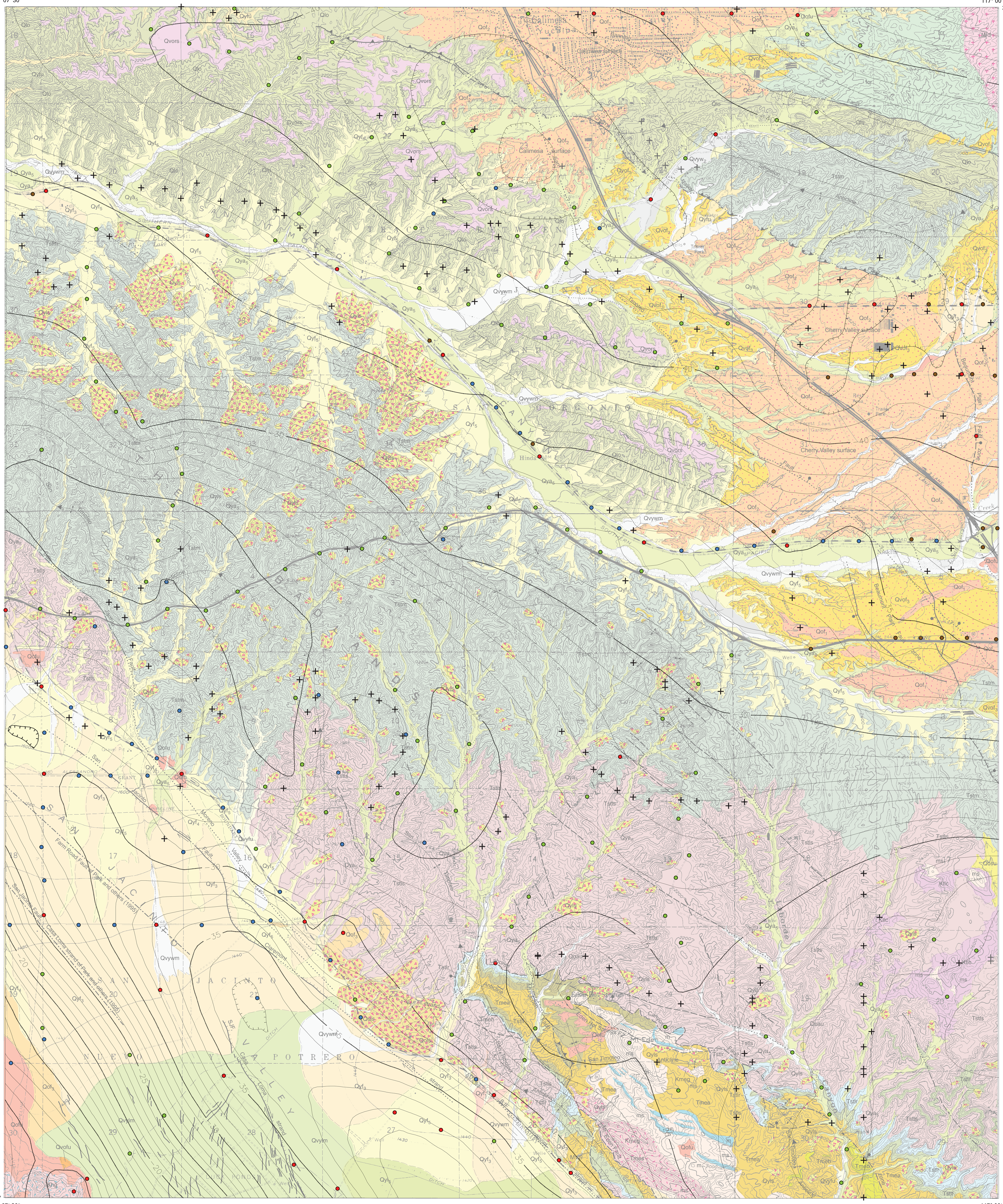
Prepared in Cooperation with
San Gorgonio Pass Water Agency and
California Geological Survey

**Open-File Report 2010–1274**
**Sheet 3 of 3**
*Pamphlet accompanies map*




Base from U.S. Geological Survey, El Casco, 1967
Universal Transverse Mercator projection. NAD 27

12°
TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 2015

SCALE 1:24,000
1 ½ 0 1 MILE
1 .5 0 1 KILOMETER
CONTOUR INTERVAL 40 FEET

CALIF
AREA OF MAP

Gravity compilation by:
V.E. Langenheim, 2006, 2008
Geology mapped by:
J.C. Matti, 1973-1974, 1979, 1996, 2006; D.M. Morton, 1974, 2004, 2009
Digital preparation by P.M. Cossette, 2003; J.G. Matti, 2003, 2005; D.M. Hirschberg, 2008, 2009, 2013
Edited by Theresa Iki
Manuscript approved for publication November 5, 2010

## GRAVITY DATA

Gravity investigations have been conducted in the El Casco quadrangle in support of groundwater investigations, seismic-hazard assessment, and geologic studies to better characterize the 3-dimensional structure of the region. On sheet 3 of 3 we show gravity contours created from a 300-m grid based on 244 gravity measurements within the quadrangle, edited slightly from the compilation of Langenheim and others (2006). These data include 128 gravity measurements collected by the U.S. Geological Survey since 2000; 54 measurements collected by University of California, Riverside, and 22 National Geodetic Survey stations—the remaining data are derived from Langenheim and others (1991). Gravity stations are non-uniformly distributed in the region.

The datum of observed gravity for this map is the International Gravity Standardization Net of 1971 (International Union of Geodesy and Geophysics, 1971) that was described by Morelli (1974); the reference ellipsoid is the Geodetic Reference System of 1967 (GRS67; International Association of Geodesy and Geophysics, 1971). The observed gravity data were reduced to free-air anomalies using standard formulas (for example, Telford and others, 1976). Bouguer, curvature, and terrain corrections to a radial distance of 166.7 km were applied to the free-air anomaly at each station to determine the complete Bouguer anomalies at a standard reduction density of 2,670 kg/m3 (Plouff, 1977). An isostatic correction was then applied to remove the long-wavelength effect of deep crustal and/or upper mantle masses that isostatically support regional topography. The isostatic correction assumes an Airy-Heiskanen model of isostatic compensation (Heiskanen and Vening-Meinesz, 1958). An isostatic correction using a sea-level crustal thickness of 25 km, a crustal density of 2,670 kg/m3, and a mantle-crust density contrast of 400 kg/m3 was applied to the gravity data to remove long-wavelength crustal gravity effects of topographic loading (Jachens and Griscom, 1985). The resulting isostatic residual gravity values should reflect lateral variations of density within the mid- to upper crust (Simpson and others, 1986); this statement is supported by the favorable comparison of the observed isostatic gravity field with that predicted from seismic velocities in southern California (Langenheim and Hauksson, 2001).

Accuracy of the data is estimated to be about ±0.2 to ±0.5 mGal based on comparison of observed gravity values at duplicate stations from different data sources and expected error resulting from the total terrain correction. Total terrain corrections for the stations collected for this study ranged from 1.3 to 6.1 mGal, with an average of 2.1 mGal. If the error from the terrain correction is considered to be 5 to 10 percent of the terrain correction, the largest error expected for the data is 0.6 mGal. However, the possible error caused by the terrain correction is small (less than 0.2 mGal) for most of the stations.

To help delineate structural trends and gradients expressed in the gravity field, a computer algorithm was used to locate the maximum horizontal gravity gradient (Cordell and Grauch, 1985; Blakely and Simpson, 1986). Concealed basin faults beneath the valley areas on the El Casco quadrangle were mapped using horizontal gradients in the gravity field (red circles on sheet 3). Gradient maxima occur approximately over steeply-dipping contacts that separate rocks of contrasting densities. For moderate to steep dips (45° to vertical), the horizontal displacement of a gradient maximum from the top edge of an offset horizontal layer is always less than, or equal to, the depth to the top of the source (Grauch and Cordell, 1987).

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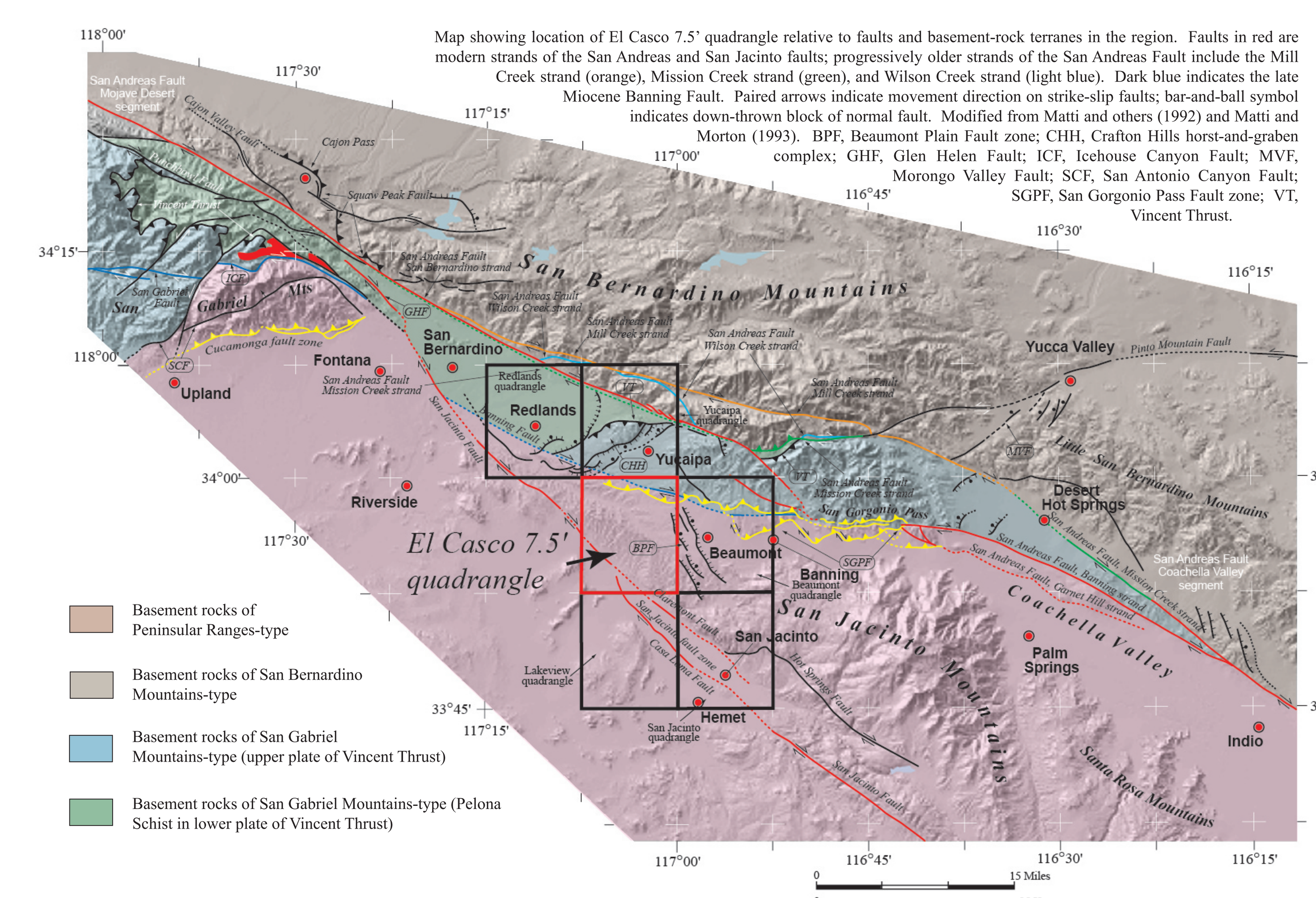
## EXPLANATION OF MAP SYMBOLS

+ **Density boundary**

**Gravity station**

- Data from various published and unpublished sources
- Data from University of California, Riverside
- Data collected for this study
- Data from Defense Mapping Agency




Map showing location of El Casco 7.5' quadrangle relative to faults and basement-rock terranes in the region. Faults in red are modern strands of the San Andreas and San Jacinto faults; progressively older strands of the San Andreas Fault include the Mill Creek strand (orange), Mission Creek strand (green), and Wilson Creek strand (light blue). Dark blue indicates the late Miocene Banning Fault. Paired arrows indicate movement direction on strike-slip faults; bar-and-ball symbol indicates down-thrown block of normal fault. Modified from Matti and others (1992) and Matti and Morton (1993). BPF, Beaumont Plain Fault zone; CHH, Crafton Hills horst-and-graben complex; GHF, Glen Helen Fault; ICF, Icehouse Canyon Fault; MVF, Morongo Valley Fault; SCF, San Antonio Canyon Fault; SGPF, San Gorgonio Pass Fault zone; VT, Vincent Thrust.

# Geologic and Geophysical Maps of the El Casco 7.5′ Quadrangle, Riverside County, California, with Accompanying Geologic-map Database

## Gravity Map

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2015



Digital files available at http://dx.doi.org/ofr20101274

Suggested Citation: Matti, J.C, Morton, D.M., and Langenheim, V.E., 2015, Geologic and geophysical maps of the El Casco 7.5′ quadrangle, Riverside County, southern California: U.S. Geological Survey Open-File Report 2010–1274, pamphlet 141 p., 3 sheets, scale 1:24,000, http://dx.doi.org/ofr20101274.