DEPARTMENT OF THE INTERIOR
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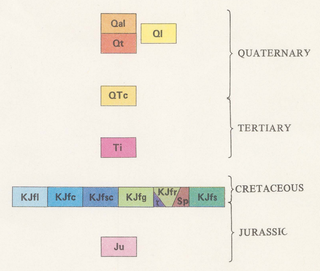
Base from 15′ (1:62,500) U.S. Geological Survey Topographic Quadrangles (Orick, Trinidad, Teetah Creek, Coyote Peak, Blue Lake, Willow Creek, Pilot Creek, and Iaqua Buttes)

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

Qal MODERN ALLUVIUM (Qal)

The modern alluvium of Redwood Creek and its major tributaries comprises two distinct lithologic facies. The environments of deposition of these units are described by Janda and others (1975). Alluvium in the inner floodplain consists mainly of sandy pebble and cobble gravel. Boulders comprise a significant portion of the alluvium in the upstream reaches of Redwood Creek. The upper floodplain consists of overbank deposits that are predominantly fine sandy loam and silt loam. In Redwood Valley, in stream reaches downstream of Bridge Creek, and along Prairie Creek, the fine-grained alluvial facies comprises a significant amount of the total alluvium shown on the map.

Ql LANDSLIDE DEPOSITS (Ql)

Landslide deposits and scars are widespread throughout the Redwood Creek basin (Nolan and others, 1976; Harden and others, 1978). Only deposits of large complex slumps and earthflows are shown on this map.

Qt STREAM TERRACE DEPOSITS (Qt)

Deposits of moderately to intensely weathered alluvium are widespread in the Redwood Creek basin. The deposits are lithologically similar to the modern gravelly alluvium of Redwood Creek. Bodies of older alluvium underlie prominent terrace surfaces adjacent to Redwood Creek. Numerous scattered concentrations of cobbles that are remnants of former terrace deposits also occur on gently sloping hillslopes near Redwood Creek. The terraces and alluvial deposits resulted from the progressive incision of Redwood Creek during late Pleistocene and Holocene time. With one exception, the deposits are up to six meters thick and occur between about 3 and 200 meters above the present stream channel. An unusual alluvial deposit, which is at least 50 m thick and lithologically identical to Redwood Creek alluvium, occurs on a low divide near the mouth of Bridge Creek. This deposit is the only evidence of a former thick alluvial fill in the Redwood Creek basin.

QTc COASTAL PLAIN SEDIMENTS (QTc)

Unconsolidated to weakly consolidated silts, sands, and gravels associated with minor amounts of organic-rich mud occur in the northern part of the Redwood Creek basin. Primary sedimentary structures and textures of these sediments reflect coastal-plain deposition in fluvial, estuarine, and littoral environments. Exposures of the unit on flat ridge tops and summit areas are deeply weathered. Differences in lithology, weathering, and topographic position of the deposits indicate that several distinct depositional subunits are present. The extensive exposures of the unit in the Gold Bluffs Beach–Prairie Creek–Holter Ridge areas clearly display these lithologic variations, as well as the differences in topographic position and degree of post-depositional fracturing.

The coastal plain sediments which appear to be oldest contain fragmentary Pliocene plant fossils (Moore and Silver, 1968). In addition, pelecypods from genera that are not diagnostic of age (W.O. Addicott, oral communication, 1979) occur in the unit together with late Miocene or Pliocene radiolaria. Moore and Silver (1968) postulated that this unit interfingers with the marine St. George Formation, which contains abundant Pliocene marine mollusks. Gravel clasts in the older deposits appear to be derived exclusively from plutonic and metamorphic terrane of the Klamath Mountains.

The older deposits of the unit are broadly warped and pervasively fractured, commonly displaying conjugate fracture sets. Most of the fractures show no offset, but a few show measurable offset with apparent displacement in both left and right lateral senses. Fracture trends vary within the unit, and a systematic variation in structural pattern with locality may be present.

Included within QTc are younger coastal plain sediments that were deposited on marine terraces cut into both Franciscan rocks and the younger coastal plain sediments. Gravel clasts in the younger subunits are derived from local Franciscan rocks as well as from the Klamath Mountain terrane. In addition, gravel clasts deposited on the marine abrasion platform cut into the Redwood Creek schist on the Elam Creek divide south of Redwood Creek include clasts of older units of QTc. Younger sediments of the unit are also pervasively fractured and locally offset by faults.

The degree of soil profile development and weathering of exposures of the younger coastal plain sediments indicate that all of the sediments are older than late Pleistocene. The sediments display strong reddish oxidation hues, and significant amounts of clay have accumulated in the B-horizons of soils developed on the deposits. Although several distinct ages of deposits are present in the area, it is difficult to ascertain the number of discrete units on different terrace surfaces because of poor exposures and post-depositional tectonism.

Ti TERTIARY INTRUSIVE ROCK (Ti)

An alkalic diatreme intrudes the incoherent unit of Coyote Creek (KJfc) at Coyote Peak on the eastern divide of the Redwood Creek basin. The diatreme covers an area of about 1.25 hm^2. Its mineralogical composition is highly unusual and includes olivine, clinopyroxene, phlogopitic biotite, nepheline, acmite, schorlamitic garnet, titanomagnetite, perovskite, and apatite (Blake, 1977; Czamanske and others, 1977). In addition, several rare sulfide minerals, some previously unknown, have been identified. Inclusions of Franciscan sedimentary rocks and fine-grained, alkalic igneous rocks also occur within the diatreme.

FRANCISCAN ASSEMBLAGE

Most of the Redwood Creek basin is underlain by rocks of the Franciscan assemblage (Bailey and others, 1964)

SANDSTONE AND MUDSTONE UNITS (KJfl; KJfc)

These rock units consist primarily of sandstone and mudstone with minor amounts of conglomerate, chert, and volcanic rock. The unit has been intensely folded and faulted and, in localized areas, penetratively sheared. The original stratigraphic positions of chert and volcanic rock are obscured by both structural deformation and scarcity of exposures. Two middle Cretaceous (Cenomanian) ammonite fossils *Desmoceras (Pseudouhligella) japonicum*, and *Calycoceras sp.* found in the Redwood Creek basin were identified by D.L. Jones (U.S. Geological Survey, written communication, 1976).

Thin-section examination revealed that the sandstone is predominantly lithic graywackes and quartzofeldspathic graywackes. They lack potassium feldspar, thereby resembling sandstones of the Central-belt Franciscan of Blake and Jones (1978). However, one thin section is as rich in potassium feldspar as are sections of sandstone from the Coastal-belt Franciscan, suggesting that unrecognized structural complexities may exist within the Franciscan sandstone (M.C. Blake, oral communication, 1978).

The sedimentary rocks of the unit appear unmetamorphosed and show no evidence of cataclasis in hand specimen. Their unaltered appearance suggests that they belong in textural zone 1 of Blake, Irwin and Coleman (1967). The presence of pumpellyite in thin section attests to some low grade metamorphism within this unit.

Lithologic and structural distinctions allow separation of two mappable subunits within the sandstone and mudstone unit. Areas underlain by relatively coherent sandstone-mudstone sequences stand in contrast to areas underlain by incoherent, more pervasively fractured and sheared sequences with greater amounts of mudstone. Contacts between the two subunits range from gradational to sharp. Outcrop patterns of subunits form broad, irregular lithologic belts elongated in a north-northwest direction.

KJfl Coherent Unit of Lacks Creek (KJfl)

The predominant rock types of the unit are coherent sandstone and interbedded sandstone and mudstone. The rhythmic bedding and internal sedimentary structures of sandstone-mudstone sequences are typical of turbidites. However, individual beds cannot be traced laterally for more than 100 m due to complex folding and faulting within this unit. Sandstone occurs as massive beds up to 10 m thick, but most beds are between 0.1 m and 3 m thick with thinner mudstone interbeds. Mudstone comprises a noticeably lower percentage of the coherent sedimentary sequence than of the incoherent sequence. The graywackes within this unit contain abundant fine volcanic detritus, but large blocks of volcanic rocks and chert are not found

High sandstone content, presence of massive beds, and less intense shearing and fracturing result in steeper, straighter hillslopes in areas underlain by the coherent unit compared to those in the remainder of the basin (Janda, 1979). Uniformly sharp ridge crests, steep slopes, and narrow V-shaped tributary canyons are characteristic of the landscape developed on this unit. Extensive exposures of this unit occur outside the Redwood Creek basin, both to the north-northwest and to the south-southeast.

KJfc Incoherent Unit of Coyote Creek (KJfc)

Areas underlain by the incoherent unit have a lower sandstone:mudstone ratio than those underlain by the coherent unit, and massive sandstone beds are less common. In addition, rocks in this unit are more brecciated and sheared, particularly in the vicinity of the Grogan fault. The incoherent unit contains tectonic blocks of chert, greenstone and sandstone, as well as isolated bedded sequences of sandstone and chert. Thin sections show that greenstone blocks contain chlorite, pumpellyite, prehnite, and mica. These greenstone blocks are commonly immersed in a sheared mudstone matrix. Large areas of bedded tuffs and flows, similar to those within the schist of Redwood Creek, are not found.

Exotic blocks of glaucophane schist or high-grade metamorphic rocks are not found in either the coherent or incoherent units of the Redwood Creek basin except along the Grogan fault zone. The absence of exotic blocks and the comparative lesser degree of shearing relative to that described in Franciscan melange in other areas (Blake and others, 1967; Kelsey and Allwardt, 1975) led to the decision not to call this unit Franciscan melange. However, the extensive shearing and the landscape morphology of the incoherent unit suggest that it is similar to melange in other areas. Occurrences of large blocks of greenstone, chert, or sandstones in this unit are delineated by (x).

The incoherent unit underlies a subdued, rolling landscape with less deeply incised drainage networks than those developed on the coherent unit. The large, resistant blocks form prominent points on the landscape. Expanses of grass-oak woodland and grass-bracken fern prairie are common within the incoherent terrane, whereas prairies are restricted to ridge tops in areas underlain by the coherent unit.

KJfsc SANDSTONE AND MELANGE UNIT OF SNOW CAMP MOUNTAIN (KJfsc)

The sandstone and melange unit of Snow Camp Mountain is in fault contact to the north with the schist of Redwood Creek and is bounded on the east by the Grogan fault zone. This unit consists of bodies of bedded graywacke intermixed with melange. The sandstone and associated melange show no megascopic evidence of metamorphism, indicating that the rocks belong to textural zone 1 of Blake and others (1967). The melange displays a pervasively sheared siltstone-rich matrix and contains exotic blocks of higher metamorphic grade. Exotic blocks include blueschist, metagraywacke with segregated quartz bands and a cataclastic texture characteristic of textural zone 2, coarsely crystalline intrusive or hypabyssal rocks, and whitish-green metacherts. The melange matrix locally contains abundant dense greenstones.

The sandstone and melange unit is lithologically and structurally comparable to similar units that crop out over extensive areas to the south in the Mad, Van Duzen, and Eel River basins. The Snow Camp Mountain unit appears to be contiguous with the sandstone and melange unit in the Mad River basin to the south. The unit is markedly different from both the incoherent and the coherent sandstone and mudstone units (KJfc and KJfl) in that neither KJfc nor KJfl contains exotic blocks.

The landscape developed on the Snow Camp Mountain unit is in general more hummocky than the hillslopes of the incoherent unit to the east. Portions of the area that are underlain by massive sandstone display steep slopes, prominent ridges, and V-shaped valleys. In contrast, areas underlain by melange display more rolling hummocky hillslopes.

KJfg METAMORPHOSED SANDSTONE AND MUDSTONE OF THE GROGAN FAULT ZONE (KJfg)

Metamorphosed sedimentary rocks of the Grogan fault zone consist mainly of mudstone and sandstone, with conglomerate and greenstone also present. The composition and structure of rocks of this unit suggest that it was derived from parts of both the coherent and the incoherent units. However, rocks of this unit are more metamorphosed than either KJfc or KJfl. Outcrops of siltstone and mudstone have a phyllitic sheen due to the presence of metamorphic chlorite and white mica. Thin sections of the sandstones of this unit commonly reveal the presence of lawsonite. Talley (1976) also reported the presence of metamorphic chlorite.

Sandstones and conglomerates commonly show alignment of clasts by mechanical shattering and rotation, and sandstones have a weak foliation in outcrop. Siltstones and mudstones of this unit show platy cleavage in outcrop. KJfg rocks belong to textural zone 2 of Blake, Irwin and Coleman (1967).

A complete transition from unmetamorphosed sandstone and mudstone to schist has not been observed along the Grogan fault. However, rocks in the 0.3- to 0.5-km-wide fault zone between State Highway 299 and the mouth of Lacks Creek do appear to represent a fairly complete textural gradation. At some localities along the Grogan fault rocks of this unit are absent. The textural zone 2 rocks described by Blake and others (1967) along the South Fork Mountain fault, to the south of the mapped area, are almost totally absent along the continuation of that fault in the Redwood Creek basin.

SCHIST OF REDWOOD CREEK AND SOUTH FORK MOUNTAIN SCHIST (KJfr; KJfs)

Rocks included in this unit consist primarily of fine-grained quartz-mica schist. The rocks are lithologically and texturally similar to the textural zone 3 South Fork Mountain Schist of Blake, Irwin and Coleman (1967). Two bodies of schist occur in the Redwood Creek basin. The larger of the two, the schist of Redwood Creek (KJfr), underlies the western half of the basin. The eastern portion of the basin from the southern Lacks Creek divide southward is also underlain by schist. This body is named the South Fork Mountain Schist (KJfs) because it can be traced continuously southward to this unit's type locality of Pickett Peak (Blake and others, 1967). The schist of Redwood Creek has been previously mapped as the Kerr Ranch Schist in the Blue Lake Quadrangle by Manning and Ogle (1950) and as the South Fork Mountain Schist in the Willow Creek Quadrangle by Young (1978).

KJfr Schist of Redwood Creek (KJfr)

Considerable variations in mineralogy, texture, lithology, and structure are evident within this unit. However, intense shearing and complex folding and faulting precluded mapping subunits within the schist.

The most common rock type within this unit is metamorphosed mudstone. Its typical mineral assemblage is quartz-albite-white mica-chlorite. Some of the metamorphosed mudstones have abundant carbonaceous material but the material is not graphite (Leathers, 1978; M.C. Blake, Jr., U.S. Geol. Survey, written communication, 1980). Metamorphosed sandstones which locally display graded bedding are also present in the schist of Redwood Creek. These coarser-grained rocks are quartzofeldspathic schists, lack obvious carbonaceous material, and commonly contain lawsonite and epidote.

Another major lithologic component of the schist of Redwood Creek is metamorphosed basalt and tuff. The common mineral assemblage is quartz-albite-chlorite-epidote-actinolite. Exposures of these rocks suggest that they may be equivalent to the Chinquapin Metabasalt Member of the South Fork Mountain Schist (Blake and others, 1967). Large metabasalt outcrops form prominent knobs on the landscape. Occurrences of metabasalt are indicated by (▲).

Our field observations do not confirm the existence of distinct belts of contrasting metamorphic grade within the schist, as were reported by Talley (1976). Local outcrops of textural zone 2 metagraywacke occur in contact with textural zone 3 schist, suggesting that considerable structural complexity exists within the unit.

Our work in the Redwood Creek basin suggests that the schist of Redwood Creek was derived from finer-grained and generally more organic-rich sediments than the rocks of the coherent unit of Lacks Creek or the incoherent unit of Coyote Creek. In addition, more volcanic rocks are present in the schist terrane. These differences indicate that the schist of Redwood Creek represents either a different provenance or a different sedimentary facies than rock units KJfc or KJfl.

KJfs South Fork Mountain Schist (KJfs)

The dominant rock type of this unit, quartz-albite-white mica-chlorite schist, is mineralogically similar to the schist of Redwood Creek. However, our observations suggest that the South Fork Mountain Schist is generally coarser-grained than the schist of Redwood Creek. Conversely, Monsen and Aalto (1980) suggest that the schist at Pine Ridge Summit is finer-grained than the schist of Redwood Creek.

t TECTONIC BLOCKS (t)

Tectonic blocks occur within the schist of Redwood Creek (KJfr). These tectonic blocks range from about ten meters to hundreds of meters in size, and they are of different metamorphic grade than the surrounding schist. The blocks consist of amphibolite, metamorphosed serpentinite, glaucophane schist, and metavolcanic rocks. Omphacite was seen in a thin section of one glaucophane schist block. The blocks are commonly associated with extensively sheared schist and occasionally with serpentinite. The blocks appear to outcrop in a north-northwest trending linear zone within the schist. Talley (1976) also recognized such a zone and identified similar rock types within it.

Sp SERPENTINITE (Sp)

Outcrops of serpentinite are less common in the Redwood Creek basin than in most other areas underlain by the Franciscan assemblage (Jennings, 1977). However, serpentinite does occur locally along the Grogan fault. In addition, isolated outcrops were found within the northern part of the schist of Redwood Creek (KJfr).

KLAMATH MOUNTAIN ROCKS

Ju SERPENTINITES, METAVOLCANICS, AND METASEDIMENTARY ROCKS (Ju)

Rocks of the Klamath Mountain tectonic province (Irwin, 1972) crop out along the eastern portions of the Redwood Creek basin south of State Highway 299. Young (1978) mapped the Klamath Mountain rocks and the South Fork fault, which is the boundary between Franciscan rocks to the west and the Klamath Mountain rocks to the east. Young's contact is used for the South Fork fault and two of his map units have been grouped together into one undifferentiated unit.

The Klamath Mountain rocks within the Redwood Creek basin consist mainly of ultramafic rocks. These ultramafic rocks may be correlative with Upper Jurassic ultramafic rocks of the Josephine ophiolite of Harper (1980), 75 km to the north. In the vicinity of Horse Mountain, the ultramafic rocks include sheared serpentinite and coarsely crystalline, partially serpentinized peridotite. A zone of tectonically mixed rocks, consisting of serpentinite, foliated greenstone, diorite, and metagraywacke occurs in the South Fork thrust zone near Titlow Hill (Young, 1978).

FAULTS

The major boundaries between Mesozoic rock units in the Redwood Creek basin are north-northwest trending faults parallel to the regional structural trend in northwestern California. The four major faults, from southwest to northeast, are the Bald Mountain and the Grogan faults (Strand, 1962), and unnamed fault that separates unmetamorphosed Franciscan units (KJfc and KJfl) from the South Fork Mountain Schist (KJfs), and the South Fork fault (Irwin, 1974). The geologic cross-section shows these faults and the Mesozoic units which they separate. In addition, a set of ENE–WSW trending faults occurs within the basin, and an E–W trending fault truncates the southern end of the schist of Redwood Creek (KJfr). A series of prominent photogeologic lineaments, which may be faults, is discussed in a separate section

The Bald Mountain fault separates unmetamorphosed Franciscan sandstone from the schist of Redwood Creek (KJfr). The northern end of the Bald Mountain fault near the coast is a low angle, east-dipping thrust (Strand, 1963; S. Cashman, oral communication, 1980). The irregular outcrop pattern displayed throughout the length of the Bald Mountain fault suggests that it may be a low angle fault thrusting the schist of Redwood Creek (KJfr) over unmetamorphosed melange (KJfsc). However, poor exposures prevent further definition of the dip of the fault. Irregularities in the pattern of the fault's outcrop may also be due to secondary fault offset of the Bald Mountain fault, as suggested by Manning and Ogle (1950) We are uncertain of the character of this fault, especially along the southern portion, although we have interpreted it as a thrust on the cross-section.

The Grogan fault separates the schist of Redwood Creek (KJfr) from both incoherent and coherent Franciscan sandstone and mudstone units (KJfc and KJfl) along a zone of metamorphosed and pervasively sheared rocks (KJfg) which define the Grogan fault zone. The Grogan fault zone is notably straight compared to the other major NNW-trending faults. The straightness of the fault, even in highly dissected areas in the northern portions of its mapped extent, suggests that it is vertical or near-vertical. The rocks in the fault zone (KJfg) are partly the product of deformation along a shear zone of varying width. Occasional tectonic blocks, including omphacite-bearing metabasalt and serpentine, have been incorporated into the shear zone.

The unnamed fault that separates the unmetamorphosed units (KJfc and KJfl) from the South Fork Mountain Schist (KJfs) has been informally called the Indian Field Ridge fault because of its good exposure in this area. The southern extension of this fault is associated with a clear textural gradation from texture zone 1 to texture zone 3 in the Yolla Bolly area (Blake and others, 1967) and in the Pickett Peak Quadrangle (Irwin and others, 1974). However, our mapping revealed no textural zone 2 rocks along this contact. Instead, a thin zone of pervasively sheared, unmetamorphosed Franciscan sediments separates KJfc and KJfl from KJfs and indicates that the contact is a fault. The irregular outcrop pattern of the Indian Field Ridge fault, especially between Grouse Mountain and Indian Field Ridge, suggests that it dips eastward at a low angle. Monsen and Aalto (1980) have also interpreted this contact near Pine Ridge Summit as a thrust fault.

The South Fork fault (Irwin, 1974) thrusts Klamath Mountain rocks over rocks of the Franciscan assemblage. Young (1978) indicates that the Klamath Mountain rocks immediately above the South Fork fault in the Redwood Creek basin consist of serpentinite, serpentinized periodotite, and a zone of tectonically mixed rocks that includes serpentinites, metagraywackes, and metavolcanics.

The east-west trending fault that truncates the southern end of the schist of Redwood Creek (KJfr) and separates KJfr from the Franciscan melange and sandstone unit (KJfsc) is informally called the Snow Camp Creek fault. This fault is evidently older than the Grogan fault because the Grogan appears to truncate its eastern end. A narrow belt of pervasively sheared rock, similar in textural character to rocks of KJfg, occurs along the Snow Camp Creek fault zone. Limited exposures of the Snow Camp Creek fault suggest that it is vertical.

Outcrop patterns of the major rock units suggest the presence of a set of ENE–WSW trending faults that offset the NNW-trending contacts between units. Limited exposures and extensive mass movement prohibit clear delineation of these faults. Some apparent ENE–WSW offsets may be the result of large-scale landsliding.

None of these faults shows evidence of movement during Quaternary time. Because Cenozoic deposits are scarce in the Redwood Creek basin in the vicinity of these faults, documentation of post-Mesozoic movement would be difficult. The Grogan fault zone appears to be buried by the Coastal Plain sediments (QTc). Although numerous offsets occur within QTc, no relationship between these offsets and a northern extension of the Grogan fault has been established so far.

PHOTOGEOLOGIC LINEAMENTS (BCL; SCML; SCCL)

A number of photogeologic lineaments exist in the Redwood Creek basin. With one exception, they trend NNW parallel to the regional structural trend.

The most prominent lineament, the Bridge Creek lineament (BCL), is formed by the aligned drainage segments of the main stem of Bridge Creek, a segment of Devils Creek, and two tributary reaches of Panther Creek. The Schist of Redwood Creek (KJfr) is more pervasively sheared along the lineament trace than elsewhere in the schist body. Geomorphic expression of this lineament cannot be found to the south of the Panther Creek basin. To the north of Bridge Creek, the lineament is tentatively defined by segments of Tom McDonald and McArthur Creeks, although geomorphic expression along this extension is less well defined than to the south.

Another set of photogeologic lineaments occurs in the southwestern portion of Redwood Creek basin. These lineaments are collectively called the Snow Camp Mountain lineaments (SCML) and are marked by ponds and undrained depressions aligned along a NNW trend. Although large mass movements could have formed any single undrained depression or pond, the linear trend of several features suggests that they are fault-related.

Between the Snow Camp Mountain lineaments (SCML) and the Bridge Creek lineament (BCL) isolated ponds and undrained depressions are locally aligned with other depressions and/or straight drainage segments. An example is a pond near Christmas Prairie and a segment of Lupton Creek. However, alignment of geomorphic features in this area is not pronounced enough to define a specific lineament.

The Bridge Creek and Snow Camp Mountain lineaments (SCML; BCL) occur almost exclusively within unit KJfr and therefore do not show displacement of contrasting rock types or of post-Mesozoic units, even if the lineaments are fault-related. However, the geomorphic features that define these lineaments are similar to the geomorphic expressions of active faults elsewhere. Herd (1978) has proposed that recent faulting along a northward extension of the Hayward-Rogers Creek right-lateral fault zone may extend into the Snow Camp Mountain area.

The Snow Camp Creek lineament (SCCL) trends ENE along Snow Camp Creek and an unnamed creek to the east-northeast. The SCCL is in close proximity to the Snow Camp Creek fault, but is along a distinctly different trend than this fault.

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GEOLOGIC MAP OF THE REDWOOD CREEK DRAINAGE BASIN, HUMBOLDT COUNTY, CALIFORNIA

By

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1982