-bedded turbidites thought to range in age from Middle Miocene to Early

Cenozoic, (McLaughlin and others, 1982). Turbidites are characterized by closely-spaced folds of three generations. Represents youngest known terrane within the Franciscan Complex in California. Present only in extreme southwest corner of map

Yager Subterrane

ymt **Chiefly marine mudstone and sandstone (Paleocene-Upper Eocene)**

yst **Chiefly marine sandstone, locally conglomerate (Paleocene-Upper Eocene)**

Coastal Terrane

Broken formation consisting largely of arkosic sandstone. Fossils range in age from Late Cretaceous to Eocene. Characterized by abundant laumontite veins. Locally isoclinally folded and/or stratally disrupted. Contains fossils of possible Tethyan affinities that may suggest large scale translation from equatorial regions (oral commun., R.J. McLaughlin, 1983 in Silberling and Jones, 1984)

cosa **Chiefly broken to coherent well-bedded sandstone and argillite (Late Cretaceous-Eocene)**

cosas **Chiefly sheared argillite and sandstone (Late Cretaceous-Eocene)**

cov **Basalt flows, tuff, breccia, and diabase intrusives (Late Cretaceous-Eocene)--**
Locally contain manganese, pink pelagic limestone, or minor cherty partings

Central Terrane

Tectonic melange consisting of resistant blocks in a highly sheared argillaceous matrix. The matrix, where well-exposed and less sheared, commonly made up of interbedded fine-grain mudstone, lithic sandstone, and radiolarian tuff. Pillow lava is probably also part of the matrix but is usually detached by faulting. Fossils from the matrix and interbedded chert range in age from Late Jurassic (Tithonian) to Early Cretaceous (Valanginian)

ctmm **Melange matrix (Late Jurassic-Early Cretaceous)--chiefly sheared argillite and lithic sandstone or graywacke with some interbedded green tuff. Includes scattered high-grade blueschist, eclogite, and amphibolite blocks (not shown)**

ctsp **Serpentite (Late Jurassic-Early Cretaceous)--possibly includes some Coast Range ophiolite**

ctcr **Coast Range ophiolite (Late Jurassic-Early Cretaceous)--includes peridotite, diabase, gabbro, basalt, and may include other rocks derived from the Coast Range ophiolite**

ctls **Pelagic limestone (?)--(only two localities on map)**

ctgs **Greenstone (?)**

ctch **Chert (?)**

ctss **Sandstones (?)**

Yolla Bolly Terrane

Intercalated graywacke, shale, conglomerate, and radiolarian chert, all intruded by diabase-gabbro and quartz keratophyre and subsequently metamorphosed to blueschist facies. Cherts contain radiolarians of Middle(?) Jurassic to Middle Cretaceous age (Blake and others, 1981).

ybt **Taliaferro metamorphic complex (Early Cretaceous? metamorphic age)**--Includes schistose metagraywacke, crumpled phyllite, meta-greenstone, and metachert

ybtmm **Melange (Early Cretaceous to Late Jurassic)**--Mostly sheared argillite, graywacke, and conglomerate with abundant blocks of fine-grained greenstone, chert, plus scarce serpentinite, and rare blueschist and amphibolite knockers. Radiolarians extracted from chert are Tithonian-Valanginian in age (Blake and others, 1984)

ybh **Metagraywacke of Hammerhorn Ridge (Early Cretaceous-Late Jurassic)**--Dominantly graywacke with lesser amounts of argillite and conglomerate and abundant interbeds of chert which yield fossils of Tithonian-Valanginian age, (Blake and others, 1984)

ybtch **chert (Middle ? Jurassic-Middle Cretaceous)**

Pickett Peak Terrane

Strongly deformed quartz-mica schist, metagraywacke, metabasalt, and metachert. Contains high-pressure blueschist-facies minerals. Includes South Fork Mountain Schist, Colebrooke Schist of southwest Oregon, and Valentine Spring Formation. No fossils are known; radiometric ages on metamorphic minerals suggest an Early Cretaceous (125 Ma) metamorphic age (Lanphere and others, 1978)

sfm **South Fork Mountain Schist (Early Cretaceous ?)**--Consists chiefly of fine-grained quartz-albite-muscovite-chlorite schist and commonly contains microscopic lawsonite. Most of the South Fork Mountain Schist is poorly exposed owing to a thick cover of slope debris

sfmmb **Chinquapin metabasalt member (Early Cretaceous ?)**--A fine-grained albite-chlorite-actinolite-epidote gneiss with local crossite-rich layers; also includes sparse metachert

vsmv **Metavolcanic rocks within the Valentine Springs Formation (Early Cretaceous ?)**

Elder Creek Terrane

eco **Coast Range Ophiolite (Late Jurassic)**--Dismembered ophiolite consisting of sheared serpentinite and small blocks of gabbro and diabase

ecms **Mudstone (Late Jurassic-Early Cretaceous)**--Dark-gray, mainly hackly fractured, with minor tan siltstones and sandstones. Limestone nodules, lenses, and thin beds locally abundant

Western Jurassic Terrane

- wJg **Galice(?) Formation (Late Jurassic)**--Interbedded mudstone, graywacke, and conglomerate ranging in texture from weakly slaty to semischist. Fossils have not been found in the Galice(?) Formation in this mapped area but is presumed to correlate with similar rocks in southern Oregon containing fossils that indicate a Late Jurassic (late Oxfordian and middle Kimmeridgian) age (Imlay, 1959). Age of metamorphism is Late Jurassic based on K-Ar analysis (148+/-1.8 Ma, 151+/- 4.4 Ma, and 153+/- 4.5 Ma; Lanphere, and others, 1978)
- wJr **Rogue(?) Formation (Late Jurassic?)**--Mafic to intermediate volcanic flows(?), breccia, and tuff; includes volcanic conglomerate in upper part
- wJsp **Serpentinite (Late Jurassic?)**--Occurs as tectonic slices along South Fork fault; may be related to Josephine ophiolite of Harper (1980) which is more completely exposed in the Western Jurassic terrane farther north in the Klamath Mountains province
- wJd **Diorite-Ammon Ridge Pluton (Late Jurassic?)**
- wJgb **Gabbro (Late Jurassic?)**
- wJgn **Friday Camp gneiss (Late Jurassic?)**--Weakly foliated hornblende-diorite gneiss
- wJgm **Meta-Galice (Late Jurassic?)**--Hornfels and fine-grained chialstolite- biotite-chlorite schist adjacent to the Ammon Ridge pluton

Rattlesnake Creek Terrane

- rcv **Volcanic broken formation and melange (Middle Jurassic to Middle? Triassic)**-- Consists of sheared and dislocated mafic volcanic rocks, including pillow basalt, flows?, tuff, volcanic breccia, and volcanoclastic rocks that contain locally interbedded red and gray to black thin-bedded radiolarian chert; includes minor intermediate and silicic volcanic rocks, lenses, and tectonic blocks of limestone, amphibolite, plutonic rocks and serpentinite. Microfossils in various bodies of chert and limestone have yielded ages ranging from Permian to Jurassic. A K-Ar age on blueschist-facies chert is 185+/- 8.8 Ma (Irwin, 1985). Continuity of lithic units is disrupted by faults and obscured by landslides
- rcs **Detrital sedimentary rocks (Jurassic or Triassic)**--Well-bedded somewhat slaty rocks ranging from mudstone to pebble conglomerate; may be inliers or fault slices of Western Jurassic terrane, (Irwin, 1985)
- rcp **Plutonic rocks (Jurassic to Triassic)**--Medium- to coarse-grained rocks that range from diorite to granite; includes Eltapom and Grassy Mountain plutons, Bear Wallow diorite, and Tule Creek granite complex. Some are isotopically dated as Early Jurassic (193-207 Ma; Wright, 1982) in Chancelulla Peak and Dubakella Mountain quadrangles. May include some intermediate and silicic volcanic rocks

rcsp **Serpentinite (age uncertain)**--Dominantly serpentinitized peridotite, but includes associated metasomatized mafic rocks of uncertain origin as well as minor sheared-in volcanic rocks and chert. Continuity of serpentinite zone is disrupted by faults and obscured by landslides

rcgb **Gabbro (Jurassic to Triassic?)**

Hayfork Terrane

Western Hayfork Subterrane

hhvc **Chert and argillite (Middle Jurassic)**--Dominantly thin-bedded radiolarian chert locally interlayered with argillite and meta-andesite. Generally overlies (conformably?) and locally interfingers with the Hayfork Bally Meta-andesite

hhb **Hayfork Bally Meta-andesite (Middle Jurassic)**--Layered mafic volcanogenic rocks ranging in texture from coarse agglomerate to crystal tuff, probably representing an island-arc deposit. Commonly characterized by euhedral augite and plagioclase crystals in a light-to dark-green groundmass. Locally includes interlayered thin-bedded radiolarian chert and dark argillite. Age of meta-andesite is thought to be Middle Jurassic on basis of a probable cogenetic relation with the Ironside Mountain batholith (170 Ma, revised constant) and on K-Ar isotopic ages of 159 Ma (Fahan and Wright, 1983) measured on hornblende from meta-andesite

him **Ironside Mountain Batholith (Middle Jurassic)**--Mostly medium-grained monzodiorite, but includes quartz diorite and minor gabbro and pyroxenite. Fine-grained and hybrid? varieties are common along much of the boundary between the batholith and the Hayfork Bally Meta-andesite. Age of batholith is Middle Jurassic based on isotopic ages of about 170 Ma determined by K-Ar analysis (Lanphere and others, 1968, revised constant) and by U-Pb analysis (Wright, 1982)

hgb **Gabbro (Middle Jurassic?)**--Includes the Goods Creek pluton and some small unnamed intrusives bodies in both the Eastern and Western Hayfork subterrane

hpx **Pyroxenites (Middle Jurassic?)**--Includes the Chancelulla Peak zoned ultramafic complex

Eastern Hayfork Subterrane

hm **Melange (Middle? Jurassic)**--Slaty argillite and other clastic sedimentary rocks, thin-bedded chert, volcanoclastic rocks, sparse recrystallized limestone (ls), minor mica schist, amphibolite (ha), and serpentinite (hsp). Unit structurally overlies unit hhb

ha **Amphibolite tectonic blocks (age unknown)**--Rare occurrences within the Eastern Hayfork subterrane

hgd **Granodiorite (Middle Jurassic?)**--Unnamed small intrusive body in the northern part of the Hayfork terrane

hd **Diorite (Middle Jurassic?)**--Small intrusives bodies mostly in the northern part of the Hayfork terrane

North Fork Terrane

Jnf **Tectonically dismembered ophiolite (Late Triassic-Middle? Jurassic)**-- Includes overlying siliceous tuff, chert, sandstone, and limestone. Locally a melange containing blocks and slabs of Permian limestone having Tethyan faunal affinities and blueschist knockers. Radiolarians from chert range from Late Triassic to Middle? Jurassic (Irwin and others, 1982)

Jnfsp **Serpentinite of the North Fork terrane (?)**

Jnfgb **Gabbro (?)**

Jnfd **Diorite (?)**--Small isolated intrusives bodies in the North Fork terrane

Jnfs **Stuart Fork Formation (pre-Late Jurassic?)**--Metasedimentary rocks; includes phyllitic quartzites and dark quartz-mica phyllites, commonly graphitic (Davis and others, 1965)

Jnfv **Stuart Fork Formation (pre-Late Jurassic?)**--Metavolcanic rocks; Fine-grained greenstones and associated schistose metavolcanic rocks interfingering with siliceous Stuart Fork rocks in upper part of formation. Schistose rocks include mainly actinolite schists and phyllonites (Davis and others, 1965)

Central Metamorphic Terrane

cms **Salmon Hornblende Schist (Devonian)**--Amphibolite-grade hornblende schist and gneiss, probably represents mafic volcanic rocks of an island arc; locally includes lenses of micaceous schist. Lower part of unit in the Weaver Bally area may be a metagabbro; co-metamorphic with Abrams Mica Schist; K-Ar isotopic ages of 390 and 399 Ma (Hotz, 1977) of possibly correlative amphibolites in the Yreka-Callahan area, north of the Redding map area, suggests a Devonian age of metamorphism

cma **Abrams Mica Schist (Devonian)**--Schistose metasedimentary rocks; generally micaceous and quartzitic; discontinuous lenses of micaceous marble near base; Rb-Sr isotopic ages of about 380 Ma indicate Devonian age of metamorphism (Lanphere and others, 1968); unit equivalent to the Grouse Ridge Formation of Davis and Lipman (1962)

cmsa **Undifferentiated Salmon Hornblende and Abrams Mica schists (Devonian)**

Eastern Klamath Terrane

Island-arc volcanic rocks plus intercalated sedimentary rocks of Devonian through Middle Jurassic age. Forms a younging-eastward, homoclinal but internally deformed sequence that is faulted against the Trinity terrane to the west. Overlain to the south and east, with great angular unconformity, by Cretaceous sedimentary strata of the Great Valley sequence

Jp **Potem Formation (Jurassic)**--Sandstones, shales, and tuffs; Thin-bedded sandstones and gray, sometimes slaty, shales predominate in lower part and

comprise the greater part of the unit. Subordinate lentils of limestone are contained in lower part. Tuffaceous conglomerate predominates in upper half of the formation

- mi **Mafic intrusive rocks (Jurassic)**--Mainly two-pyroxene diorite formerly mapped as Bagley Andesite in northeast part of the quadrangle; Radiometric age is 160 Ma (Paul Renne, oral commun., 1986)
- Ja **Arvison Formation (Jurassic)**--Volcanic breccia, tuff, agglomerate, and volcanic conglomerate, named by Sandborn (1960) for exposures in the Big Bend area
- T m **Modin Formation (Late Triassic)**--Extensive succession of andesitic tuffaceous beds, overlain by shaley sandstone and shale; volcanic conglomerate at the base locally contains limestone fragments with Hosselkus-type fossils; unit here includes underlying Brock Shale of Diller (1906)
- T h **Hosselkus Limestone (Late Triassic)**--Medium- to light-gray, lenticular limestone as much as 60 m thick
- T p **Pit Formation (Permian (?) or Triassic)**--Predominantly gray and black shale with interbedded layers of tuff in lower part and limestone lenses in upper part. Also contains local mafic flows and dome-like bodies of silicic volcanic rock. Contains lenses of massive sulfide in lowermost part in local areas. Some cherty layers at the base in two localities have yielded radiolarians of Permian age, (Silberling and Jones, 1982; Fraticelli, 1984)
- Pbh **Bully Hill Rhyolite (Permian?)**--Dominantly porphyritic and nonporphyritic quartz keratophyre; locally includes much volcanic breccia. Contains lenticular bodies of massive sulfide in uppermost part. Formation is of small areal extent, highly variable in thickness, and extensively altered. Age is uncertain, but possibly late Permian based on radiolarians of Permian age in chert bed above the Bully Hill in the Shasta Lake area (Fraticelli, 1984)
- Ppr **Pit River Stock (Permian)**--Coarse-grained quartz diorite, granodiorite, and albite granite, with associated aplite dikes. Isotopic age as determined by U/Pb ratios on zircon is 261 Ma (Fraticelli and others, 1985)
- aqd **Augite-quartz diorite (Permian ?)**--Includes medium-grained augite quartz diorite, fine-grained diorite, and minor granodiorite that intrude and surround the McCloud Limestone
- md **Mafic rocks (Permian ?)**--Includes mafic diorites and diabasic rocks that intrude Bragdon, Baird, and Nosoni formations
- Pd **Dekkas Andesite (Permian)**--Predominantly albitized andesite (keratophyre) and subordinate albitized basalt (spilite); forms massive flows and volcanic breccia; commonly porphyritic and (or) amygdaloidal. Contains lenses of mudstone and tuffaceous mudstone
- Pn **Nosoni Formation (Permian)**--Predominantly mafic volcanic tuffs and subordinate mudstone, tuffaceous sandstone, mafic flows, volcanic conglomerate, and breccia. Some mudstone is calcareous and contains abundant fusulinids of

Permian age (Fratlicelli, 1984). Formation thickens from south to north but is absent in some areas. Contact with overlying Dekkas Andesite is locally difficult to ascertain

- Pm McCloud Limestone (Permian and Pennsylvanian?)**--Light-gray massive limestone; locally contains abundant Permian fusulinids; forms individual large blocks in many areas owing to disruption by faults and (or) engulfment by mafic quartz diorite or other dark fine-grained intrusive rock; may be in part Pennsylvanian but fossil evidence is controversial (Skinner and Wilde, 1965)
- Mb Baird Formation (Mississippian and Pennsylvanian?)**--Predominantly volcanoclastic sandstone composed of clasts of intermediate volcanic rocks; subordinate interbedded purple-weathering tuff, mudstone, shale, and blue-gray bioclastic limestone. Some shale and limestone lenses are highly fossiliferous; lowest part of Baird in southern part of its exposed area is massive albitized porphyritic andesite flows
- Mbd Bragdon Formation (Mississippian)**--Dark-gray to black shale, mudstone, and siltstone in lower part; siliceous sandstone, grits, and chert conglomerate prominently interlayered with dark pelitic rocks in middle and upper parts; some tuffaceous beds near top of formation seem to be conformable with and gradational into the overlying Baird Formation. The abundant chert in the conglomerate is of unknown source
- Dk Kennett Formation (Devonian)**--Lowest part in southern exposure of Kennett is silicic volcanoclastic debris derived largely from erosion of Balaklala Rhyolite. This is overlain by interlayered black carbonaceous and cherty shales containing local volcanoclastic interbeds. Shales typically weather medium- to light-gray. Uppermost part contains massive gray limestone lenses, locally with abundant fossils. Contact with overlying Bragdon Formation is unconformable and may be a thrust fault of regional extent
- Dmm Mule Mountain Stock (Devonian)**--Highly altered phaneritic igneous body consisting of trondhjemite, albite granite, and quartz diorite; U/Pb isotopic age is 400 Ma (Albers and others, 1981)
- Dbr Balaklala Rhyolite (Devonian?)**--Silicic flows, breccias, and tuffs; subordinate dikes and mafic flows; all rocks are intensely albitized, and protolith was probably dacite. Most of the rocks are quartz keratophyres, but through long informal usage are usually referred to as rhyolite. The unit is divided into three informal units (not differentiated on this map); a nonporphyritic rhyolite consisting of flows and breccias, with subordinate tuffs and mafic flows; a medium-grained porphyritic rhyolite consisting of flows; and a coarse-grained porphyritic rhyolite consisting of flows and breccias in the upper part. The Balaklala is considered to be a cogenetic extrusive equivalent of the Mule Mountain stock. The lower and middle units are intruded by the stock
- Dcg Copley Greenstone (Devonian?)**--Chiefly keratophyre and subordinate spilite pillow lavas and volcanic breccias; includes some metaandesite and metabasalt, as well as boninite and shaly tuff lenses in lower part. Pillow lavas conspicuously dominate the upper part where it is locally interlayered with

and also intruded by middle facies of Balaklala Rhyolite. Probably coeval with Balaklala Rhyolite

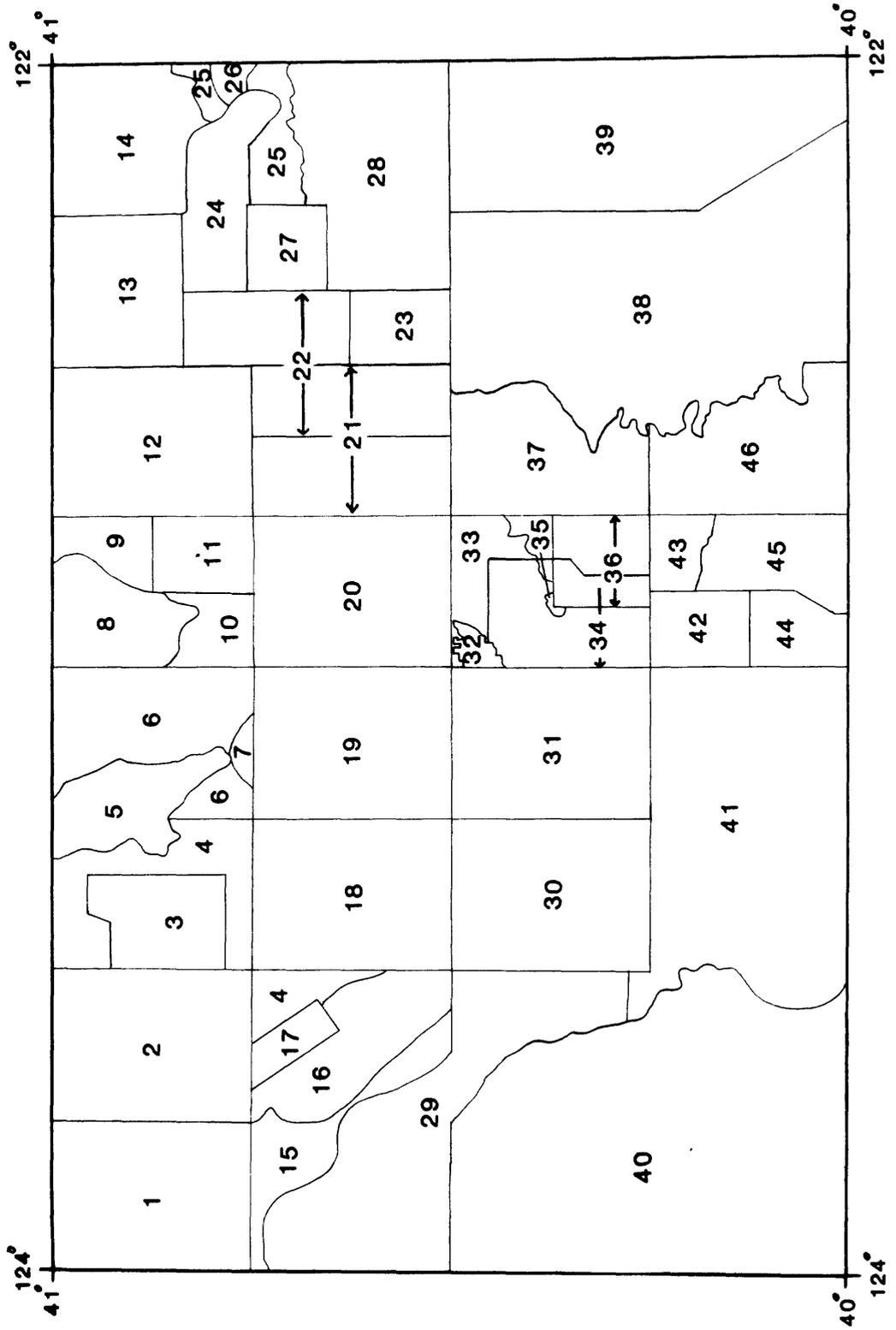
Trinity Terrane

tum **Trinity Ultramafic (Ordovician ?)**--Strongly deformed and recrystallized peridotite, minor layered and intrusive gabbro, diabase dike-sill-complex, plus rare volcanic rocks. Has yielded early Paleozoic radiometric ages. May represent an Ordovician ophiolite, (Lindsley-Griffin, 1977) or a mantle diapir, intrusive into an island-arc or back-arc basin environment, (Quick, 1981)

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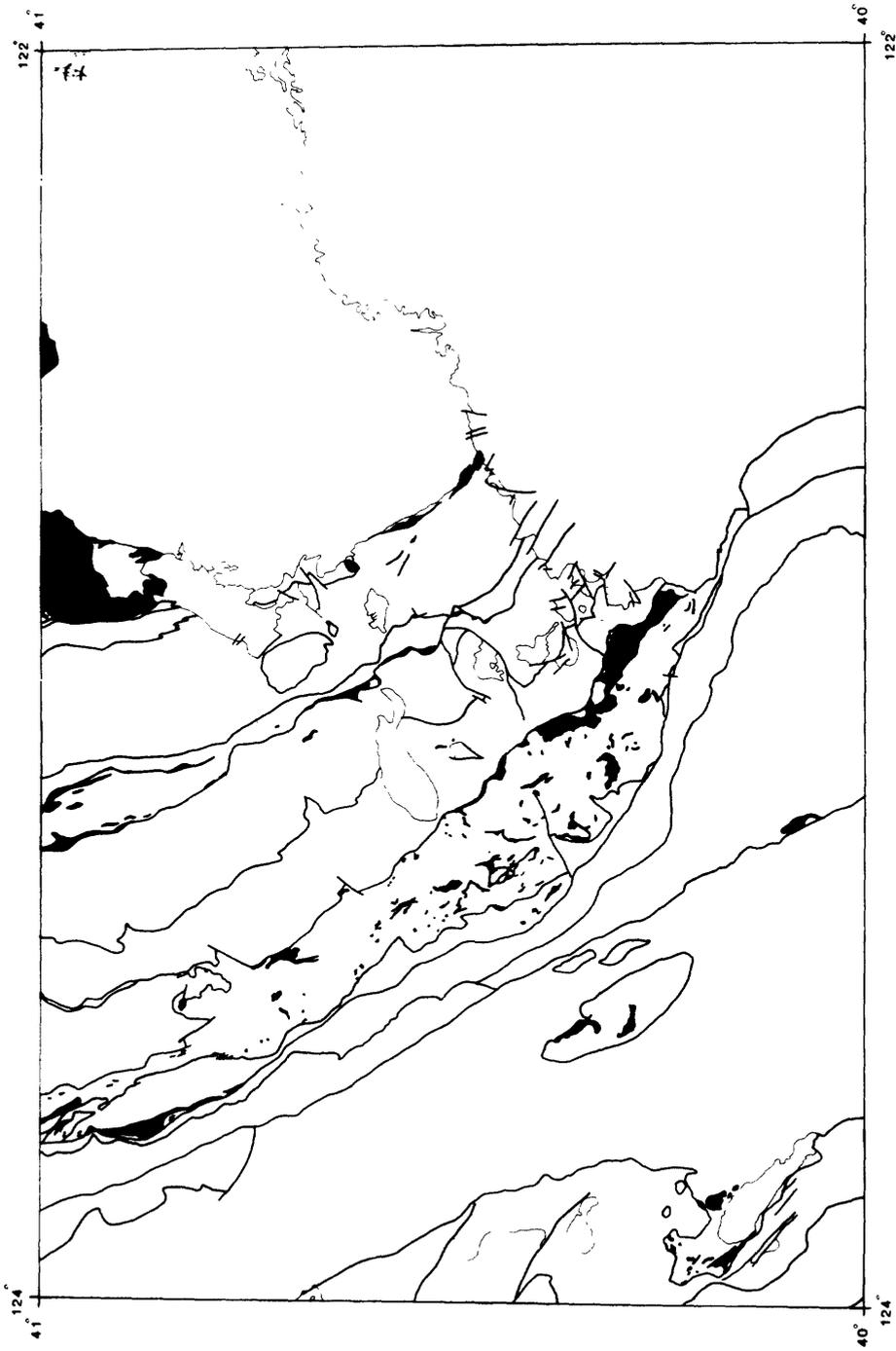


Figure 2. Simplified map showing the distribution of ultramafic rocks (solid areas) in the Redding 1X2 degree quadrangle. All ultramafic rocks shown are mostly serpentinized peridotite. Includes the Trinity ophiolite (?) of Lindsley-Griffin (1977), and the Coast Range ophiolite. Terrane boundaries and major faults are shown in a heavier line weight, boundaries of superjacent rocks are shown in the lighter line weight.

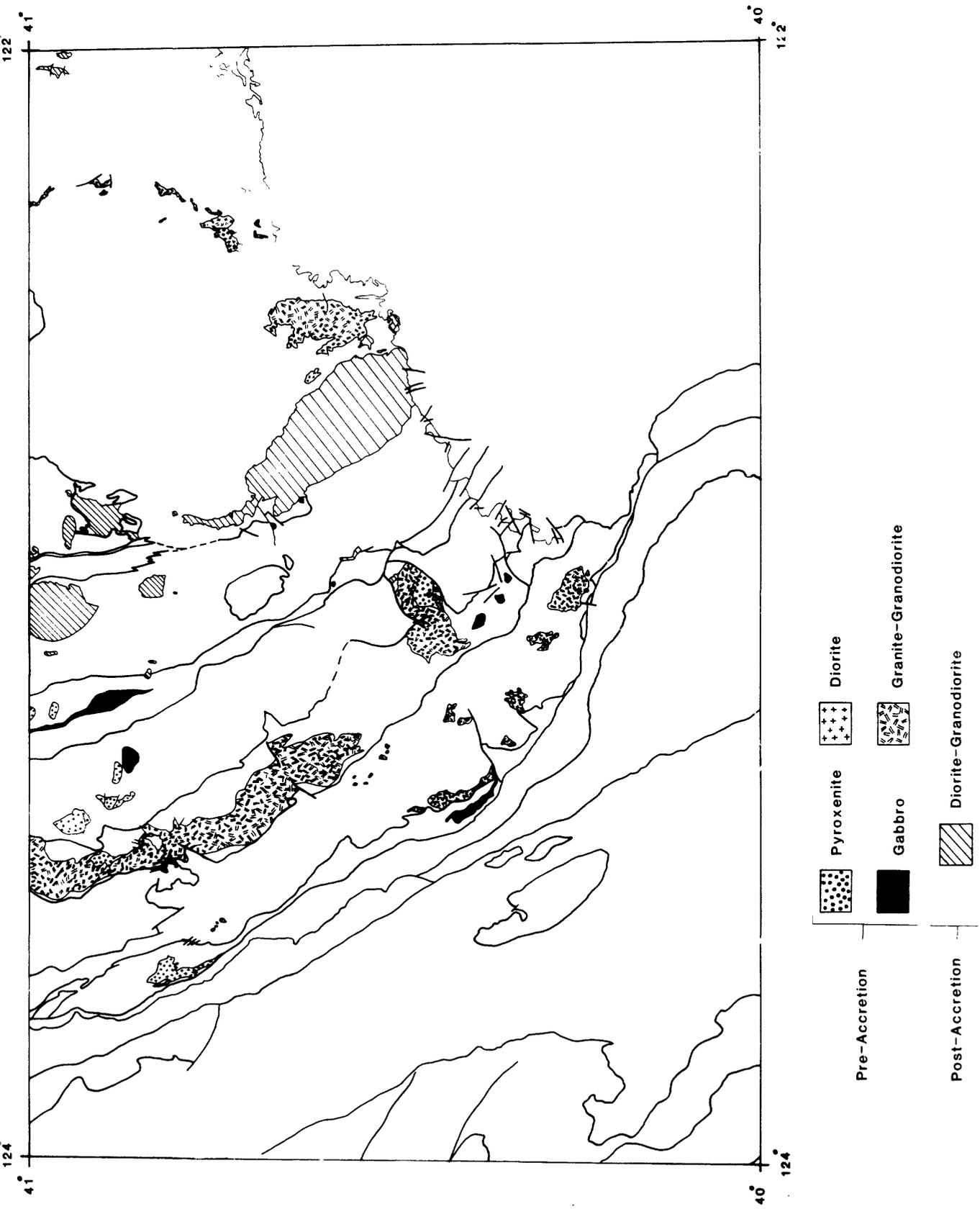


Figure 3. Simplified map showing the distribution of plutonic rocks in the Redding 1X2 degree quadrangle.