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U.S. GEOLOGICAL SURVEY

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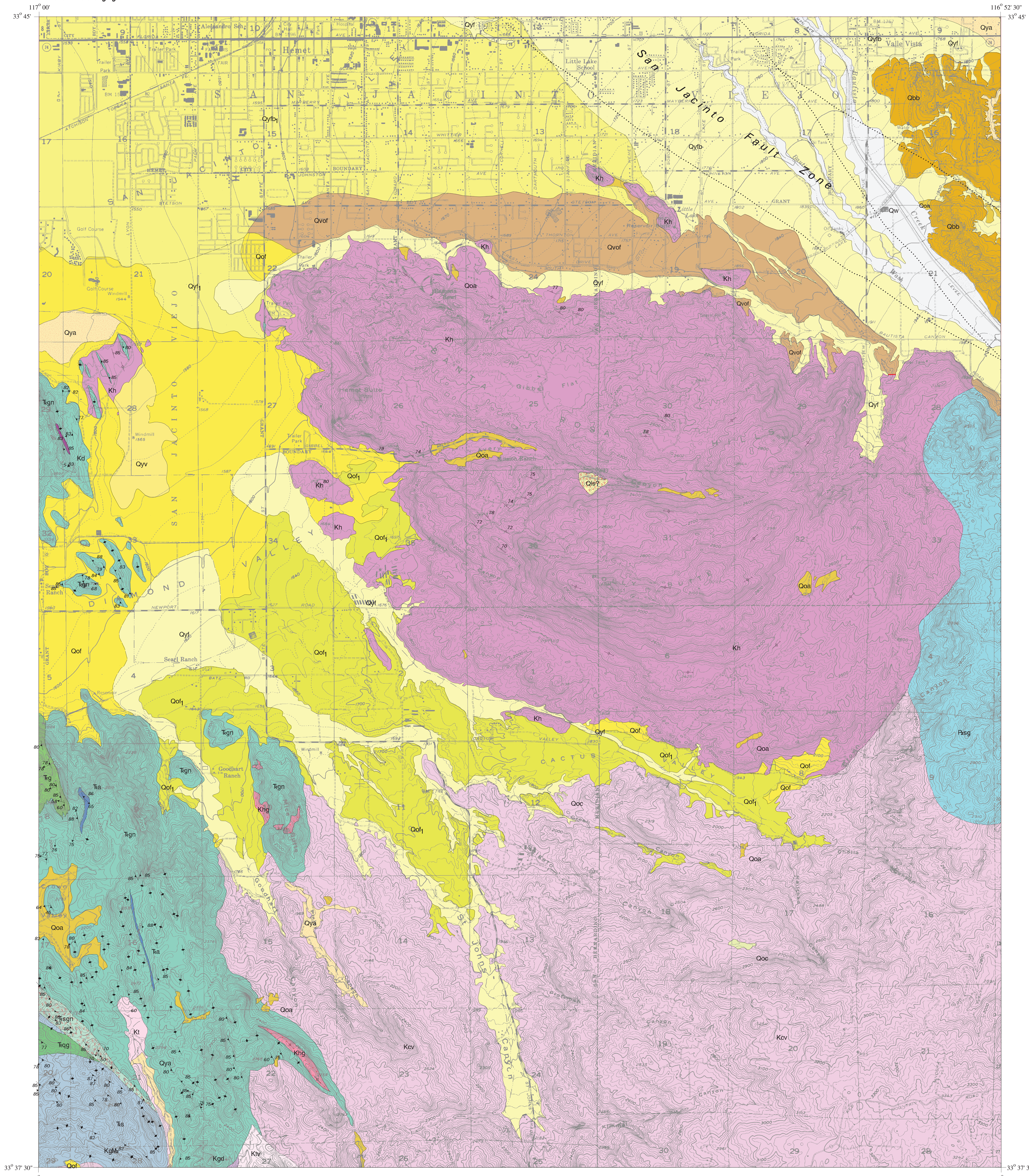

Base from U.S. Geological Survey
7.5' Hemet quadrangle, 1973
Polyconic projection

SCALE 1:24,000

CONTOUR INTERVAL 20 FEET

Geology mapped by D.M. Morton and J.C. Matti; 2003-04, and K.R. Bovard; 2004. Metamorphic contact in the eastern part of the quadrangle after Sharp (1967).

Preliminary Geologic Map of the Hemet 7.5' Quadrangle, Riverside County, California

Version 1.1

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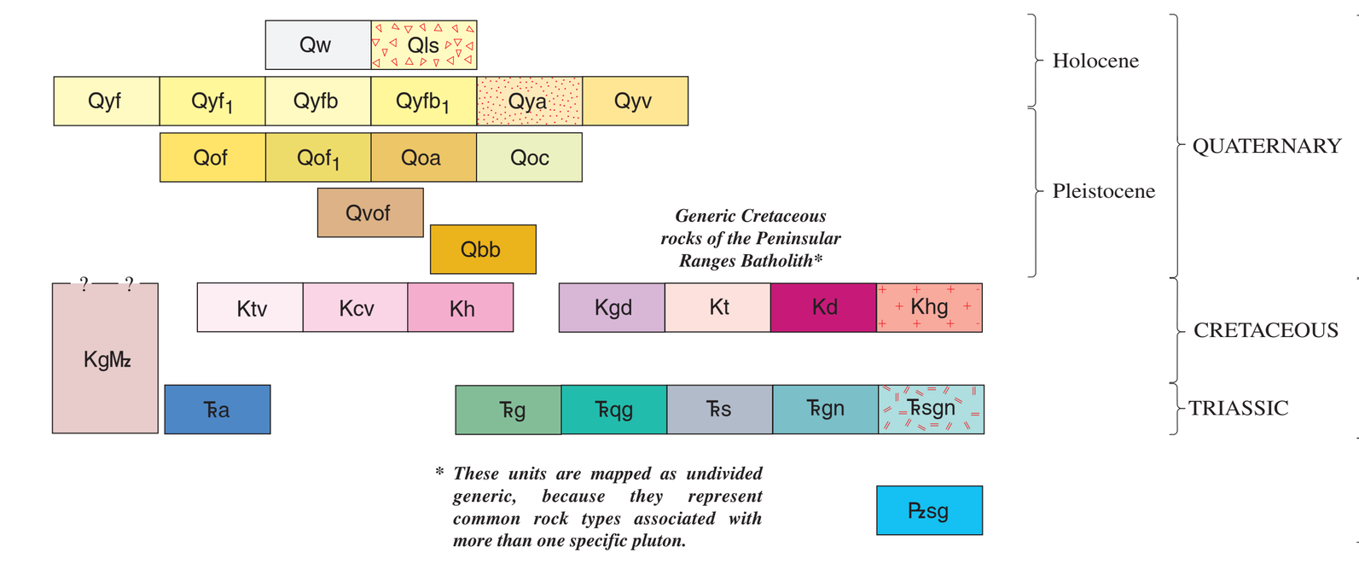
CORRELATION OF MAP UNITS



* These units are mapped as undivided generic, because they represent common rock types associated with more than one specific pluton.

EXPLANATION

Contact—Solid where located within ±15 meters; dashed where located within ±30 meters

Fault—Dotted where concealed

Strike and dip of igneous foliation

- 55 **Inclined**
- 35 **Inclined, approximate strike and dip**
- **Vertical**
- **Vertical, approximate strike and dip**

Strike and dip of metamorphic foliation

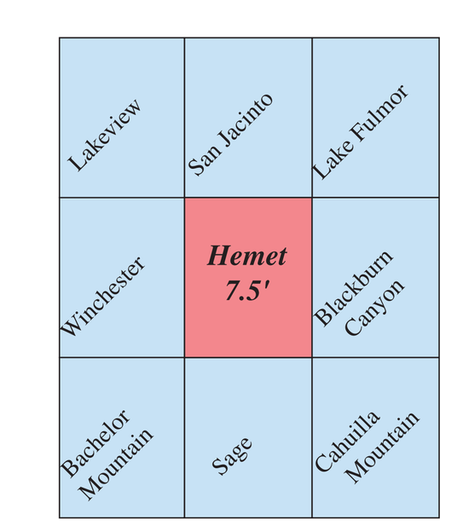
- 70 **Inclined**
- **Vertical**

Bearing and plunge of metamorphic lineations

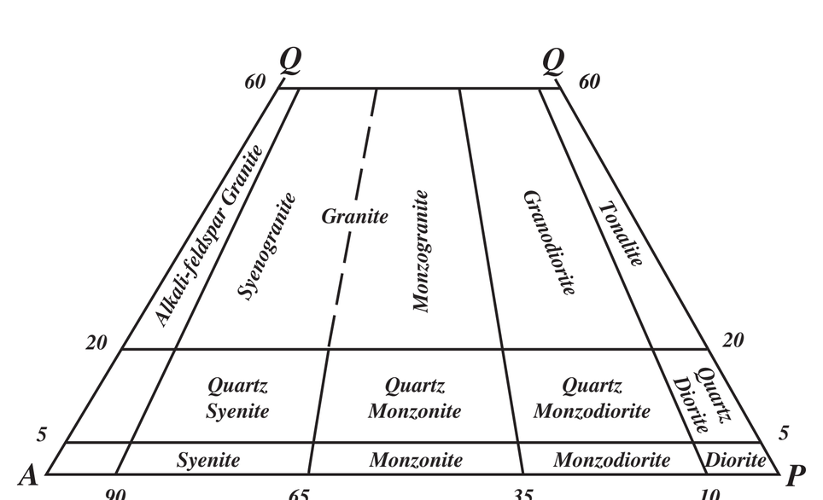
- 55 **Inclined**

Bearing and plunge of minor metamorphic fold axes

- 40 **Inclined**



SURROUNDING 7.5' QUADRANGLES



Classification of plutonic rock types (from IUGA, 1973, and Streckeisen, 1973). A, alkali feldspar; P, plagioclase feldspar; Q, quartz.

This map was printed on an electronic plotter directly from digital files. Dimensional calibration may vary between electronic plotters and between X and Y directions on the same plotter, and paper may change size due to atmospheric conditions; therefore, scale and proportions may not be true on plots of this map.

Digital files available on World Wide Web at http://pubs.usgs.gov/of/2004/1455/

DESCRIPTION OF MAP UNITS

VERY YOUNG SURFICIAL DEPOSITS—Sediment recently transported and deposited in channels and washes, on surfaces of alluvial fans, alluvial plains, and hillslopes. Soil-profile development is non-existent. Includes:

Qw **Wash deposits (late Holocene)**—Unconsolidated bouldery to sandy alluvium of active and recently active washes of Bautista Creek. Ephemeral river channels having fresh flood scour and channel-and-bar morphology. Subject to localized reworking and introduction of new sediment mainly during winter months. In places, especially upper reaches of drainages, contains clasts up to one meter across. Grain shapes range from angular to rounded; larger clasts tend to be more rounded than smaller clasts

Qls **Landslide deposits undivided (late Holocene)**—Largely coherent mass on the south side of Avery Canyon; may or may not be landslide

YOUNG SURFICIAL DEPOSITS—Sedimentary units that are slightly consolidated to cemented and slightly to moderately dissected. Younger surficial units have upper surfaces that are capped by slight to moderately developed pedogenic-soil profiles (A/C to A/AC/BcambricCox profiles). Includes:

Qyf **Young alluvial fan deposits (Holocene and late Pleistocene)**—Unconsolidated deposits of alluvial fans and headward drainages of fans. Consists predominately of gravel, sand, and silt. Trunk drainages and proximal parts of fans contain higher percentage of coarse-grained sediment than distal parts. Three principal fans, Goodhart-St. Johns, Cactus Valley, and an unnamed, east-oriented drainage on the north side of the Santa Rosa Hills consist almost entirely of granitic (tonalite) debris. These fans are incised into dissected older alluvial fan deposits. Includes:

Qyf_1 **Young alluvial fan deposits, Unit 1 (Holocene and late Pleistocene)**—Unconsolidated alluvial fan deposit consisting of a mixture of Qyf and $Qyfb_1$. In part slightly older than parts of Qyf

Qyfb **Young alluvial fan deposits of Bautista Canyon (Holocene and late Pleistocene)**—Unconsolidated deposits of alluvial fans and headward drainages of fans. Consists predominately of gravel, sand, and silt. Trunk drainages and proximal parts of fans contain higher percentage of coarse-grained sediment than distal parts. Contains mineral detritus derived from metamorphic rocks generally not found in Qyf. Includes:

$Qyfb_1$ **Young alluvial fan deposits of Bautista Canyon, Unit 1 (Holocene and late Pleistocene)**—Unconsolidated deposits of alluvial fans and headward drainages of fans. Consists predominately of gravel, sand, and silt. Trunk drainages and proximal parts of fans contain higher percentage of coarse-grained sediment than distal parts. Contains mineral detritus derived from metamorphic rocks

Qya **Young alluvial channel deposits (Holocene and late Pleistocene)**—Unconsolidated, gray, sandy alluvium along two broad channels in the northeastern part of quadrangle and two channels in southwestern part of quadrangle

Qyv **Young alluvial valley deposits (Holocene and late Pleistocene)**—Fluvial deposits along valley floor. Consists of unconsolidated grayish, silty and clay-bearing sandy alluvium west of Santa Rosa Hills

OLD SURFICIAL DEPOSITS—Sedimentary units that are moderately consolidated and slightly to moderately dissected. Older surficial deposits have upper surfaces that are capped by moderately to well-developed pedogenic soils (A/AB/B/Cox profiles and Bt horizons as much as 1 to 2 m thick and maximum hues in the range of 10YR 5/4 and 6/4 through 7.5YR 6/4 to 4/4 and mature Bt horizons reaching 5YR 5/6). Includes:

Qof **Old alluvial fan deposits (late to middle Pleistocene)**—Reddish brown, gravel and sand alluvial-fan deposits; indurated, commonly slightly dissected. In places includes thin alluvial-fan deposits of Holocene age. Includes:

Qof_1 **Old alluvial fan deposits, Unit 1 (late to middle Pleistocene)**—Reddish brown, gravel and sand alluvial-fan deposits; indurated, and well dissected. In places includes thin alluvial-fan deposits of Holocene age. Most of unit is dissected older alluvial fan complex of Goodhart, St. Johns, and Cactus Valleys located in the eastern part of Diamond Valley. Before dissection consisted of a fan complex extending from Avery Canyon to Goodhart Canyon. Mostly older than Qof

Qoa **Old axial channel deposits (late to middle Pleistocene)**—Fluvial sediments. Consists of moderately indurated, commonly slightly dissected gravel, sand, silt, and clay-bearing alluvium. Locally capped by thin, discontinuous alluvial deposits of Holocene age

Qoc **Old colluvial deposits (late to middle Pleistocene)**—Colluvial deposits on hillsides and at bases of slopes. Ranges from rubble to sand. Unconsolidated to slightly indurated

VERY OLD SURFICIAL DEPOSITS—Sediments that are slightly to well consolidated to indurated, and moderately to well dissected. Upper surfaces are capped by moderate to well developed pedogenic soils (A/AB/B/Cox profiles having Bt horizons as much as 2 to 3 m thick and maximum hues in the range 7.5YR 6/4 and 4/4 to 2.5YR 5/6). Includes:

Qvof **Very old alluvial fan deposits (Pleistocene)**—Moderatly to well indurated reddish brown alluvial fan deposits derived from Bautista Canyon and north side of Santa Rosa Hills. Grain size chiefly sand and gravel

Qbb **Bautista beds (Pleistocene)**—Arkosic, coarse-grained to conglomeratic sandstone. Unconsolidated to moderately indurated, pale gray to brownish gray, biotite-bearing. Contains scattered, discontinuous cobble and boulder beds Fine-grained sandstone and silty and clayey beds locally are common. Composed almost entirely of detritus from tonalite

Ktv **Tonalite of the Tucalota Valley pluton (Cretaceous)**—Informally named for exposures in Tucalota Valley area near center of pluton (Morton, 2004). Relatively homogeneous, medium-grained, biotite-hornblende tonalite. Most of tonalite is massive and contains sparse ellipsoidal mafic inclusions

Kcv **Tonalite of the Coahuila Valley pluton of Sharp 1967 (Cretaceous)**—Relatively homogeneous hornblende-biotite tonalite and minor granodiorite. Gray, medium grained, hypidiomorphic granular. Most tonalite is massive and contains sparse ellipsoidal mafic inclusions. Contains subequal amounts of biotite and hornblende. Typically consists of 40 to 50 percent, compositionally zoned, subhedral andesine, 20 to 35 percent quartz, and 0 to 8 percent potassium feldspar. Color index ranges from 10 to 30. Sphene is conspicuous accessory mineral in much of unit, occurring as large euhedral crystals. Other accessory minerals are epidote minerals (pistacite and allanite), zircon, apatite, tourmaline, and opaque minerals. Contains sparse, ellipsoidal, mafic inclusions consisting essentially of biotite, hornblende, and plagioclase. Weathers to form large boulder outcrops. Emplacement ages based on zircon from a tonalite sample collected within the Coahuila Valley pluton southeast of the Hemet quadrangle. Tonalite gave an isotope dilution age of 96.5 Ma and an ion probe age of 95.5 Ma; Ar/Ar ages of hornblende was 94.4 Ma and biotite 91.9 Ma (Premo and others, 1998)

Kh **Hemet pluton (Cretaceous)**—Heterogeneous plutonic assemblage consisting mainly of biotite-hornblende and biotite tonalite. Biotite tonalite commonly has semiporphyritic texture with phenocrysts of euhedral biotite up to 1 cm across. Most of the tonalite contains readily visible small subhedral and euhedral sphene crystals. Textures range from essentially massive to moderately well foliated. Contains layers of tan and brown weathering contaminated tonalite. Ellipsoidal mafic inclusions are sparse or absent in many parts of the pluton. Local pegmatite dikes occur in the western part of the pluton. More heterogeneous than the adjacent Coahuila Valley pluton. Included by Sharp (1967) as a sphene-bearing part of his Coahuila Valley pluton (Kt_5). Sphene-bearing tonalite collected at the Romona Bowl gave an isotope dilution age of 95.9 Ma and an ion probe age of 93.4 Ma; Ar/Ar ages of hornblende was 92 Ma and biotite 90 Ma (Premo and others, 1998). A tonalite sample collected near the metamorphic rock contact near the west side of the quadrangle gave an isotope dilution age of 96.7 Ma and an ion probe age of 99 Ma; Ar/Ar ages of hornblende was 94 Ma and biotite 92 Ma (Premo and others, 1998)

Generic Cretaceous granitic rocks of the Peninsular Ranges batholith

Kgd **Granodiorite (Cretaceous)**—Medium- to coarse-grained, equigranular to porphyritic, heterogeneous biotite granodiorite. Contains some schist inclusions

Kt **Tonalite (Cretaceous)**—Foliated biotite-hornblende tonalite; contains ellipsoidal mafic inclusions oriented parallel to tonalite foliation. Apparently emplaced in part along or within a suture in schist and gneiss. Restricted to southwest corner of quadrangle

Kd **Dioritic rock (Cretaceous)**—Hornblende diorite constituting small elongate body emplaced along foliation within gneissic rock near west edge of quadrangle. Deeply weathered; has little surface exposure on hill north of Searl Ranch

Khg **Heterogeneous granitic rocks (Cretaceous)**—Wide variety of heterogeneous granitic rocks includes a mixture of monzogranite, granodiorite, tonalite, and gabbro. Some heterogeneous assemblages include large proportions of schist and gneiss. Tonalite composition rock is most abundant rock type

End rocks of Peninsular Ranges batholith

KgMz **Intermixed Mesozoic schist and Cretaceous granitic rocks (Mesozoic)**—Wide variety of Triassic schist and related metamorphic rocks mixed with Cretaceous granitic rocks ranging in composition from monzogranite to quartz diorite. Most granitic rocks are tonalite composition

Ta **Amphibolite (Triassic)**—Black elongate-shaped masses of plagioclase and hornblende. Locally contains garnet in vugs. Restricted to Tgn unit in southwest part of quadrangle

Tg **Graywacke (Triassic)**—Predominantly lithic graywacke. Thick layered, massive, commonly contains angular fragments of schist (chips) and discontinuous layers of biotite schist

Tqg **Intermixed quartzite and graywacke (Triassic)**—Intermixed quartzite and lithic metagraywacke; quartzite may or may not be feldspathic

Ts **Schist (Triassic)**—Biotite schist, in part gradational with phyllite. In lower metamorphic-grade rocks, consists of andalusite-biotite schist. In higher metamorphic-grade rocks, consists of cordierite-biotite schist, and sillimanite-biotite schist

Tgn **Biotite gneiss and schist (Triassic)**—Medium-to dark-gray, coarse-grained biotite gneiss and schist and biotite-quartz-feldspar gneiss and schist. Locally contains sillimanite and cordierite. Commonly includes minor amounts of quartzite and calc-silicate hornfels

Tsgn **Mixed low metamorphic grade and upper amphibolite grade rocks (Triassic)**—Tectonically intermixed schist, graywacke, and impure quartzite of Ts and Tg, and gneiss of Tgn

Pzsg **Schist and gneiss (Paleozoic?)**—Brown weathering layered gniess and schist of amphibolite grade. In part migmatitic. Mostly foliated biotite schist and gneiss. Contains white mica and sparse garnet bearing layers. Includes some quartzitic layers

GEOLOGIC SUMMARY

The Hemet 7.5' quadrangle is located near the eastern edge of the Perris block (Woodford and others, 1971) of the Peninsular Ranges batholith. The northeastern corner of the quadrangle extends across the San Jacinto Fault Zone onto the edge of the San Jacinto Mountains block. The Perris block is a relatively stable area located between the Elsinore Fault Zone on the west and the San Jacinto Fault Zone on the east. Both of the fault zones are active; the San Jacinto being the seismically most active in southern California. The fault zone is obscured by very young alluvial deposits. The concealed location of the San Jacinto Fault Zone shown on this quadrangle is after Sharp, 1967.

The geology of the quadrangle is dominated by Cretaceous tonalite formerly included in the Coahuila Valley pluton of Sharp (1967). The northern part of Sharp's Coahuila Valley (his Kt_5) pluton is separated out as the Hemet pluton. Tonalite of the Hemet pluton is more heterogeneous than the tonalite of the Coahuila Valley pluton and has a different sturctural pattern. The Coahuila Valley pluton consists of relatively homogeneous hornblende-biotite tonalite, commonly with readily visible large euhedral honey-colored sphene crystals. Only the tip of the adjacent Tucalota Valley pluton, another large tonalite pluton, extends into the quadrangle. Tonalite of the Tucalota Valley pluton is very similar to the tonalite of the Coahuila Valley pluton except it generally lacks readily visible sphene.

In the western part of the quadrangle a variety of amphibolite grade metasedimentary rocks are informally referred to as the rocks of Menifee Valley; named for exposures around Menifee Valley west of the Hemet quadrangle. In the southwestern corner of the quadrangle a mixture of schist and gneiss marks a suture that separated low metamorphic grade metasedimentary rocks to the west from high metamorphic grade rocks to the east. The age of these rocks is interpreted to be Triassic (Morton, 2004) and the age of the suturing is about 100 Ma (Premo, and others, 1998), essentially the same age as the adjacent Coahuila Valley pluton (Sharp, 1967). Rocks within the suture zone consist of a mixture of lithologies from both sides of the suture. Gneiss, schist, and anatectic gneiss are the predominate lithologies within the rocks on the east side of the suture. Lesser amounts of metalithic greywacke and lenticular masses of black amphibolite are subordinate rock types. Biotite, biotite-sillimanite and lesser amounts of garnet-biotite-sillimanite schist and metaquartzite-metalithic greywacke lithologies occur west of the suture.

Pleistocene continental beds, termed the Bautista beds (e.g., Sharp, 1967) occur east of the San Jacinto Fault Zone in the northeast corner of the quadrangle. Most of the Bautista beds were derived from the San Jacinto pluton that is located just to the east of the sedimentary rocks. Along the northern part of the quadrangle is the southern part of a large Holocene-late Pleistocene fan emanating from Baustista Canyon. Sediments in the Bautista fan are characterized by their content of detritus derived from amphibolite grade metasedimentary rocks located in the Bautista Canyon drainage. Between the Holocene-late Pleistocene Bautista fan and the Santa Rosa Hills is the remnant of a much older Bautista Canyon alluvial fan. A pronounced Holocene-late Pleistocene channel was developed along the south fringe of the very old alluvial fan and the Santa Rosa Hill. A now dissected late to middle Pleistocene alluvial complex was produced by the coalesced fans of Goodhart, St. Johns, and Avery canyons, and Cactus Valley.

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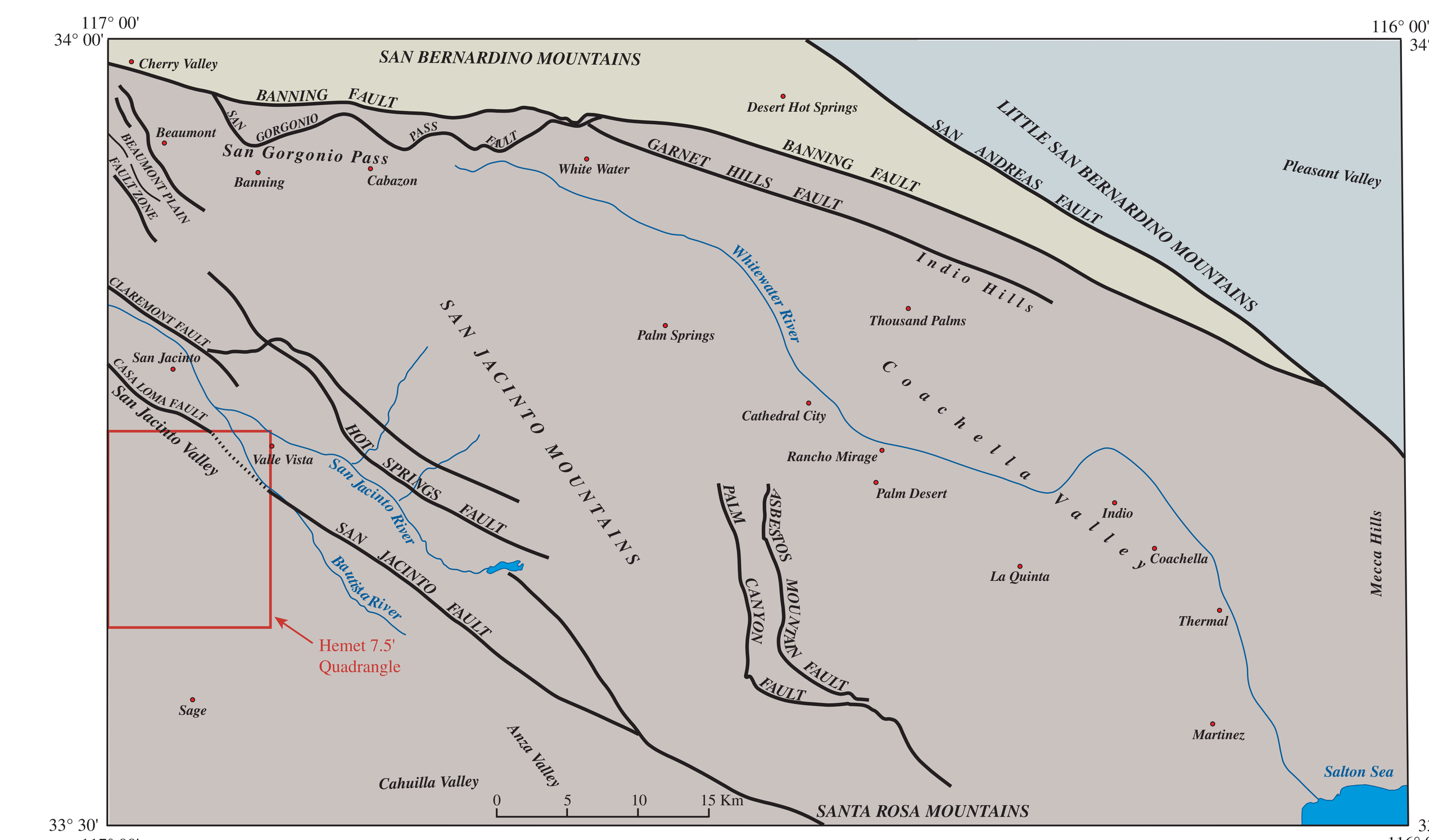

Rocks of the Peninsular Ranges assemblage.

Rocks of the San Gabriel Mountains assemblage. Includes basement (mostly concealed by Quaternary deposits) that is offset by the San Jacinto Fault

Rocks of the San Bernardino Mountains assemblage. Includes basement (mostly concealed by Quaternary deposits) of the Mojave Desert, which is similar to San Bernardino Mountains basement

Map of Palm Springs 30' X 60' quadrangle showing the location of the Hemet 7.5' quadrangle. Colored areas define structural assemblages. Approximate locations of most faults having large displacements or lengths are shown. • Town or geographic feature.