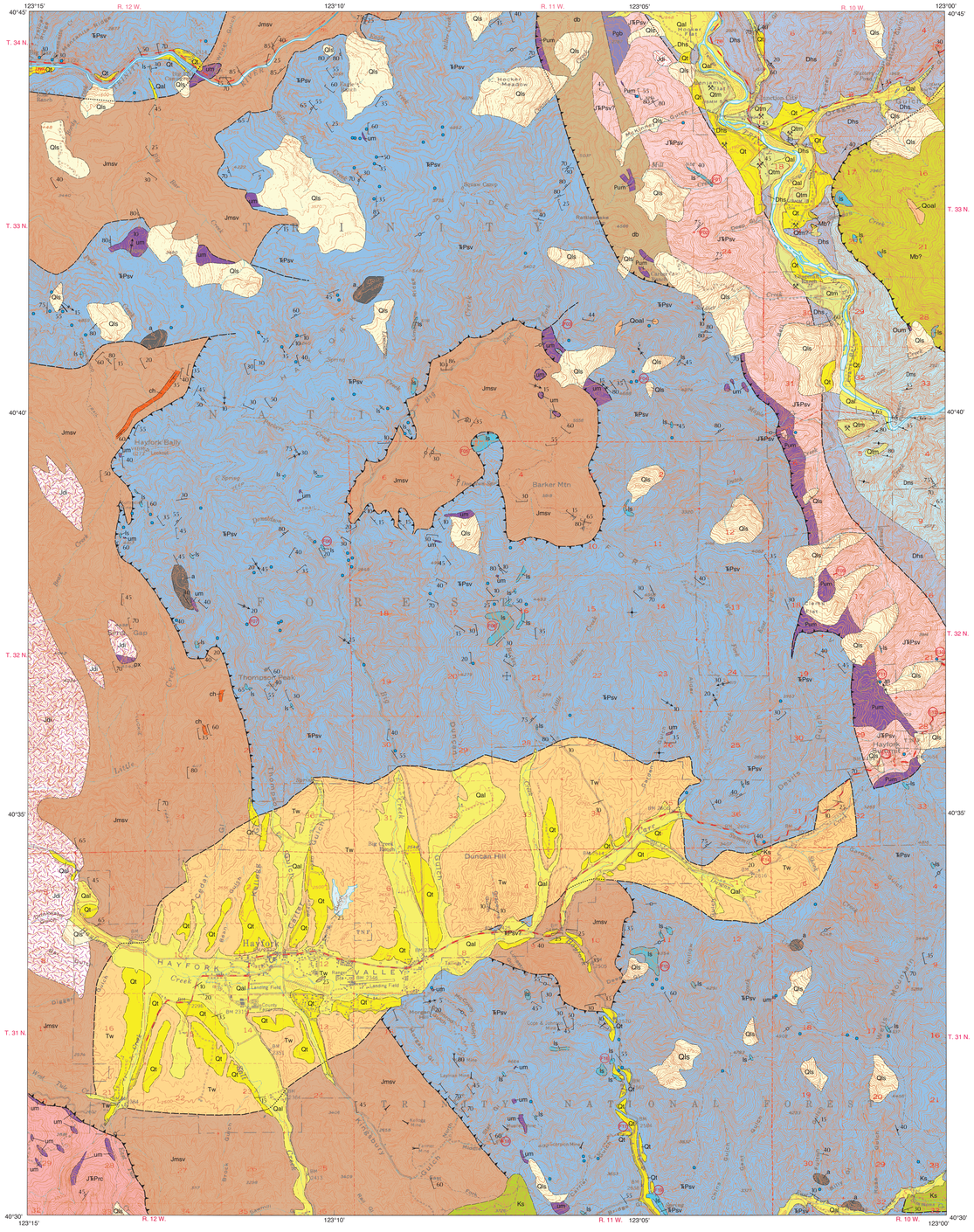
U.S. Department of the Interior
U.S. Geological Survey

Scientific Investigations Map 3119



Base: U.S. Geological Survey Hayfork 15-minute quadrangle, 1951; polyconic projection, North American Datum 1927.

19°
true north
magnetic north

SCALE 1:50 000

1 0 1 2 3 4 MILES
3000 0 3000 6000 9000 12000 15000 18000 21000 FEET
1 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 50 FEET
DATUM IS MEAN SEA LEVEL

AREA OF MAP
CALIFORNIA

Geology mapped by W.P.Irwin in 1968-72; assisted by A.W. Snoke,1968, and Andrew Tarshis,1970. GIS database and digital cartography by W.P. Irwin and C.M. Wentworth, 2009
Edited by T.A. Lindquist
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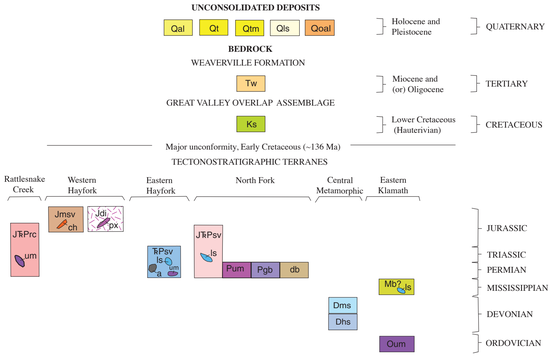
CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

UNCONSOLIDATED DEPOSITS

Qal — **Alluvium (Holocene and Pleistocene)**—Unconsolidated sand and gravel in channels of modern streams and on associated low terraces. Much has been reworked by placer mining for gold. Includes some deposits that result from slumping and slope wash in areas underlain by Weaverville Formation. Structural symbols in unit Qal were measured on small outcrops of underlying bedrock

Qt / Qtm — **Terrace deposits (Quaternary)**—Moderate- to high-level terraces, generally but not everywhere covered by a veneer of sand and gravel. Includes associated colluvium. Terraces from which the sand and gravel have been mostly removed from bedrock by gold-placer mining are shown as unit Qtm

Qls — **Landslide deposits (Quaternary and older?)**

Qoal — **Old alluvium (Quaternary and older?)**—Includes old soil, colluvium, and gravel. Associated with topographically high remnants of old land surfaces

BEDROCK

WEAVERVILLE FORMATION

Tw — **Weaverville Formation (Miocene and (or) Oligocene)**—Nonmarine, weakly consolidated mudstone, sandstone, and conglomerate, containing impervious dark-green clay and sparse interbeds of light-colored tuff. Locally contains abundant fossil plants and some lignitic coal beds. The fossil plants are considered Oligocene(?) (MacGinitie, 1937); the pollen and spores are considered late Oligocene and (or) early Miocene (Barnett, 1982). Formation is poorly exposed, mainly owing to weak consolidation. Distribution and contact relations shown on map are based in large part on interpretation of topography

GREAT VALLEY OVERLAP ASSEMBLAGE

Ks — **Great Valley sequence (Lower Cretaceous)**—Firmly consolidated and well-bedded marine mudstone, sandstone, and conglomerate. Small patch at Summit Creek is mostly mudstone that has sparse calcareous nodules. Patch near center of southern boundary of the quadrangle is mostly conglomerate. Microfossils from patch at southeast corner of quadrangle (but collected just east of the quadrangle boundary) are considered (R.D. Berry, written commun., 1969) to be Early Cretaceous (Hauterivian-Barremian, Zone K). Microfossils from the Summit Creek patch (fossil locality no. 14; table 1) are probably late Early Cretaceous (Albian) (W.V. Sliter, written commun., 1974)

TECTONOSTRATIGRAPHIC TERRANES

Eastern Klamath Terrane

Mb?/ls — **Bragdon(?) Formation (Mississippian)**—Well-indurated conglomerate, grit, sandstone, thin-bedded chert and, locally, recrystallized limestone (ls, where divided). Includes minor(?) amounts of mafic volcanic rock, some of which is vesicular and weathers purple. Part of thrust plate, the Oregon Mountain outlier, which structurally overlies rocks of Central Metamorphic terrane (see Irwin, 2009). Correlation with the Bragdon Formation is uncertain. May be correlative with units of Yreka terrane (Cashman and Cashman, 2006)

Qum — **Serpentinite (Ordovician?)**—Probably a small isolated slice of Trinity ophiolite at base of Oregon Mountain outlier (see Irwin, 2009)

Central Metamorphic Terrane

Dms — **Abrams Mica Schist (Devonian)**—Schistose metasedimentary rocks, generally micaceous and quartzitic. Contains micaceous marble, most commonly as small lenses near base of unit. Unit is equivalent to the Grouse Ridge Formation of Davis and Lipman (1962)

Dhs — **Salmon Hornblende Schist (Devonian)**—Hornblende schist and gneiss, probably derived from mafic volcanic rocks. Composition similar to mid-ocean ridge basalt (Barrow and Metcalf, 2006). Locally includes minor lenses of micaceous schist

North Fork Terrane

J'kPsv / ls / Pum / Pgb / db — **Broken formation (Lower Jurassic to Permian)**—Mafic volcanic rocks, thin-bedded chert, phyllite, and mildly recrystallized limestone (ls, where divided). Volcanic rocks locally have well-developed pillow structure, are vesicular, and weather to shades of red and purple. Radiolarians in chert and tuff range in age from Permian to Early Jurassic (Pliensbachian) (Blome and Irwin, 1983). Much of the volcanic rock may represent the upper part of the North Fork ophiolite, the lower part being ultramafic rock (Pum), gabbro (Pgb), and diabase (db) that form the western border of the terrane. Although the diabase is assumed to be part of the ophiolite, the genetic relation is not clear
- Dots mark small limestone bodies

Eastern Hayfork Terrane

J'kPsv / ls / a / um — **Broken formation and mélange (Triassic and Permian)**—Interlayered mafic volcanic rocks, slaty argillite, thin-bedded chert, phyllite, quartz-keratophyre tuff and associated small intrusive bodies, siliceous sandstone, grit, and pebble conglomerate. Includes minor amounts of chlorite schist, blocks of epidote amphibolite (a, where divided), micaceous metachert, mica schist, recrystallized limestone (ls, where divided), and serpentinized ultramafic rock (um, where divided). In addition, some patches of ultramafic rock (um) present in unit Jmsv may be structural outliers. Fossils in the limestone are variously Permian and Triassic in age and, at several localities, the microfauna and corals are of Tethyan faunal affinity (Irwin and Blome, 2004). Chert yielded radiolarians of Permian and Triassic ages but none clearly of Jurassic age
- Dots mark small limestone bodies

Western Hayfork Terrane

Jmsv / ch — **Metavolcaniclastic andesite (Jurassic)**—Andesite that ranges in texture from coarse agglomerate to thin-bedded tuff. Locally includes interlayers of dark slaty argillite and thin-bedded chert (ch, where divided). Chert at several localities beyond the quadrangle contains poorly preserved Mesozoic radiolarians (Irwin and Blome, 2004). Intruded by:

Jdi / px — **Ironside Mountain batholith and related plutons (Jurassic)**—Mostly syenodiorite and pyroxene diorite; locally includes quartz diorite, minor amounts of gabbro, pyroxenite (px, where divided), and contact-metamorphosed rocks. Part of, and restricted to, Western Hayfork terrane. Isotopic analysis (K-Ar) indicates an approximate 165 Ma (Middle Jurassic) age of emplacement of the Ironside Mountain batholith (Lanphere and others, 1968, p. 1038); U/Pb analysis of zircons from the Ironside Mountain batholith and related plutons yielded ages of 170-163 Ma (Wright, 1981)

Rattlesnake Creek Terrane

J'kPrc / um — **Mélange (Jurassic to Permian)**—Mainly volcanic and volcaniclastic rocks, thin-bedded chert, phyllite, and serpentinized ultramafic rock (um, where divided). Volcanic rocks are commonly pillow lava, are vesicular, and weather to shades of red and purple. Much chert is red and locally stained by dark oxides of iron and manganese. Beyond the limits of the quadrangle, the Rattlesnake Creek terrane also includes bodies of recrystallized limestone; fossils in some limestone bodies are Permian. Radiolarians in the chert are commonly Triassic and, rarely, Early Jurassic (Irwin and others, 1977; Irwin and Blome, 2004). Rocks of Rattlesnake Creek terrane are generally sheared and dislocated. The lithic assemblage indicates that the terrane is a highly dismembered ophiolite and mélange. Surficially, the terrane is characterized by highly unstable hillsides

MAP SYMBOLS

- Contact, showing dip; dashed where approximately located
- Fault, showing dip; dashed where approximately located; teeth on upper plate where thrust
- Attitude of inclined bedding
- Direction and dip of bedding
- Inclined / Vertical / Horizontal — Attitude of foliation
- Inclined / Vertical — Attitude of joints
- Inclined / Vertical / Horizontal — Attitude of cleavage
- Small fold, showing plunge of axis where known
- Prospect pit
- Mine adit
- Fossil locality

Table 1. Fossil localities in the Hayfork 15' quadrangle

Map#	I&B#(1)	Field#	Lithology	Fossils	Age
F01	197	I-1-72	Limestone	Fusulinids	Early Permian
F02	198	I-22-81	Chert	Radiolarians	Middle to Late Jurassic
F03	93	I-14-77	Chert	Radiolarians	Triassic or Jurassic
F04	94	I-32-70	Limestone	Fusulinids	Early Permian
F05	95	I-1-73	Limestone	Foraminifers and gastropods	Pennsylvanian or Permian
F06	96	I-49-70	Limestone	Conodonts	Ordovician to Triassic
F07	97	I-11-70	Limestone	Conodonts	Late Triassic
F08	98	I-15-70	Limestone	Conodonts	Ordovician to Triassic
F09	99	I-11-76	Chert	Radiolarians	Middle or Late Triassic
F10	200	W-57-26c	Limestone	Fusulinids	Late Pennsylvanian to early Permian
F11	201	I-3-76	Chert	Radiolarians	Early or Middle Jurassic
F12	202	I-10-76	Chert	Radiolarians	Early or Middle Jurassic
F13	203	I-1-76	Chert	Radiolarians	Early Jurassic
F14		I-11-69	Great Valley seq.	Foraminifers	Early Cretaceous (late Albian?)(2)
F15	99	I-19-70	Limestone	Conodonts	Middle Triassic
F16	100	I-10-72	Limestone	Conodonts	Early Triassic
F17	101	I-26-81	Chert	Radiolarians	Permian
		I-8-82	Chert	Radiolarians	Permian
F18	102	I-32-68	Conglomerate	Rugose corals	Silurian
		I-18-70	Conglomerate	Mixed faunas	Permian
F19	103	I-10-68	Limestone	Microfauna	Permian or early Mesozoic

(1) I&B# refers to numbers from Irwin and Blome (2004).
(2) Age by W.V. Sliter, written commun., 1974.

SYNOPSIS

The Hayfork 15' quadrangle is located just west of the Weaverville 15' quadrangle in the southern part of the Klamath Mountains geologic province of northern California. It spans parts of six generally north-northwest-trending tectonostratigraphic terranes that are, from east to west, the Eastern Klamath, Central Metamorphic, North Fork, Eastern Hayfork, Western Hayfork, and Rattlesnake Creek terranes (See Generalized Terrane Map). Remnants of a once-widespread postaccretionary overlap assemblage, the Cretaceous Great Valley sequence, crop out at three localities in the southern part of the Hayfork quadrangle. The Tertiary fluvial and lacustrine Weaverville Formation occupies a large, shallow, east-northeast-trending graben in the south half of the quadrangle.

The small area of Eastern Klamath terrane is part of the Oregon Mountain outlier, which is more widely exposed to the east in the Weaverville 15' quadrangle (Irwin, 2009). It was originally mapped as a thrust plate of Bragdon(?) Formation, but it is now thought by some to be part of an outlier of Yreka terrane that has been dislocated 60 km southward by the La Grange Fault (Cashman and Cashman, 2006). The Central Metamorphic terrane, which forms the footwall of the La Grange Fault, was formed by the eastward subduction of oceanic crustal basalt (the Salmon Hornblende Schist) and its overlying siliceous sediments with interbedded limestone (the Abrams Mica Schist) beneath the Eastern Klamath terrane. Rb-Sr analysis of the Abrams Mica Schist indicates a Middle Devonian metamorphic age of approximately 380 Ma (Lanphere and others, 1968), which probably represents the age of subduction.

The North Fork terrane, which is faulted against the western boundary of the Central Metamorphic terrane, consists of the Permian(?) North Fork ophiolite and overlying broken formation and mélange of Permian to Early Jurassic (Pliensbachian) marine metasedimentary and metavolcanic rocks. The ophiolite, which crops out along the western border of the terrane, is thrust westward over the Eastern Hayfork terrane.

The Eastern Hayfork terrane is a broken formation and mélange of volcanic and sedimentary rocks, including chert and blocks of amphibolite, limestone, and serpentinized ultramafic rocks. The chert contains radiolarians of Permian and Triassic ages, but none of clearly Jurassic age. In contrast, the cherts of the North Fork terrane contain Early and Middle Jurassic radiolarians in addition to those of Permian and Triassic ages; also, some limestones of the Eastern Hayfork terrane contain fossil faunas of Tethyan affinity, but those of the North Fork terrane do not.

The Western Hayfork terrane is an andesitic volcanic arc that was accreted to the Eastern Hayfork terrane. It consists mainly of metavolcaniclastic andesitic agglomerate and tuff, as well as argillite and chert, and it includes the dioritic Ironside Mountain batholith, which intruded during Middle Jurassic time. Two large patches of Western Hayfork terrane mapped in the central part of the Eastern Hayfork terrane may be exposed through windows in the Eastern Hayfork terrane, although the structural relation is not clear.

The Rattlesnake Creek terrane is a mélange that occupies only a small area in the southwest corner of the Hayfork quadrangle; however, it is a major unit in the Hyampom 15' quadrangle to the west. It consists mainly of broken and sheared ophiolitic rocks of probable Permian or early Mesozoic age.

The Cretaceous Great Valley sequence overlap assemblage here postdates the Early Cretaceous (approximately 136 Ma) emplacement of the Shasta Bally batholith, which is widely exposed to the east in the Weaverville 15' quadrangle. The Great Valley sequence once covered much of the southern Klamath Mountains; however, in the Hayfork quadrangle, only three small patches remain near its southern boundary.

Weakly consolidated nonmarine sedimentary rocks of the Weaverville Formation of mid-Tertiary age, which contain abundant fossil plants, occupy a large, shallow, east-northeast-trending graben in the southern part of the Hayfork quadrangle. The formation overlaps the main boundary between the Eastern and Western Hayfork terranes.

Mineral production from the Hayfork quadrangle has been small. A small amount of lignitic coal has been mined from the Weaverville Formation. Gold has been mined from several lode deposits, most of which are in the Eastern and Western Hayfork terranes near their common boundary southeast of the town of Hayfork. Much of the gold produced in the Hayfork quadrangle has come, however, from the mining of stream and terrace gravels along the Trinity River in the northeastern part of the quadrangle, and along Hayfork Creek in the southern part of the quadrangle.

This map of the Hayfork 15' quadrangle is a digital rendition of U.S. Geological Survey Miscellaneous Field Studies Map MF-576 (Irwin, 1974), with various improvements and additions.

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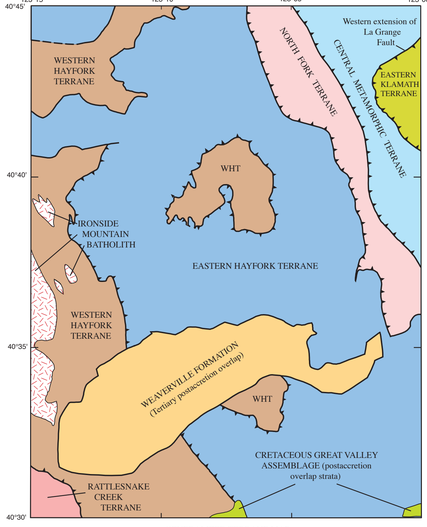

GENERALIZED TERRANE MAP

The oldest rocks in the Hayfork 15' quadrangle, present along its northeast border, are part of the Oregon Mountain outlier of the Eastern Klamath terrane, which is more widely exposed to the east in the Weaverville 15' quadrangle. There, these Mississippian(?) or older rocks are generally separated from the underlying rocks of the Central Metamorphic terrane by ultramafic rocks of the Trinity terrane. In the Hayfork quadrangle, however, only one small remnant of Trinity ophiolite (Qum) was mapped along that contact. The Central Metamorphic terrane is in fault contact with the North Fork terrane, which is a melange with an ophiolite along much of its western side that is thrust westward over the Eastern Hayfork terrane. The Eastern Hayfork terrane, also a melange, occupies much of the central part of the quadrangle. It is considered to be in thrust contact with the underlying Western Hayfork terrane, based on interpretation of the two central areas of Western Hayfork terrane (WHT) as antiformal windows. The Western Hayfork terrane is a Jurassic volcanic-arc deposit that is genetically related to the Ironside Mountain batholith.

Reconnaissance Geologic Map of the Hayfork 15′ Quadrangle, Trinity County, California

By

William P. Irwin

2010

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