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U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

# PRINCIPAL FACTS AND BASE STATION DESCRIPTIONS FOR GRAVITY DATA COMPILED FOR THE SANTA ANA 1° BY 2° QUADRANGLE, CALIFORNIA

By

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**Open-File Report 93-217-A**

93-217-A Principal facts documentation
93-217-B Gravity data on diskette

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## ABSTRACT

Data collected by the University of California at Riverside (UCR), the California Division of Mines and Geology (CDMG), the U.S. Geological Survey (USGS), and others have been compiled to create a data set consisting of 7,447 stations on the Santa Ana 1° by 2° quadrangle. A listing of these data by source is on the diskette (Part B) accompanying this report. This report supplements *The Complete Bouguer gravity anomaly map of the Santa Ana 1° by 2° quadrangle, California* by Biehler and others (1992). Descriptions, coordinates, and observed gravity values for 39 base stations have been included. Locations of the data sets and a color Bouguer anomaly map contoured at an interval of 10 mGal are included.

## INTRODUCTION

Principal facts for 7,447 gravity stations used in preparing *The complete Bouguer gravity anomaly map of the Santa Ana 1° by 2° quadrangle, California* (Biehler and others, 1992) are contained in this report. The Santa Ana quadrangle is located between 33° and 34° north latitude and 116° and 118° west longitude (fig. 1). This report documents the principal facts, accuracies, locations, and base station descriptions. A page size complete Bouguer gravity anomaly map in color at a 10 mGal interval is included. This is the last in a series of principal facts reports for 1° by 2° gravity maps covering the State of California.


Figure 1. Index map

## SOURCES OF DATA

The onshore gravity data in the Santa Ana 1° by 2° quadrangle include 5,077 stations collected by Shawn Biehler and students at the University of California at Riverside (UCR; Appendix 1), supplemented by 197 gravity stations collected by A.G. Hull (written commun., 1991), 479 gravity stations collected by W.R. Moyle and D.J. Downing (A.G. Hull, written commun., 1991), 354 gravity stations from the Defense Mapping Agency (National Geophysical Data Center, 1984), 533 gravity stations collected by the California Division of Mines and Geology (CDMG), 162 stations from E.L. Blanck Jr. (1987), and 384 stations collected by the U.S. Geological Survey (USGS). A total of 261 offshore marine gravity measurements were made with shipboard gravity meters during the 1970 cruise of the Surveyor (NOAA-NAVOCEANO), the 1973 cruise of the G.B. Kelez (USGS), and the 1974 cruise of the S.P. Lee (USGS) (Vedder and others, 1974). The presentation of the data is divided into 8 data sets, as outlined in Table 1 and shown in Figures 2-9.

**Table 1. SOURCES OF GRAVITY DATA FOR THE SANTA ANA 1° BY 2° QUADRANGLE**

| *DATA SET NUMBER* | *SOURCE OF DATA* | *AREA OF DATA* | *NUMBER OF STATIONS* |
|---|---|---|---|
| 1 | University of California at Riverside (see Appendix 1 for additional information) | Figure 2 | 5,077 |
| 2 | California Division of Mines and Geology | Figure 3 | 533 |
| 3 | Moyle and Downing | Figure 4 | 479 |
| 4 | U.S. Geological Survey (onshore) | Figure 5 | 384 |
| 5 | U.S. Geological Survey (offshore) | Figure 6 | 261 |
| 6 | Defense Mapping Agency | Figure 7 | 354 |
| 7 | Hull, A.G. | Figure 8 | 197 |
| 8 | Blanck Jr, E.L. | Figure 9 | 162 |
| | | Total | 7,447 |

## BASE STATIONS

Thirty-nine base stations were used on the Santa Ana 1° by 2° Quadrangle (fig. 10). Table 2 summarizes 39 base stations established by the CDMG, the USGS, and the DMA. In Appendix 3 are descriptions of these 39 bases. These bases originally were established on two different gravity datums. While this list does not include all possible bases used, it provides a comprehensive list for further work in the area.

## GRAVITY DATUMS AND REDUCTION METHODS

The datum of observed gravity for this report and the gravity anomaly map (Biehler and others, 1992) is that of Woollard and Rose (1963; Chapman, 1966) The data were reduced using the 1930 International Gravity formula (Swick, 1942, p. 61) to maintain compatibility with the published Bouguer gravity map of the State of California (Oliver and others, 1980). The observed-gravity data were reduced to free-air anomalies using standard formulas, for example (e.g., Telford and others, 1976). Bouguer, curvature, and terrain corrections (to a distance of 166.7 km; Plouff, 1977) were applied to the free-air anomaly at each station to determine the complete Bouguer anomalies at a standard reduction density of 2.67 g/cm$^3$ (Swick (1942, p. 65)).

Offshore gravity values from surface ship measurements were tied to harbor base stations on the 1963 datum of Woollard and Rose (1963; Vedder and others, 1974). A hand- contoured free-air gravity anomaly map was digitized on a 2-minute geographic grid and the locations of the gridded data were used to calculate complete Bouguer gravity anomalies.

Whenever data were reduced using an International Gravity Standardization Net 1971 base (IGSN 71; Morelli, 1974, p.18)), observed-gravity values needed to be converted using a formula by Oliver and others (1980, p.52). Datums were changed using a program called "recalc" .

Principal sources of error for gravity anomalies in onshore gravity data are inaccurate elevations and inaccurate terrain corrections. Errors associated with terrain corrections are assumed to be 5 to 10 percent of the value of the total terrain correction. Therefore, the average error based on the average terrain correction (2.35 mGal) is about 0.1 to 0.2 mGal, but in rugged areas of the San Jacinto Mountains, errors may be as large as 5 to 9 mGal. Errors resulting from elevation uncertainties are probably less than 0.5 mGal for most of the data because most of the stations are at or near bench marks or surveyed elevations and are accurate to about 0.2 and 3 m, respectively. Measurements for which elevations were obtained by contour interpolation have errors as high as 1.2 mGal. In general, the total error for the data shown on the map is less than 5 mGal (one contour interval). Relative errors for local anomalies in a given region are more accurate than 1.0 mGal, except in mountainous terrain.

## PRINCIPAL FACTS

Table 3 describes the principal facts information on the diskette (part B of this report). Included on the diskette: station name, latitude, longitude, elevation, observed gravity, free air anomaly, simple Bouguer anomaly, inner-zone terrain corrections, letter designation (D) for USGS onshore data of the outer-most zone of the inner-zone terrain corrections, total terrain correction and complete Bouguer anomaly. Accuracy codes for data collected by

the U.S. Geological Survey are in Table 4. A listing of the principal facts may be found on the accompanying diskette, part B of this report. The principal facts are contained in 8 files: 1. UCR, 2. CDMG, 3. Moyle-Downing, 4. USGS-onshore, 5. USGS- offshore, 6. DMA, 7. Hull, and 8. Blanck (see figures 2-9).

These data sets were edited to remove data points that caused anomalies resulting from erroneous values of elevations, locations or observed gravity. The original DMA set contained 5,869 stations. Most of these were duplicates of UCR and USGS data. We originally received the UCR data from DMA, but we re-computed terrain corrections and adjusted the observed gravity datum for their data. Sources of data collected by UCR are included in Appendix 1. DMA gravity station sources are explained in Appendix 2.

## COLOR MAP

Figure 11 is a complete Bouguer anomaly map of the Santa Ana 1° by 2° quadrangle, contoured at 10 mGal. Gravity highs are shown in red and lows are in purple.

## ACKNOWLEDGMENTS

Our thanks to the many who collected gravity data on the Santa Ana 1° by 2° Quadrangle. We especially appreciate the contributions of the following individuals and organizations who had a significant contribution to the project: H.W. Oliver, R.C. Jachens, D.A. Ponce, John Mariano, C.W. Roberts, Craig Erdman, Rodger Tang, Tracy Bare, Eleanor Dixon, Bruce Kohrn, E.L. Blanck Jr., A.G. Hull, W.R. Moyle, D.J. Downing, C.R. Willingham, Bruce Blackerby, W.C. Elliot, Stephen Park, Bernard Gilpin, Carl Blomquist, K.C. Crowley, M.R. Ghaeni, Steve Roche, Steve Wilds, E.E. Weldy, J.W. Gasch, G.P. Eaton, N.W. Martin, J.D. Fett, Victor Yanasheski, T.H. McCulloh, UCR students, Caltech students, and a private oil consulting company.

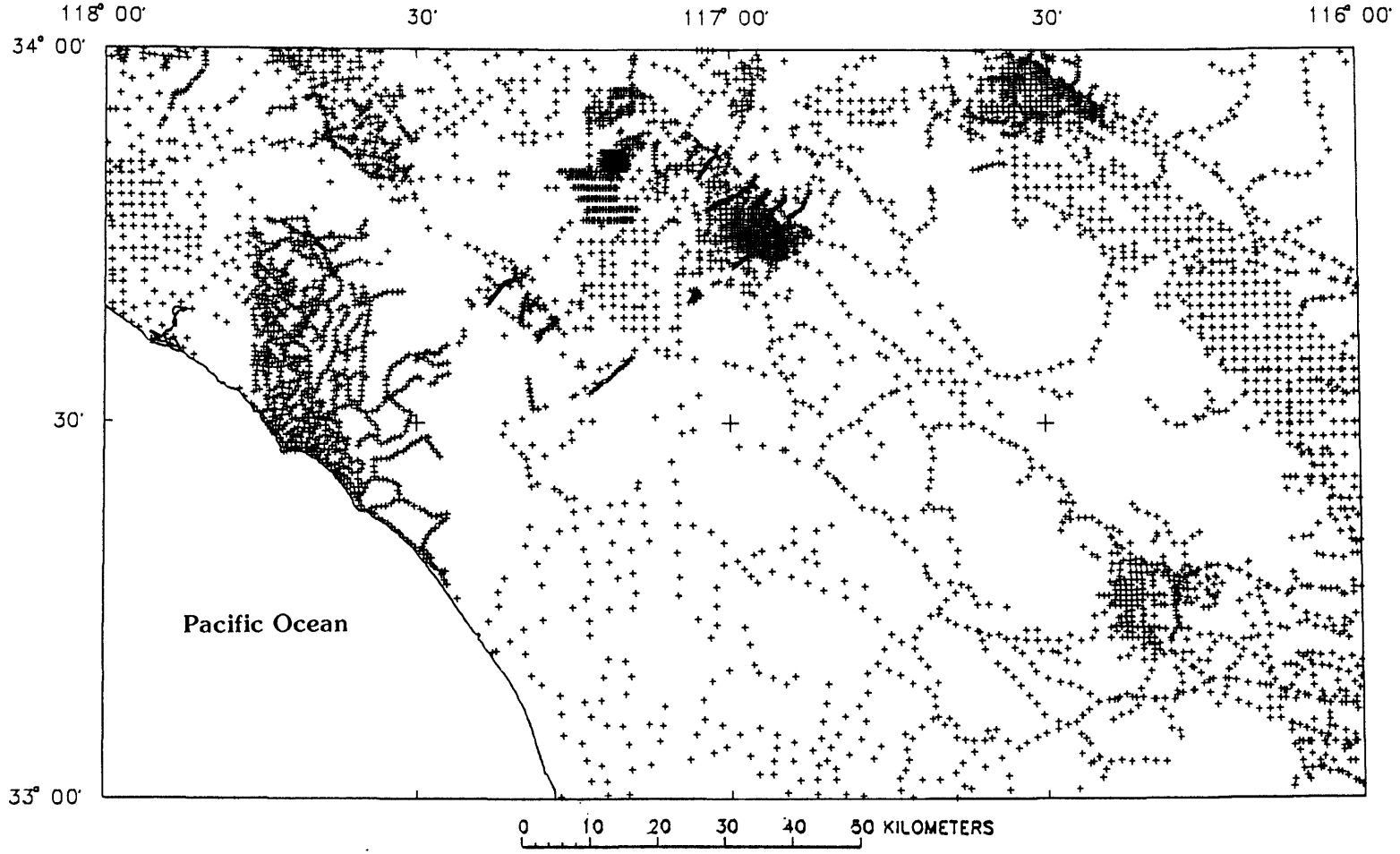



FIGURE 2. University of California at Riverside data

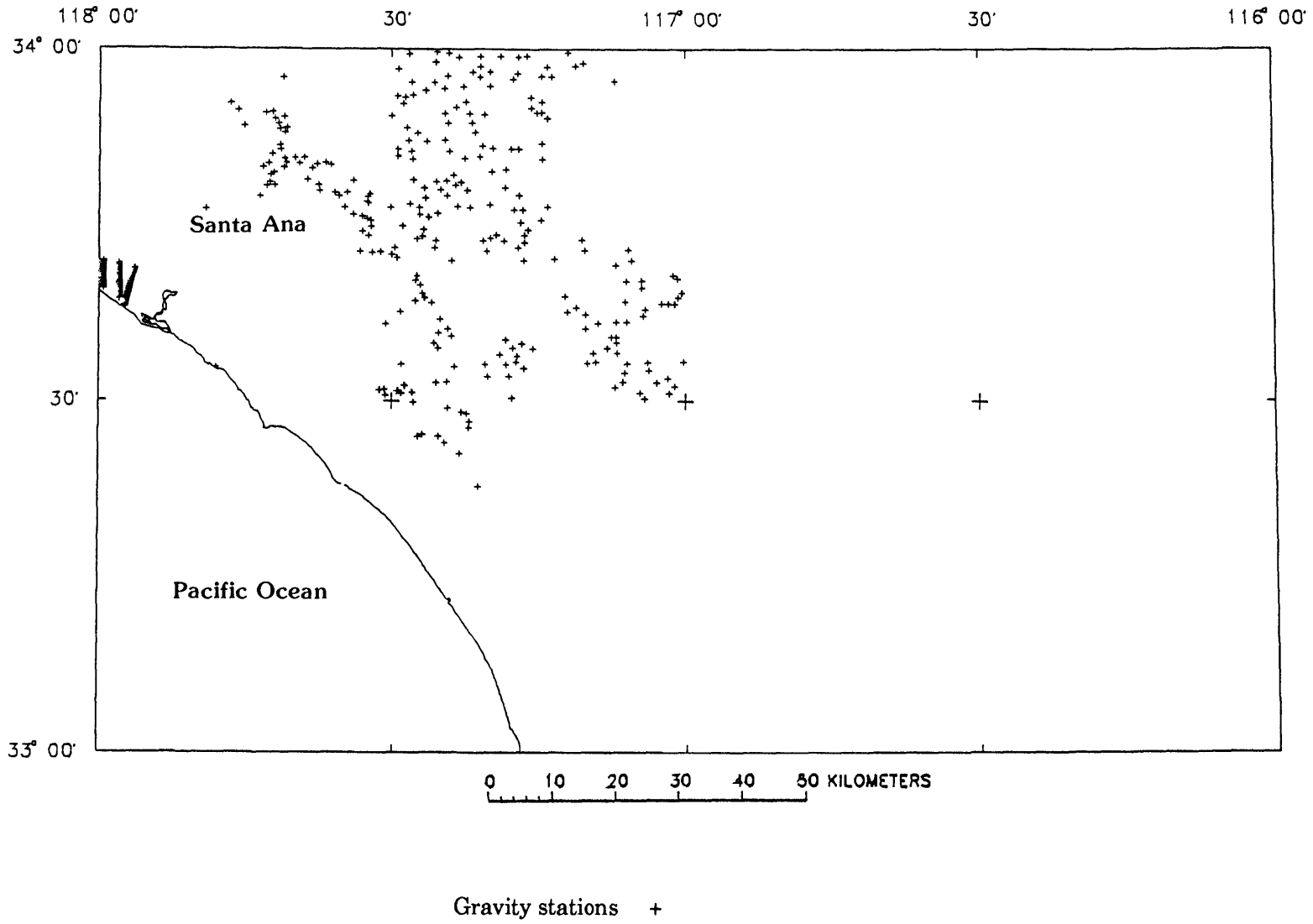



FIGURE 3. California Division of Mines and Geology data

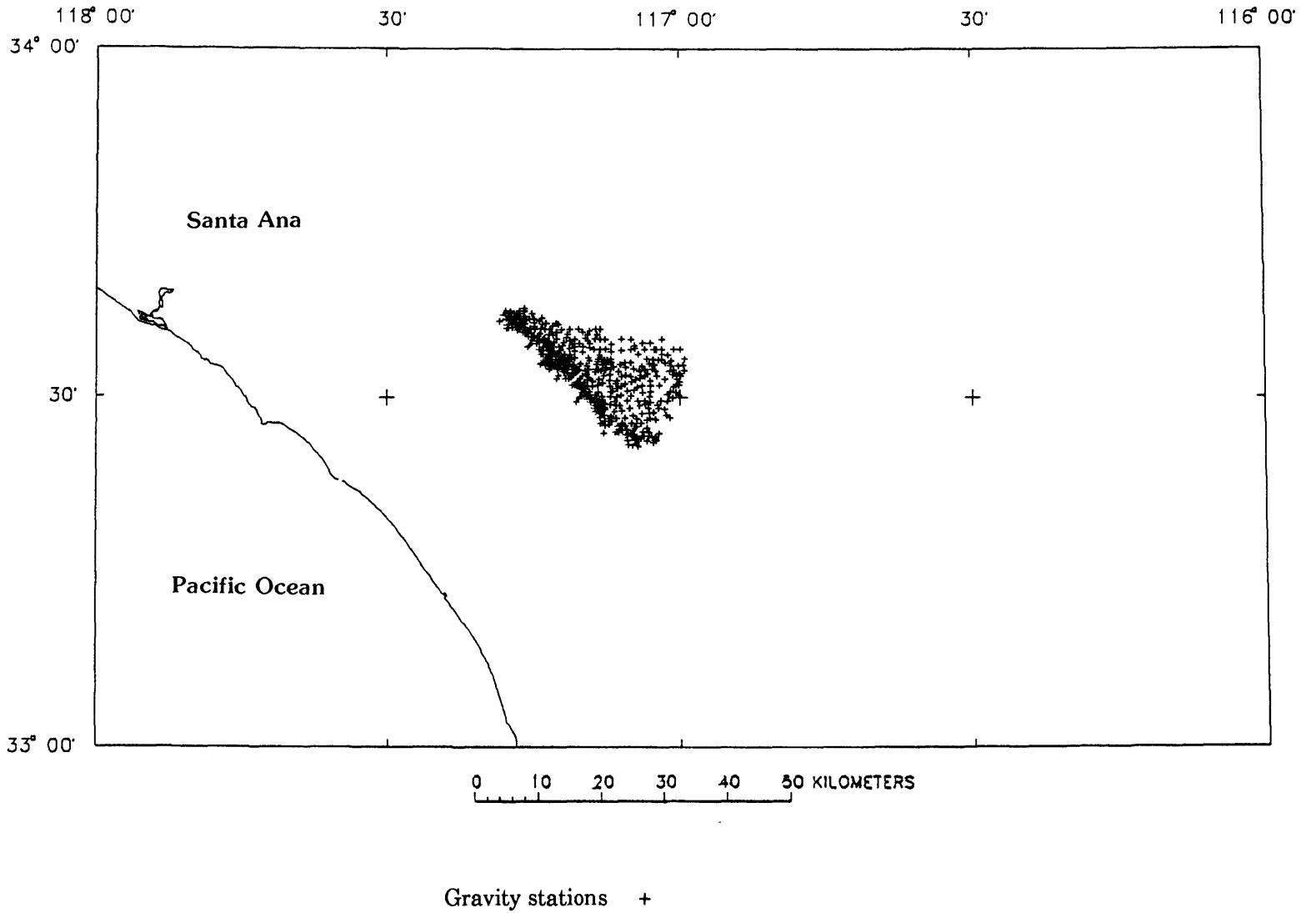



FIGURE 4. Moyle and Downing data

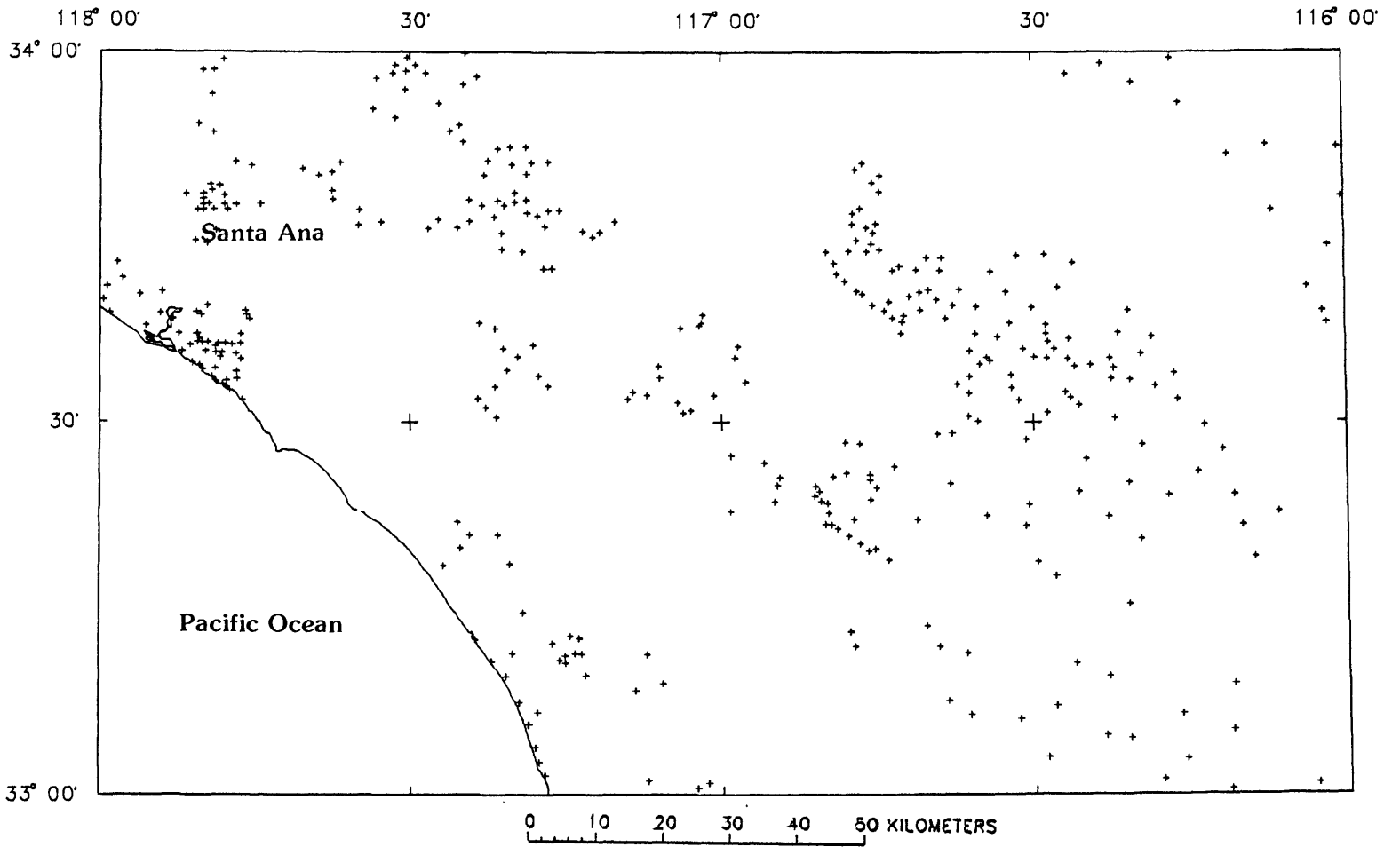



FIGURE 5. U.S. Geological Survey onshore data

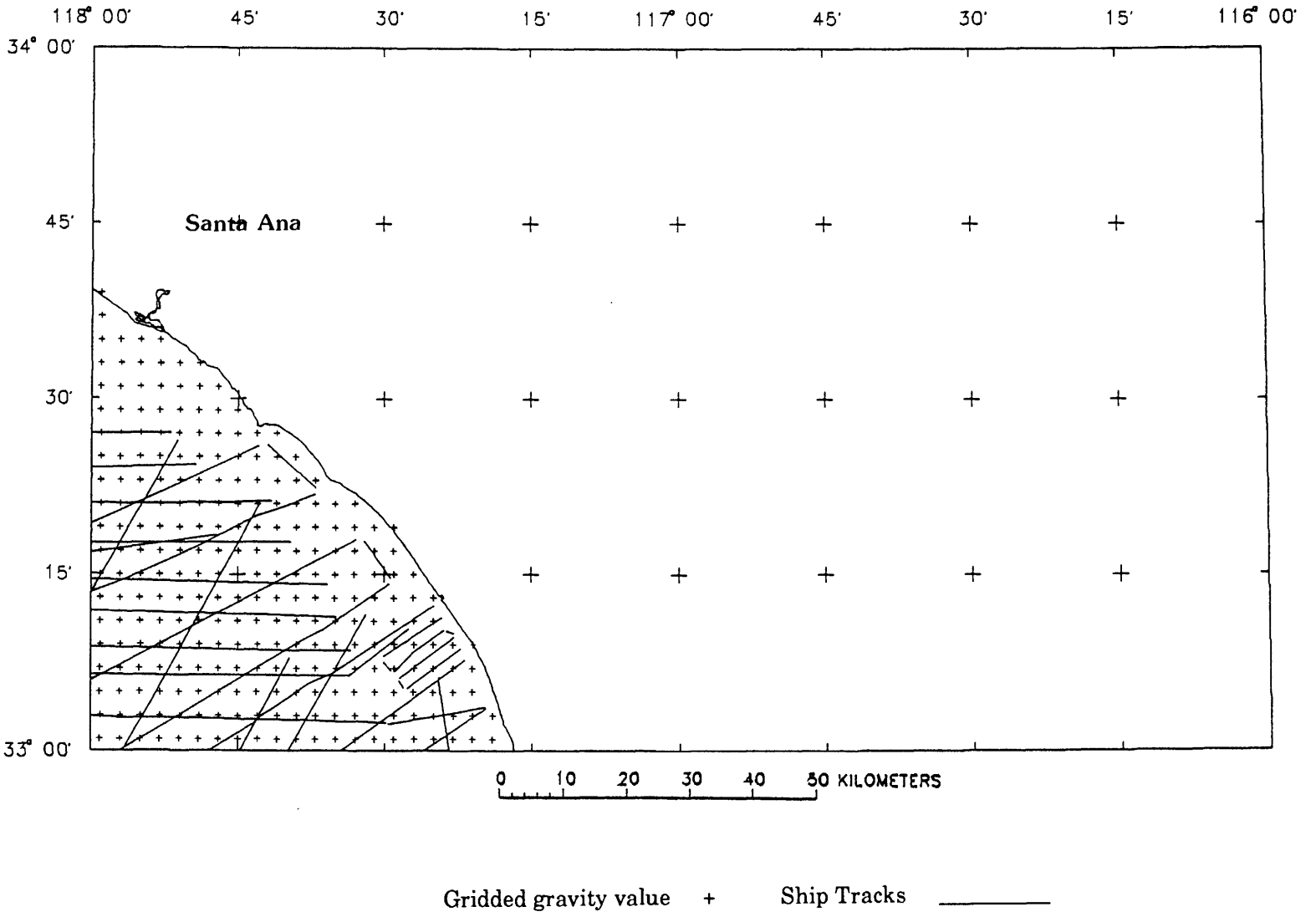



FIGURE 6. U.S. Geological Survey offshore data

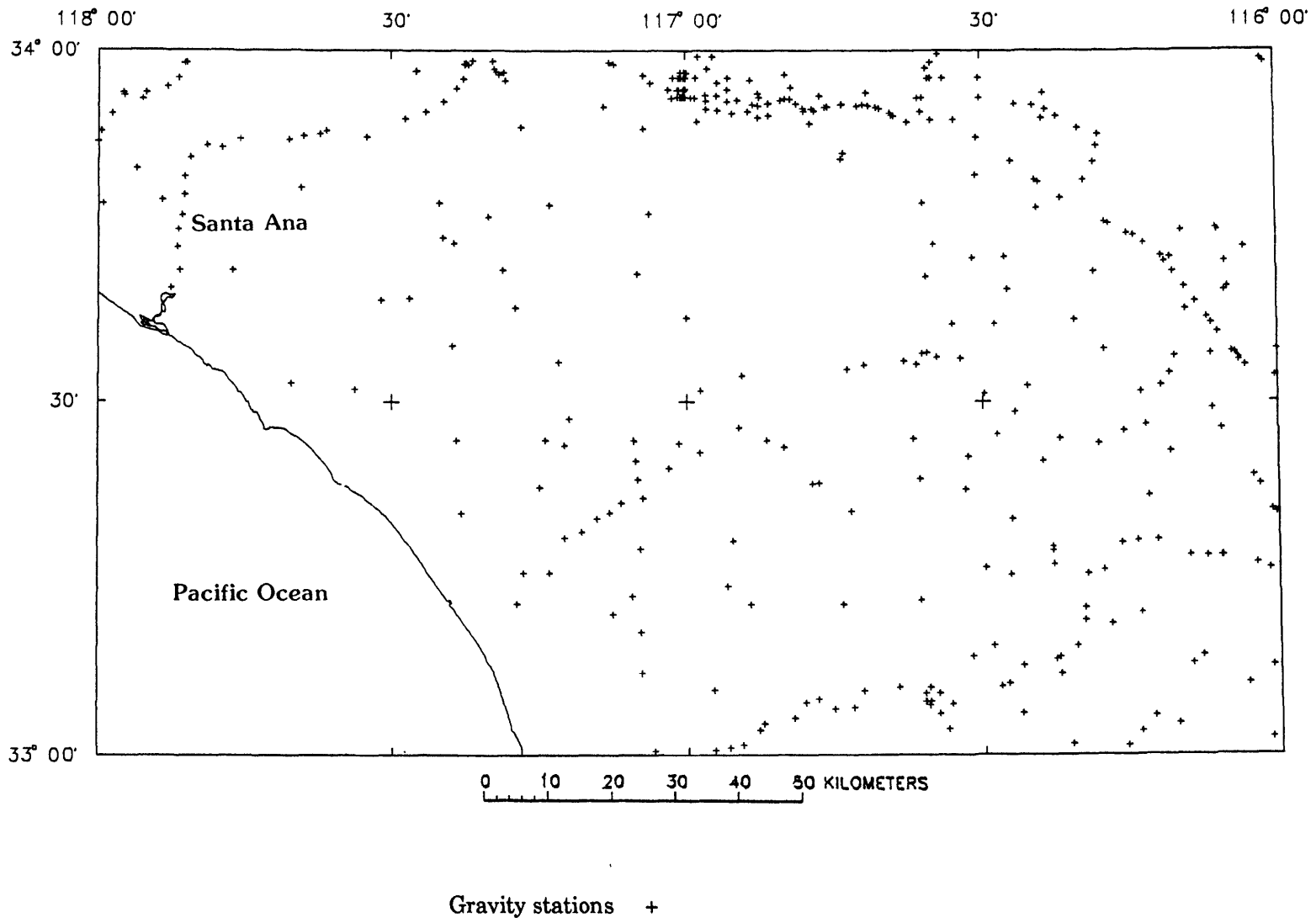



FIGURE 7. Defense Mapping Agency data

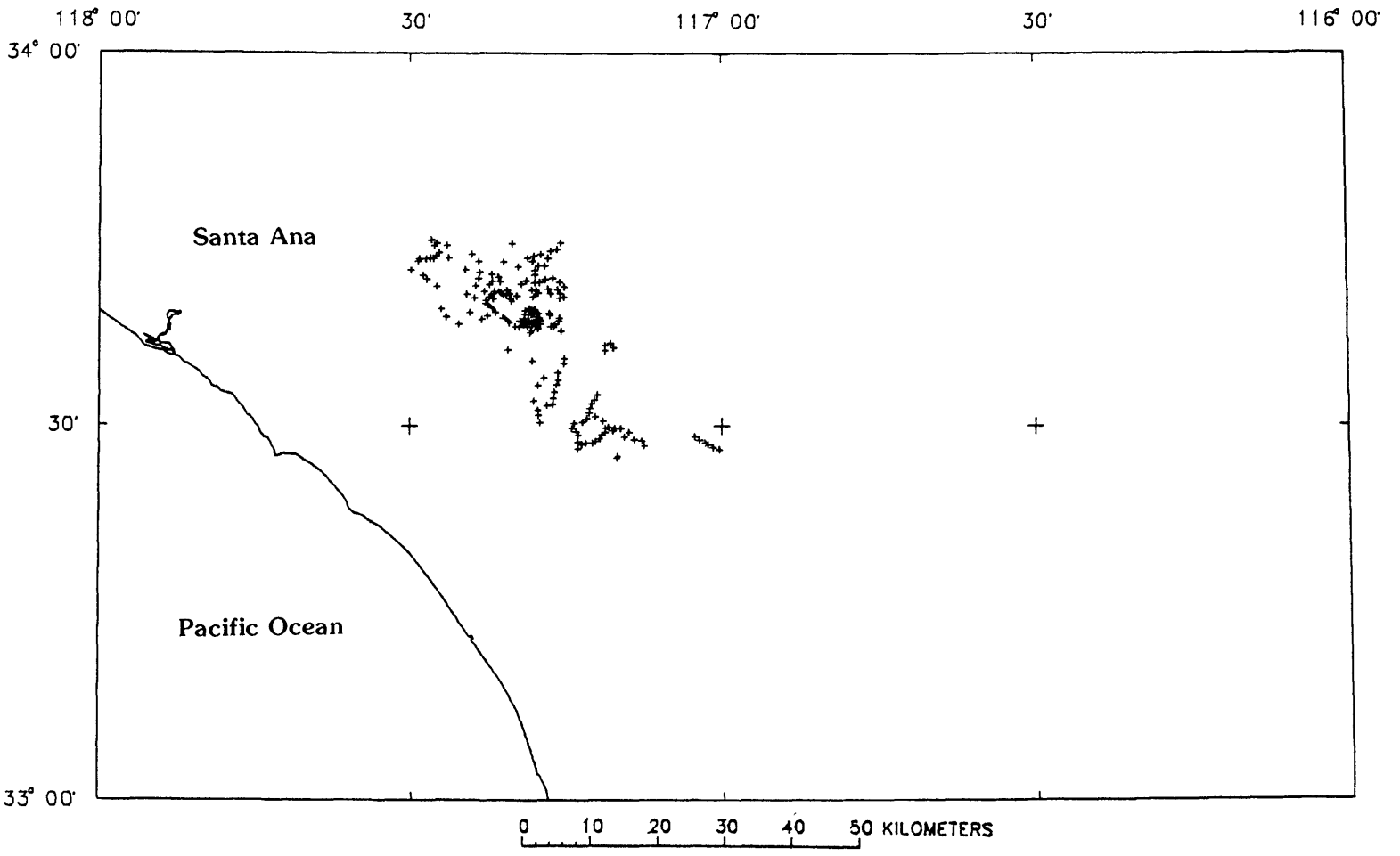



FIGURE 8. Hull data

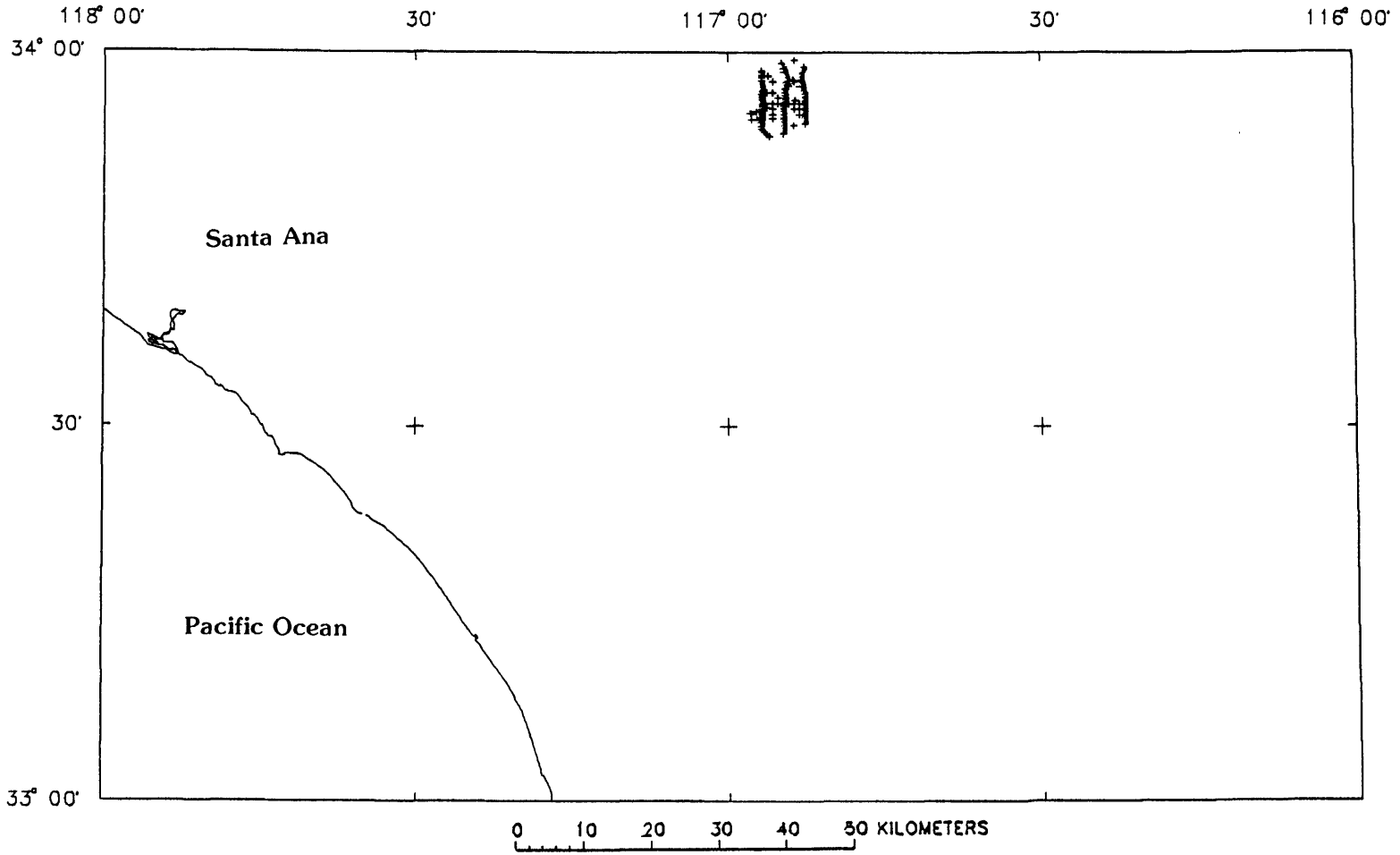



FIGURE 9. Blanck Jr data

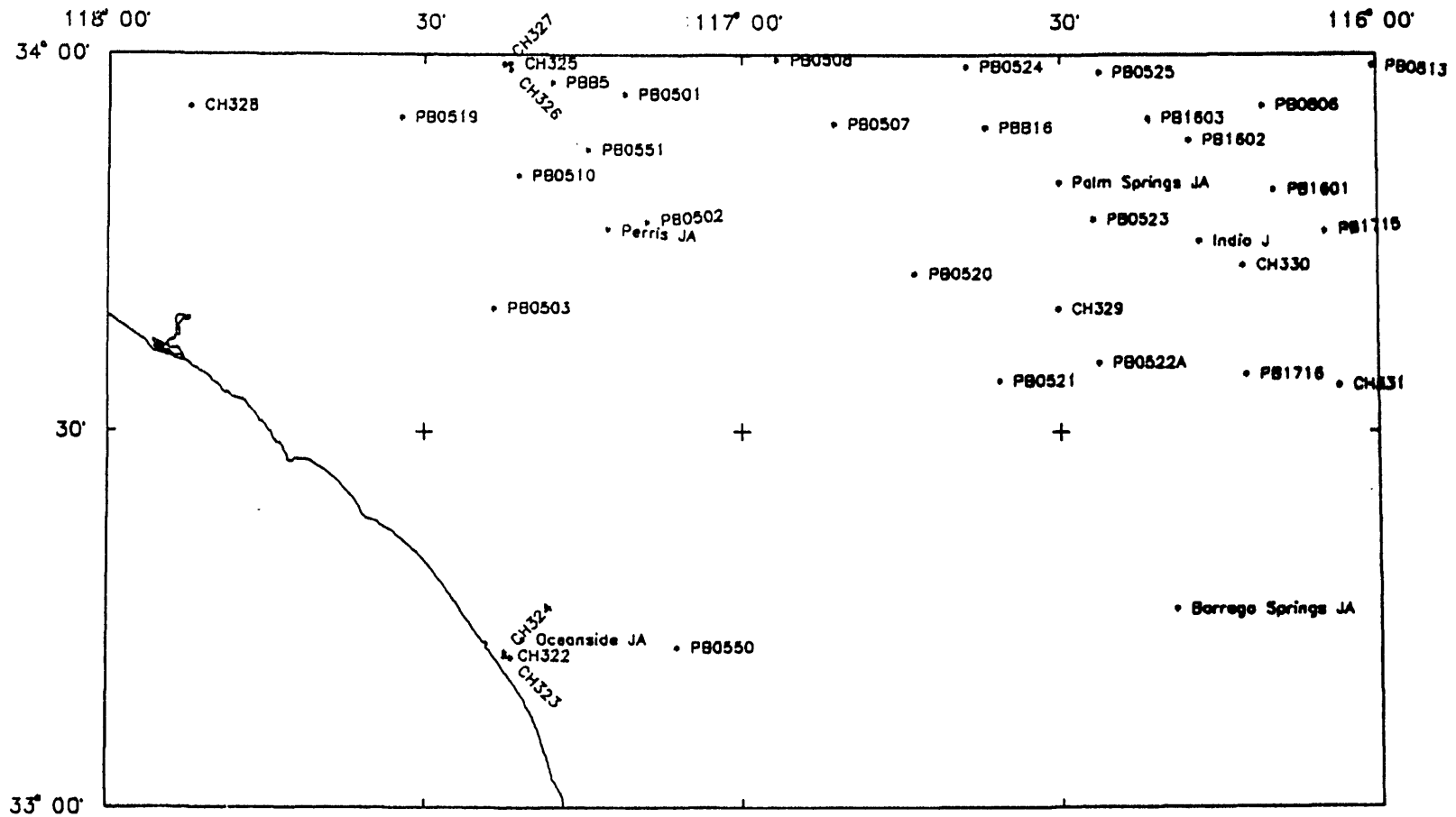
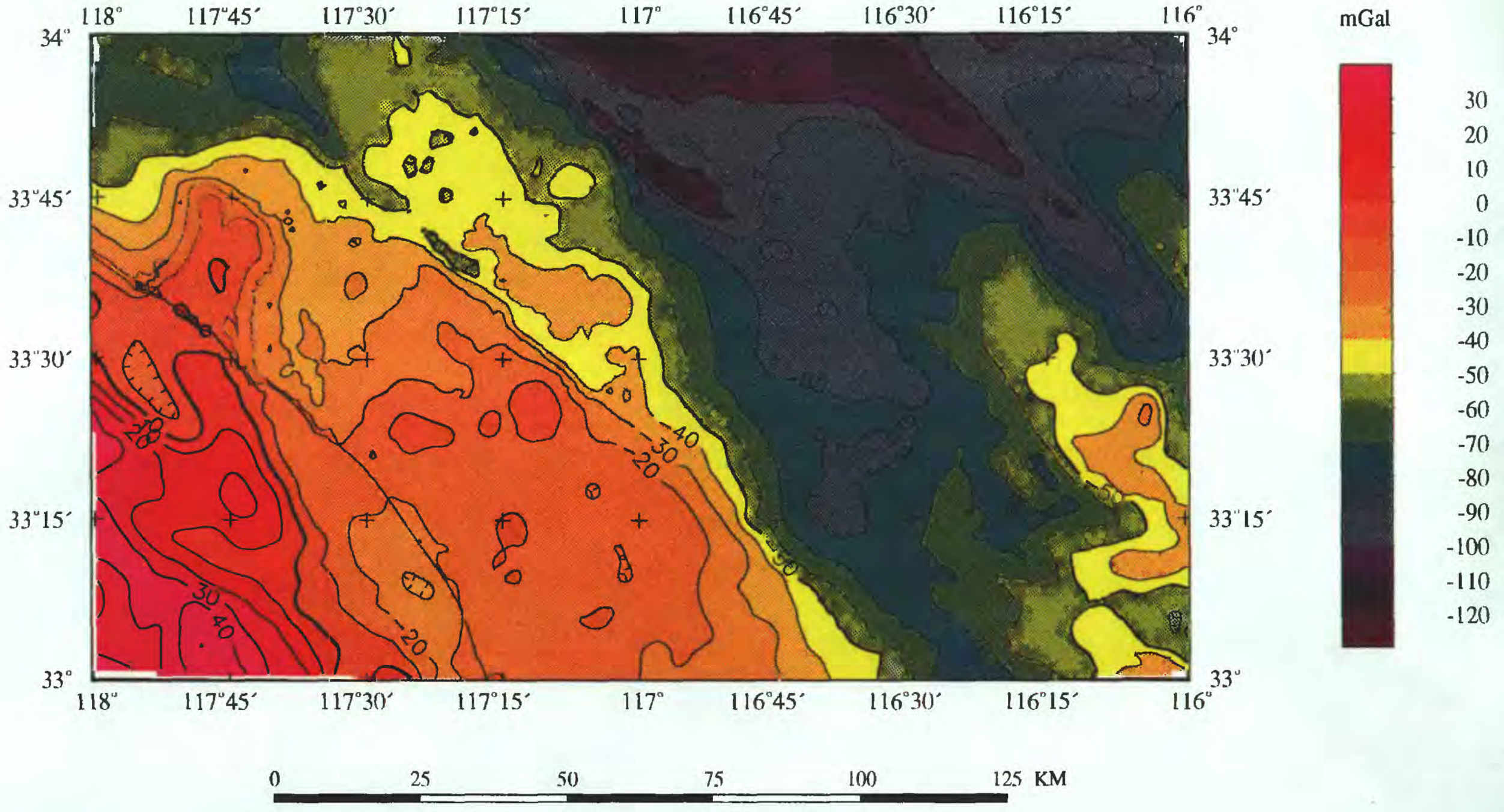



FIGURE 10. Base stations of the Santa Ana 1° by 2° sheet (listed in table 2 and described in appendix 3)




**10 mGal contour interval; hachures indicate closed lows**

FIGURE 11. Complete Bouguer gravity anomaly map

## Table 2. Santa Ana gravity base stations (see figure 10 and appendix 3)

| Gravity Base Station # | Name (location) | Latitude North | Longitude West | Datum IGSN71 or Wool./Rose | Observed Gravity mGal |
|---|---|---|---|---|---|
| PBB5 (HGSO) | Riverside (Primary Base) | 33° 57.47' | 117° 18.30' | IGSN71 | 979,498.692 |
| PBB16 | Whitewater | 33° 53.91' | 116° 37.41' | IGSN71 | 979,470.519 |
| PB0501 | Sunnymead | 33° 56.55' | 117° 11.45' | IGSN71 | 979,457.093 |
| PB0502 | Perris | 33° 46.33' | 117° 09.31' | IGSN71 | 979,487.237 |
| PB0503 | Elsinore | 33° 39.45' | 117° 23.80' | IGSN71 | 979,422.001 |
| PB0507 | Banning | 33° 54.19' | 116° 51.69' | IGSN71 | 979,384.538 |
| PB0508 | Beaumont | 33° 59.26' | 116° 57.20' | IGSN71 | 979,341.501 |
| PB0510 | Cajaleco | 33° 50.05' | 117° 21.49' | IGSN71 | 979,493.677 |
| PB0519 | Norco | 33° 54.68' | 117° 32.60' | IGSN71 | 979,541.755 |
| PB0520 | Hwy 74 & 243 | 33° 42.23' | 116° 44.02' | IGSN71 | 979,268.208 |
| PB0521 | Anza | 33° 33.69' | 116° 36.10' | IGSN71 | 979,247.741 |
| PB0522A | Pinyon Flat | 33° 35.10' | 116° 26.58' | IGSN71 | 979,295.402 |
| PB0523 | Cathedral City | 33° 46.54' | 116° 27.18' | IGSN71 | 979,527.831 |
| PB0524 | Bonnie Bell | 33° 58.73' | 116° 39.18' | IGSN71 | 979,406.671 |
| PB0525 | Long Canyon | 33° 58.25' | 116° 26.61' | IGSN71 | 979,444.169 |
| PB0550 | Escondido | 33° 12.37' | 117° 06.58' | IGSN71 | 979,469.522 |
| PB0551 | La Jolla | 33° 52.14' | 117° 14.90' | IGSN71 | 979,519.069 |
| PB0806 | Joshua Tree | 33° 55.64' | 116° 11.19' | IGSN71 | 979,230.196 |
| PB0813 | Joshua Tree Nat'l Mon. | 33° 58.80' | 116° 00.79' | IGSN71 | 979,333.729 |
| PB1601 | Berdoo Canyon | 33° 48.92' | 116° 10.17' | IGSN71 | 979,483.499 |
| PB1602 | Indio | 33° 52.89' | 116° 18.07' | IGSN71 | 979,483.315 |
| PB1603 | Indio | 33° 54.69' | 116° 21.93' | IGSN71 | 979,475.460 |
| PB1715 | Fargo Canyon | 33° 45.54' | 116° 05.35' | IGSN71 | 979,487.005 |
| PB1716 | Valerie | 33° 34.19' | 116° 12.86' | IGSN71 | 979,554.344 |
| CH322 (USC&GS A-64) | Oceanside | 33° 11.70' | 117° 22.81' | Wool./Rose | 979,571.46 |
| CH323 (US-241) | Oceanside Pendulum Station | 33° 11.84' | 117° 22.42' | Wool./Rose | 979,566.25 |
| CH324 | Oceanside High School | 33°11.84' | 117° 22.42' | Wool./Rose | 979,564.35 |
| CH325 (USC&GS Z-1) | Riverside Library | 33° 58.96' | 117° 22.28' | Wool./Rose | 979,548.18 |
| CH326 (USC&GS Y-1) | Riverside Court House | 33° 58.79' | 117° 22.45' | Wool./Rose | 979,548.81 |
| CH327 (UCR Base) | Riverside, UCR Base | 33° 58.46' | 117° 19.51' | Wool./Rose | 979,532.14 |
| CH328 [Destroyed] | Banning City Hall | 33° 55.54' | 117° 52.63' | Wool./Rose | 979,404.16 |
| CH329 [Destroyed] | Palm Springs | 33° 39.40' | 116° 30.56' | Wool./Rose | 979,523.14 |
| CH330 [Destroyed] | Indio, Roosevelt High School | 33° 42.88' | 116° 13.10' | Wool./Rose | 979,537.72 |
| CH331 (US-1019) | Mecca Pendulum Station | 33° 33.32' | 116° 04.12' | Wool./Rose | 979,551.22 |
| Borrego Springs JA | Borrego Springs | 33° 15.4' | 116° 19.5' | IGSN71 | 979,472.817 |
| Indio J | Indio | 33° 44.8' | 116° 17.1' | IGSN71 | 979,556.074 |
| Palm Springs JA | Palm Springs | 33° 49.5' | 116° 30.5' | IGSN71 | 979,507.897 |
| Perris JA | Perris | 33° 45.8' | 117° 13.1' | IGSN71 | 979,494.941 |
| Oceanside JA | Oceanside | 33° 13.0' | 117° 21.1' | IGSN71 | 979,559.752 |

**IGSN71**, International Gravity Standardization Net 1971 (IGSN, 1971); **Wool./Rose,** Woollard and Rose (1963) datum . **PB** stations were established by the USGS, (Roberts and Jachens, 1986); **CH** stations were established by CDMG, (Chapman, 1966) and **named stations** by DMA (DMA, written communication, 1982).

## TABLE 3- Explanation of principal facts information on diskette

| Item *(format)* and explanation |
|---|

**Station name** *(a8)*
An alphanumeric combination of up to 8 characters used for identification of the gravity measurement location.

**Latitude** *(f3.0,f4.2)*
Latitude in degrees and minutes, to 0.01 minute (listed without decimal point).

**Longitude** *(f4.0,f4.2)*
Longitude in degrees and minutes, to 0.01 minute (listed without decimal point).

**Elevation** *(f6.1)*
Elevation, to 0.1 feet (listed without decimal point)*[Multiply by .3048 to find meters].*

**Observed gravity** *(f7.2)*
Observed gravity, to 0.01 mGal (listed without decimal point)

**Accuracy code** *(a4)*
Four digit code describing the general location, elevation, latitude and observed gravity accuracy.

**Free air anomaly** *(f6.2)*
Free-air anomaly, to 0.01 mGal (listed without decimal point).

**Simple Bouguer anomaly** *(f6.2)*
Simple Bouguer anomaly, anomaly, to 0.01 mGal, at the reduction density of 2.67 g/cm$^3$ (listed without decimal point).

**Inner terrain correction** *(f5.2)*
Inner-zone terrain correction from 0.0 to 0.59 km for a density of 2.67 g/cm$^3$, to 0.01 mGal (listed without decimal point). The University of California at Riverside (UCR) used a special square format for inner zone of 0.0 to 3.52 km and 0.0 to 5.24 km. For information on this format contact Shawn Biehler at UCR.

**Terrain correction***(f5.2)*
Total terrain correction from 0.0 to 166.7 km for a density of 2.67 g/cm$^3$, to 0.01 mGal (listed without decimal point).

**Terrain correction code** *(a1)*
Single letter code "D" indicates 0.59 km radius. For UCR data, the letter "G" indicates 3.53 km , and "H" indicates 5.24 km (listed without decimal point).

**Complete Bouguer anomaly** *(f6.2)*
Complete Bouguer anomaly reduced for a density of 2.67 g/cm$^3$, to 0.01 mGal (listed without decimal point).

# TABLE 4.-Explanation of accuracy codes

[NGS, National Geodetic Survey; NMD, National Mapping Division; USGS, U.S. Geological Survey]

| General Elevation and location code-1st digit | | | |
|---|---|---|---|
| *Code* | *Explanation* | *Code* | *Explanation* |
| A | Altimetry, good control | P, b | On or near surveyed mark |
| B | On USGS or NGS level-line bench mark | Q | River gradient interpolation |
| C | Contour line interpolation | R | Lake or reservoir elevation by leveling |
| D | Destroyed or not found reference mark | S | Sea level elevation |
| E | Near level-line bench mark other than USGS or NGS | T | Photogrametry by USGS NMD |
| F | Map elevation, black or field checked | U | Unknown elevation Source |
| G | Map elevation, brown or not field checked | V | On vertical angle bench mark |
| H | Near vertical angle bench mark | W | Map elevation, blue |
| I | Other special source | X | On or near boundary marker |
| K | Photography by other than USGS NMD | Y | Altimetry, poor control |
| N | Near USGS or NGS level-line bench mark | Z | Special source, such as mobile elevation recorder |
| M, m | On level-line bench mark other than USGS or NGS | t | Benchmark or surveyed location to 0.1 foot |

| Elevation code-2nd digit | | | |
|---|---|---|---|
| *Code* | *Explanation* | *Elevation accuracy (ft)* | *Approximate gravity effect (mGal)* |
| 1 | On bench mark | 0.2 | 0.01 |
| 2 | Near Bench mark | 0.3 | 0.02 |
| 3 | Transit or good alidade survey | 1.0 | 0.06 |
| 4 | Vertical angle bench mark or black map elevation | 2.0 | 0.12 |
| 5 | Black map elevation on old map or good photogrametry | 4.0 | 0.24 |
| 6 | Brown map elevation or good photogrametry on 20 ft contour interval map | 10 | 0.6 |
| 7 | Brown map elevation on 80 ft contour map interval or good altimetry | 20 | 1.2 |
| 8 | Contour interpolation on 80 ft contour interval map | 40 | 2.4 |
| 9 | Contour interpolation on 200 ft contour interval map or poor altimetry | 80 | 4.8 |

| Latitude code-3rd (based at lat 37°) | | | | |
|---|---|---|---|---|
| *Code* | *Explanation [map distances in inches]* | *Latitude accuracy (min)* | *Distance accuracy (ft)* | *Approximate gravity effect (mGal)* |
| 1 | Triangulation or special survey data | 0.007 | 42 | 0.01 |
| 2 | Location known to 0.04 in on 1:24,000 map with special care | 0.014 | 84 | 0.02 |
| 3 | 0.10 in on 1:24,000 map or 0.04 in on 1:62,500 map | 0.035 | 210 | 0.05 |
| 4 | 0.21 in on 1:24,000 map or 0.08 in on 1:62,500 map | 0.07 | 420 | 0.1 |
| 5 | 0.42 in on 1:24,000 map or 0.16 in on 1:52,500 map | 0.14 | 840 | 0.2 |
| 6 | 0.40 in on 1:62,500 map or 0.1 in on 1:250,000 map | 0.35 | 2,100 | 0.5 |
| 7 | 0.80 in on 1:62,500 map or 0.2 in on 1:250,000 map | 0.7 | 4,200 | 1.0 |
| 8 | 1.60 in on 1:62,500 map or 0.4 in on 1:250,000 map | 1.4 | 8,400 | 2.0 |
| 9 | 4.00 in on 1:62500 map or 1.0 in on 1:250, 000 map | 3.5 | 21,000 | 5.0 |

| Observed gravity code-4th digit | | |
|---|---|---|
| *Code* | *Explanation* | *Approximate gravity effect (mGal)* |
| 1 | Local survey with special gravity meter | 0.01 |
| 2 | Multiple observations with LaCoste and Romberg gravity meter | 0.02 |
| 3 | Average LaCoste and Romberg or multiple observations with Worden gravity meter | 0.05 |
| 4 | LaCoste and Romberg observation with small vibrations or average Worden gravity meter | 0.1 |
| 5 | Data from loop with closure error this large | 0.2 |
| 6 | Data from loop with closure error this large | 0.5 |
| 7 | Data from loop with closure error this large | 1 |
| 8 | Data from loop with closure error this large | 2 |
| 9 | Data from loop with closure error this large | 4 |

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## Appendix 1.
## SOURCES OF DATA FROM THE UNIVERSITY OF CALIFORNIA AT RIVERSIDE.

| STATION PREFIX | YEAR | METER W=Worden L=LaCoste | DATA COLLECTED BY | PROJECT DESCRIPTIONS AND DATA SOURCES |
|---|---|---|---|---|
| SP | 1976 to 1977 | L | Stephen Park and Shawn Biehler | Geophysical investigation of the Northern Perris Block, Southern CA.; Senior Thesis, UCR, 1977. |
| BG | 1983 | L | Bernard Gilpin and Shawn Biehler | Geophysical investigation of the Seal Beach Fault Zone, CA; report for Irvine Consulting Group, 1983. |
| CB | 1982 to 1983 | L | Carl Blomquist and Shawn Biehler | Gravity anomalies and their structural implications in the Corona Basin, CA. |
| CRO | 1958 | L | Karl C. Crowley | Simple Bouguer gravity and geologic survey of La Puente, Los Angeles County, CA.; student report, UCR 1958. |
| UCR UCRR UCRC UCRM | 1966 | L | Mohammad R. Ghaeni | Gravity survey of the Elsinore-Murrieta Valley, CA.; Masters Thesis, UCR, 1967. |
| SR | 1978 | L | Steve Roche & Shawn Biehler | Gravity survey of the Elsinore Trough, CA.; report for Harding-Lawson Associates, 1978. |
| DOM | 1990 | L | Steve Wilds & Shawn Biehler | Gravity studies of the Domenigoni Valley, CA., for Metropolitan Water District (MWD.), 1990. |
| EEW | ? | ? | Edward E. Weldy | Gravity studies of the San Gabriel Valley area, CA. |
| SBV | 1966 to 1967 | L | C.R. Willingham | A gravity survey of the San Bernardino Valley, Southern CA., Masters Thesis, UCR, 1968. |
| A-,B-, C-,D-, E-,F-, G-,H-,I-J-K- | 1966 | L | Jerrie W. Gasch | Gravity survey of the Perris Reservoir Site for Department of Water Resources by CDMG.; transmitted by letter from Jerrie W. Gasch, 1968. |
| GE | 1969 | L | Gordon P. Eaton | Gravity survey of the Sunnymead Area, CA.; transmitted by letter, 1970. |
| GPEB, GPEE, GPEM, GPEN, GPEO, GPES | 1962 to 1969 | L | UCR Students | Gravity data on the Perris Block, CA.; transmitted by letter from Gordon P. Eaton, 1969. |
| WR, LM, ER | 1969 | W | C.R. Willingham | Gravity survey Riverside Area, CA., field study for UCR |
| 2303-2614 | 1964 | W | Shawn Biehler | Gravity studies in Southern CA. |
| 2845-4008 | 1965 | W | Shawn Biehler | Gravity studies in Southern CA. |
| 6014-6209 | 1967 | W | Shawn Biehler | Gravity studies in Southern CA. |
| 6374-6377 | 1968 | L | Shawn Biehler | Gravity studies in Southern CA. |
| 6622-6711 | 1969 | L | Shawn Biehler | Gravity studies in Southern CA. |
| 7162-7298 | 1970 | L | Shawn Biehler | Gravity studies in Southern CA. |
| 7180-7182 | 1973 | L | Shawn Biehler | Gravity studies in Southern CA. |
| 8000-8184 | 1981 | L | Shawn Biehler | Gravity studies in Southern CA. |
| F4A, F4B | 1964 | W | Caltech Students, Shawn Biehler | Gravity studies in Southern CA. for UCR. |



continued on next page

## Appendix 1. continued
## SOURCES OF DATA FROM THE UNIVERSITY OF CALIFORNIA AT RIVERSIDE.

| STATION PREFIX | YEAR | METER W=Worden L= LaCoste | DATA COLLECTED BY | PROJECT DESCRIPTIONS AND DATA SOURCES |
|---|---|---|---|---|
| F6A, F6B | 1966 | W | Caltech Students | Gravity studies in Southern CA. for UCR. |
| UCR, UCRA, UCRB, UCRC, UC1E | 1966 | L | UCR Students | Gravity studies in the Hemet-San Jacinto Area, CA.; transmitted by letter from G.P. Eaton, 1967. |
| BAB | 1957 | L | Bruce Blackerby | A gravity study of the Brea Canyon Area, CA.; Bruce A. Blackerby, UCR, Senior Thesis, 1958. |
| WE | 1965 | W | W.C.Elliot | Senior Thesis, San Diego State University, 1965. |
| 34798-64507 | 1951 1955 | W | private oil company | Regional gravity stations of CA., from private oil company data. |
| 2244-8821 | ? | ? | ? | Gravity study of San Juan Capistrano Embayment, from private oil company data. |
| NM | 1962? | L | Neill W. Martin | A gravimetric investigation of overburden depth and basement rock configuration at Crestmore, CA.; UCR Masters Thesis by Neill W. Martin, 1963. |
| JF | 1968 | L | John D. Fett | Geophysical investigation of the San Jacinto Valley, CA; UCR unpublished Masters Thesis, 1968. |
| JFW | 1967 | L | R.C.Willingham | Gravity studies in Southern CA. for Shawn Biehler. |
| VG | 1987 | L | Victor Yanasheski & Shawn Biehler | Gravity studies in the Desert Hot Springs Area, CA. |
| SOB | 1989 1991 | L | Shawn Biehler | Gravity studies in Southern CA. |
| TM | ? | ? | Thane H. McCulloh | |
| TH | ? | ? | Thane H. McCulloh | |

*For additional information and complete references contact Shawn Biehler or the library at the University of California at Riverside.*

# Appendix 2. DEFENSE MAPPING AGENCY (DMA) DATA SOURCES

| STATION PREFIX | DATA SOURCE CITED [by DMA] | NUMBER OF STATIONS |
|---|---|---|
| 1083 | National Gravimeter Base Network, NOAA | 22 |
| 2078 | G.P. Woollard | 23 |
| 2381 | Gravity Data Channel Islands, California and other U.S. Data, Navel Oceangraphic Operation (NAVOCEANO),Defense Mapping Agency Hydrogaphic and Topographic (DMAH/TC). | 19 |
| 2665 | R.H. Chapman, California Gravity Base Station Network, CDMG, 1966 | 4 |
| 2766 | Gravity Survey of San Gorgonio Pass, California, USGS | 52 |
| 4099 | Gravity Data in the U.S., North-south profiles | 4 |
| 5280 | California Land Gravity Survey 2626, NOAA | 129 |
| 6199 | Final WSMC Area Gravity Data Set, Defense Mapping Agency Topographic Command and Geodetic Survey Squadron (DMATC/GSSQ), 1982 | 67 |
| 6206 | Hawaii Institute of Geophysics (HIG) Gravity Data covering the U.S.; National Geodetic Survey | 34 |

## Appendix 3. Base Station Descriptions

# Santa Ana Base Station Descriptions

| GRAVITY BASE STATION # PBB5 (HGS0) | |
|---|---|
| NAME RIVERSIDE (Primary Base) | STATE California |
| LATITUDE 33°57.47'N | LONGITUDE 117°18.30'W |
| ELEVATION | |
| OBSERVED IGSN71 datum GRAVITY 979,498.692 mGal | |

## LOCATION DESCRIPTION:

Station is located about 1.5 mi southeast of the Riverside campus of the University of California. To reach it take Central Avenue - Watkins Drive exit from interstate 215, go north 0.1 mi to first side road crossing ATCHISON, TOPEKAH AND SANTA FE (AT&SF) Railway tracks (Gernert Road), then southeast 0.27 mi along northeast side of tracks to quarry siding, then 222 ft along siding to derail switch, 5.7 ft southeast of switchstand, 4.7 ft south of "derail" post, 6.9 ft northeast of northeast rail of siding and 21.0 ft northeast of the northeast rail of the main line on a granitic outcrop, and is marked with a standard gravity mark stamped "PBB5 1976 979,498.692 IGSN71". Note in 1984 the switch from the main line to the siding was removed along with the derail post and switchstand. Station is 217 ft from the center of wooden culvert # "53". Face meter uphill to read.

PBB5A 979,498.281 mGal

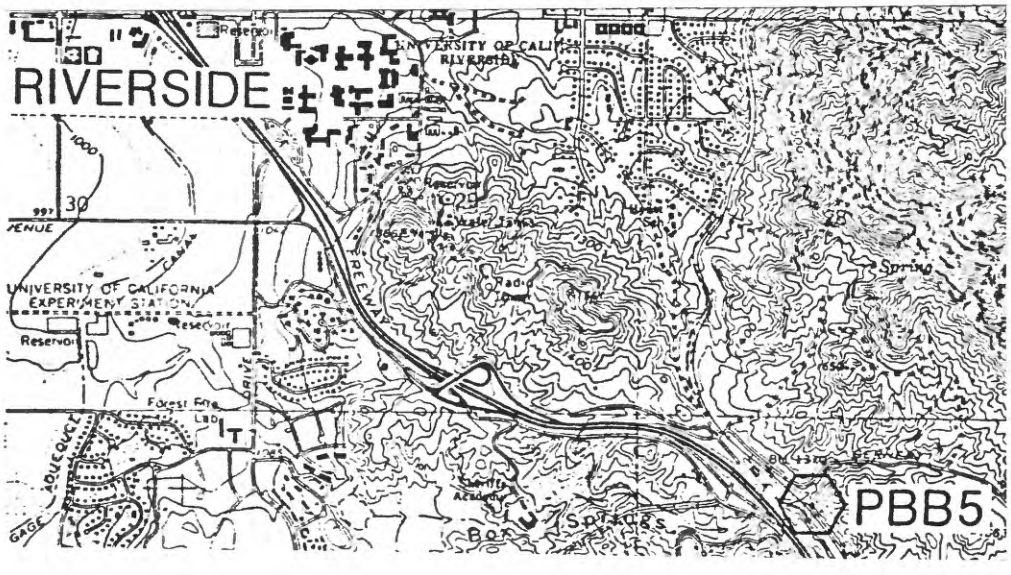
63 ft northeast of PBB5 along siding then 28.5 ft northeast of northeast rail on top of granitic outcrop, and marked with a standard gravity mark stamped "PBB5A 1976 -.411". Face meter uphill to read.

PBB5B 979,486.592 mGal

.0.85 mi east on Gernert Road, then right on the leftmost of 2 dirt roads approximately 250 ft , then left (east) about 80 ft to a 5 x 8 ft rock projecting 1 1/2 ft above ground level and about 14 ft northwest of tallest rock, in a slight depression in top of rock and marked by 1 3/8 in brass disk stamped "PBB5 B 1983". Face north.

PBB5C 979,486.800 mGal

About 22 ft northeast of PBB5B on a low rock just southwest of bottom of draw (just east of a similar rock). Face north.




(Adapted from Roberts, C.W. and Jachens, R.C., 1986)

| GRAVITY BASE STATION # PBB16 (Helicopter HGS11) | |
|---|---|
| NAME<br>Whitewater | STATE<br>California |
| LATITUDE<br>33°53.91'N | LONGITUDE<br>116°37.41'W |
| ELEVATION | |
| OBSERVED IGSN71 datum<br>GRAVITY 979,470.519 mGal | |

**LOCATION DESCRIPTION:**

3.55 mi southeast along State Highway 111 from its junction with Interstate Highway 10 at Whitewater, 1.10 mi southeast along State Highway 111, set in the top of a rock outcrop at Windy Point, 8 ft above level of road over USGS BM "100DOR 1976". Read with meter facing toward the highway. Note: The observed gravity at this station pair has increased recently due to considerable ground water recharge nearby. The observed gravity may differ by perhaps 0.1 milligal or more from the listed value.

PBB16A

145 ft east of PBB16 on a small rock ledge which is 28 ft south of the south edge of pavement, and 4 ft above the level of highway. Face meter away from road to read.

(Adapted from Roberts, C.W. and Jachens, R.C., 1986)

| GRAVITY BASE STATION # PB0501 | |
|---|---|
| NAME Sunnymead | STATE California |
| LATITUDE 33°56.55'N | LONGITUDE 117°11.45'W |
| ELEVATION | |
| OBSERVED IGSN71 datum GRAVITY 979,457.093 mGal | |

**LOCATION DESCRIPTION:**

2 mi east of Sunnymead on State Highway 60, then 1200 ft north on Nason Street to a roadcut, east of the road on a large rock outcrop containing USC&GS reference mark 'FAULT F NO. 2". Read just south of mark with meter facing north.

PB0501A 979,457.093 mGal

Over USC&GS BM "FAULT F 1950". Face meter south.

(Adapted from Roberts, C.W. and Jachens, R.C., 1986)

| GRAVITY BASE STATION # PB0502 | |
|---|---|
| NAME Perris | STATE California |
| LATITUDE 33°46.33'N | LONGITUDE 117°09.31'W |
| ELEVATION | |
| OBSERVED IGSN71 datum GRAVITY 979,487.237 mGal | |

**LOCATION DESCRIPTION:**

About 4 mi east of Perris at the junction of Menifee Road and Ellis Avenue, 80 ft east of the centerline of Menifee Road and 15 ft south of the projection of the centerline of Ellis Avenue, on a large domelike granite outcrop. Face meter north to read.

PB0502A 979,486.904 mGal

26.5 ft east of PB0502, and 85.0 ft north of power pole # "270743" on a 3 by 4 ft granite boulder projecting 1 ft above ground level. Face meter north.

(Adapted from Roberts, C.W. and Jachens, R.C., 1986)

| GRAVITY BASE STATION # PB0503 | |
|---|---|
| NAME Elsinore | STATE California |
| LATITUDE 33°39.45'N | LONGITUDE 117°23.80'W |
| ELEVATION | |
| OBSERVED IGSN71 datum GRAVITY 979,422.001 mGal | |

**LOCATION DESCRIPTION:**

8.7 mi west-southwest along State Highway 74 from the junction of Interstate Highway 15 at Lake Elsinore, to the viewpoint northwest of "The Lookout", at the northwest end of the parking area on a 3 by 3 ft granite boulder 4 ft northeast of guardrail and 5 ft from southwest end of guardrail. Face meter away from road.

PB0503A 979,422.042 mGal

Southeast of PB0503, down steps from parking area then about 6 ft to the right, midway between 2 stone and concrete wingwalls. Face meter toward wall with baseplate touching wall.

PB0503B 979,421.659

Approximately 13' east of PB0503 on top of rock projecting 2-3 ft above ground; face PB0503.


(Adapted from Roberts, C.W. and Jachens, R.C., 1986)

| GRAVITY BASE STATION # PB0507 | |
|---|---|
| **NAME** Banning | **STATE** California |
| **LATITUDE** 33°54.19'N | **LONGITUDE** 116°51.69'W |
| **ELEVATION** | |
| **OBSERVED** IGSN71 datum **GRAVITY** 979,384.538 mGal | |

**LOCATION DESCRIPTION:**

1.9 mi south along State Highway 243 from the junction of Lincoln Street and San Gorgonio Avenue in Banning to a dirt track on a hill above the highway, north 10° west from an old foundation, on a 2.5 by 5 ft boulder projecting 2 ft above the ground, just west of a boulder projecting 6 ft above ground and leaning over station. Face meter southeast to read. Marker gone 1/83.

PB0507A 979,384.557 mGal

15 ft east of PB0507 on a granite outcrop. Face meter toward Banning to read.

(Adapted from Roberts, C.W. and Jachens, R.C., 1986)

| GRAVITY BASE STATION # PB0508 | |
|---|---|
| **NAME** Beaumont | **STATE** California |
| **LATITUDE** 33°59.26'N | **LONGITUDE** 116°57.20'W |
| **ELEVATION** | |
| **OBSERVED** IGSN71 datum **GRAVITY** 979,341.501 mGal | |

**LOCATION DESCRIPTION:**

At Bogart County Park north of Beaumont, 0.5 mi northeast of the entrance station to a junction then left 0.1 mi to a concrete slab on left. To reach park go north on Beaumont Road, east on 14th Street East, then north on Cherry Avenue. Park is open from 8 am to 5 pm (weekends only during winter as of 1983). Read on northeast corner of concrete slab, about 5 ft from campsite marker "10", over gravity marker with meter facing north 20° west (parallel to the side of the slab nearest to the road).

PB0508A 979,341.491 mGal

On the southeast corner of the concrete slab and 1 ft from campsite marker "9". No gravity marker or leg holes. Face meter toward road with baseplate tangent to sides of slab.

Adapted from Roberts, C.W. and Jachens, R.C., 1986)

| GRAVITY BASE STATION # PB0510 | |
|---|---|
| NAME Cajaleco | STATE California |
| LATITUDE 33°50.05'N | LONGITUDE 117°21.49'W |
| ELEVATION | |
| OBSERVED IGSN71 datum GRAVITY 979,493.677 mGal | |

**LOCATION DESCRIPTION:**

0.5 mi west along Cajalco Road from the Cajalco Fire Station, on the south side of the road, at Metropolitan Water District of Southern California BM "41 H 1941". Base plate is set 0.4 ft east-northeast of BM. Face meter away from road to read.

PB0510A 979,493.677 mGal

78.3 ft south of PB0510 on relatively flat , low portion of east side of largest outcrop. Face meter away from road.

Adapted from Roberts, C.W. and Jachens, R.C., 1986)

| GRAVITY BASE STATION # PB0519 | |
|---|---|
| **NAME** Norco | **STATE** California |
| **LATITUDE** 33°54.68'N | **LONGITUDE** 117°32.60'W |
| **ELEVATION** | |
| **OBSERVED** IGSN71 datum **GRAVITY** 979,541.755 mGal | |

**LOCATION DESCRIPTION:**

1.0 mi east on 2nd Street from State Highway 31 in Norco, then 1.0 mi north on Hillside Avenue, on a large granite outcrop east of road. Read 10 ft south of top of outcrop with meter facing east.

PB0519A 979,541.915 mGal

About 10 ft south of PB0519 on outcrop. Face meter east-southeast to read.

(Adapted from Roberts, C.W. and Jachens, R.C., 1986)

| GRAVITY BASE STATION # PB0520 | |
|---|---|
| NAME Hwy 74 & 243 | STATE California |
| LATITUDE 33°42.23'N | LONGITUDE 116°44.02'W |
| ELEVATION | |
| OBSERVED IGSN71 datum GRAVITY 979,268.208 mGal | |

**LOCATION DESCRIPTION:**

On State Highway 74 about 0.6 mi west of junction with State Highway 243, adjacent to paddle board "074 RIV 58.59 and a culvert, on granite outcrop (boulder?) in a subdued gully 35 ft east of centerline of road and about 15 ft above road, and marked with a standard gravity marker stamped "PB0520 1976". Meter read facing west.

PB0520A 979,268.047 mGal

On granite outcrop 10 ft east of and 3 ft higher than PB0520. Meter read facing west. This site can be very overgrown and requires a machete.

(Adapted from Roberts, C.W. and Jachens, R.C., 1986)

| GRAVITY BASE STATION # PB0521 | |
|---|---|
| NAME Anza | STATE California |
| LATITUDE 33°33.69'N | LONGITUDE 116°36.10'W |
| ELEVATION | |
| OBSERVED IGSN71 datum GRAVITY 979,247.741 mGal | |

**LOCATION DESCRIPTION:**

Over USC&GS BM "N516 1955", which is 5.2 mi east along Cahuilla Road (State Highway 371) from the Post Office at Anza, 1.0 mi north of BM "T 586" along the Cahuilla Road, 0.15 mi east of Burnt Road, and 1.3 mi west of junction with State Highway 74, in the top of a 3 by 3-ft boulder, in the northwest side of a short, high fill between deep cuts, 33.5 ft northeast of the the northeast end of a cut, 27.5 ft northwest of the centerline of the road, 16 ft northeast of the southwest bank of a deep wash, 15 ft southwest of a paddleboard "75.92", about 3 ft lower than the road, 3 ft northwest of and 2 ft below base of witness post, and marked with a standard gravity marker stamped "PB0521 1976". Meter read facing east.

PB0521A 979,248.344 mGal

On east end of metal pipe culvert crossing road one gully southwest of PB0521 at paddleboard "371 RIV 75.88". Culvert is 135 ft southwest along road from PB0521, in manzanita bush. Meter read facing north.


(Adapted from Roberts, C.W. and Jachens, R.C., 1986)

| GRAVITY BASE STATION # PB0522A | |
|---|---|
| NAME Pinyon Flat | STATE California |
| LATITUDE 33°35.10'N | LONGITUDE 116°26.58'W |
| ELEVATION | |
| OBSERVED IGSN71 datum GRAVITY 979,295.402 mGal | |

**LOCATION DESCRIPTION:**

On State Highway 74 about 0.7 mi east of Pinyon Flat Camp, on north side of highway, on same granite outcrop as, and located about 3 ft east of USC&GS BM "G587 1939", adjacent to paddleboard "74 RIV 81.16". Face north to read.

PB0522 979,295.450 mGal

On granite 12 ft east of PB0522A, and marked with a standard gravity mark stamped "PB0522 1976". Face meter north to road.

(Adapted from Roberts, C.W. and Jachens, R.C., 1986)

| GRAVITY BASE STATION # PB0523 | |
|---|---|
| NAME Cathedral City | STATE California |
| LATITUDE 33°46.54'N | LONGITUDE 116°27.18'W |
| ELEVATION | |
| OBSERVED IGSN71 datum GRAVITY 979,527.831 mGal | |

**LOCATION DESCRIPTION:**

0.3 mi east of Date Palm Road in Cathedral City, on outcrop located 60 ft south of south edge of State Highway 111, 135 ft east of a concrete culvert passing under highway, at about the same elevation as the highway, 125 ft west of place where cliff meets highway, and marked with a standard gravity marker stamped "PB0523 1976". Read meter facing south.

PB0523A 979,527.823 mGal

3 ft north of PB0523.

(Adapted from Roberts, C.W. and Jachens, R.C., 1986)

| GRAVITY BASE STATION # PB0524 | |
|---|---|
| NAME Bonnie Bell | STATE California |
| LATITUDE 33°58.73N | LONGITUDE 116°39.18'W |
| ELEVATION | |
| OBSERVED IGSN71 datum GRAVITY 979,406.671 mGal | |

**LOCATION DESCRIPTION:**

On Whitewater Canyon Road, about 2.2 mi north of Bonnie Bell, on southeast corner (concrete) of cattleguard going across the road. Read meter facing north.

PB0524A 979,406.616 mGal

On northwest corner of same cattleguard as PB0524.

(Adapted from Roberts, C.W. and Jachens, R.C., 1986)

| GRAVITY BASE STATION # PB0525 | |
|---|---|
| NAME Long Canyon | STATE California |
| LATITUDE 33°58.25N | LONGITUDE 116°26.61'W |
| ELEVATION | |
| OBSERVED IGSN71 datum GRAVITY 979,444.169 mGal | |

**LOCATION DESCRIPTION:**

On Colorado River Aqueduct, in Long Canyon, about 3.5 mi north of Dillon Road, on concrete spur of aqueduct port of west side of valley marked with a standard gravity marker stamped "PB0525 1976". Meter read facing north.

PB0525A 979,443.867 mGal

On flat rock ledge about 30 ft west of PB0525 and projecting 2 ft above ground. Read facing south.

(Adapted from Roberts, C.W. and Jachens, R.C., 1986)

| GRAVITY BASE STATION # PB0550 | |
|---|---|
| NAME Escondido | STATE California |
| LATITUDE 33°12.37'N | LONGITUDE 117°06.58'W |
| ELEVATION | |
| OBSERVED IGSN71 datum GRAVITY 979,469.522 mGal | |

**LOCATION DESCRIPTION:**

Take Mountain Meadow Road exit from Interstate Highway 15 3.1 mi north of Escondido. Go east 1.2 mi to crest of Mountain Meadow Road, on southeast side of road, south 50° west about 15 ft from power pole # P214664 on elongate granite outcrop. Face meter north to read.

PB0550A 979,470.359 mGal

North 60° west about 30 ft from PB0550 and about 20 ft southeast of centerline of road on large granite outcrop projecting 5 ft above road. Face meter southwest to read.

(Adapted from Roberts, C.W. and Jachens, R.C., 1986)

| GRAVITY BASE STATION # PB0551 | |
|---|---|
| NAME La Jolla | STATE California |
| LATITUDE 33°52.14'N | LONGITUDE 117°14.90'W |
| ELEVATION | |
| OBSERVED IGSN71 datum GRAVITY 979,519.069 mGal | |

**LOCATION DESCRIPTION:**

From Interstate Highway 15 go west on Miramar Road - La Jolla Village Drive - No. Torrey Pines Road to La Jolla Shores Drive in La Jolla then left 0.55 mi, over USC&GS BM "L 895 1955", which is 0.9 mi notheast along La Jolla Shores Drive from Scripps Institute of Oceanography, at the "Y" junction of a paved road leading south, near a white board gate, 53.7 ft south of the centerline of the drive, 18 ft northwest of the centerline of the road, 2.5 ft west of the side of the concrete base of the west one of two ornamental gate pillars, 1.8 ft southeast of a witness post, about 3 ft lower than the road, and set in the top of a concrete post projecting 0.4 ft above the ground. Face meter uphill (N70°E) to read.

PB0551A 979,519.012 mGal

4.5 ft east of PB0551 on concrete foundation of concrete gatepost on the north side of pillar. Face meter toward pillar.

(Adapted from Roberts, C.W. and Jachens, R.C., 1986)

| GRAVITY BASE STATION # PB0806 | |
|---|---|
| NAME Joshua Tree | STATE California |
| LATITUDE 33°55.64'N | LONGITUDE 116°11.19'W |
| ELEVATION | |
| OBSERVED IGSN71 datum GRAVITY 979,230.196 mGal | |

**LOCATION DESCRIPTION:**

At Keys View (Salton View) in Joshua Tree National Monument, on boulder projecting about 1 ft above ground, 15 ft northwest of northwest corner of parking area, and marked with a standard gravity marker stamped "PB0806 1976". Meter is read on a rock just northwest of a small juniper 3 ft high which is 5 ft west of a 3 ft round boulder. Meter read facing north. Note: Rock has been turned over,destroying station.

PB0806A 979,230.980 mGal

on concrete sidewalk at northeast corner of parking area. Base plate set about 0.5 ft from each wall at corner. Meter read facing north.

Adapted from Roberts, C.W. and Jachens, R.C., 1986)

| GRAVITY BASE STATION # PB0813 (NGS BM "S1251 1974") | |
|---|---|
| NAME<br>Joshua Tree Nat'l Mon. | STATE<br>California |
| LATITUDE<br>33°58.80'N | LONGITUDE<br>116°00.79'W |
| ELEVATION | |
| OBSERVED IGSN71 datum<br>GRAVITY 979,333.729 mGal | |

**LOCATION DESCRIPTION:**

In Joshua Tree National Monument, about 0.4 mi southeast along the Pinto Basin Road from the White Tank Campground, southeast of a large outcrop, in the top of a large rock at a parking area, over NGS BM "S1251 1974". Read with meter facing away from main road.

PB0813A 979,333.729 mGal

South 40° east about 30 ft to ledge on side of large boulder. Marked with a standard gravity marker. Read with meter facing away from main road.

(Adapted from Roberts, C.W. and Jachens, R.C., 1986)

| GRAVITY BASE STATION # PB1601 | |
|---|---|
| NAME Berdoo Canyon | STATE California |
| LATITUDE 33°48.92'N | LONGITUDE 116°10.17'W |
| ELEVATION | |
| OBSERVED IGSN71 datum GRAVITY 979,483.499 mGal | |

**LOCATION DESCRIPTION:**

On Berdoo Canyon Road, on large flat boulder on top of low ridge adjacent to and immediately east of road and Berdoo Canyon and 1.48 mi north of junction with Dillon Road, and marked with a standard gravity marker stamped "PB1601 1976". Meter read facing north.

PB1601A 979,483.809 mGal

30 ft west of and 5 ft lower than PB1601.

(Adapted from Roberts, C.W. and Jachens, R.C., 1986)

| GRAVITY BASE STATION # PB1602 | |
|---|---|
| NAME Indio | STATE California |
| LATITUDE 33°52.89'N | LONGITUDE 116°18.07'W |
| ELEVATION | |
| OBSERVED IGSN71 datum GRAVITY 979,483.315 mGal | |

LOCATION DESCRIPTION:

Over Metropolitan Water District of Southern California BM "30X 1931", which is 12.0 mi north-northwest of Indio, about 0.4 mi north of junction of Dillon Road and Thomas Palms road, 30 ft north of and about 10 ft higher than the road, in a rock outcrop. Meter read facing north.

PB1602A 979,483.315 mGal

60 ft west of and 10 ft higher than PB1602. Meter read facing north.

(Adapted from Roberts, C.W. and Jachens, R.C., 1986)

| GRAVITY BASE STATION # PB1603 | |
|---|---|
| NAME Indio | STATE California |
| LATITUDE 33°54.69'N | LONGITUDE 116°21.93'W |
| ELEVATION | |
| OBSERVED IGSN71 datum GRAVITY 979,475.460 mGal | |

**LOCATION DESCRIPTION:**

About 4.3 mi northwest of PB1602 and 0.25 mi northeast of Dillon Road, on west slope of a gneiss rubble ridge, on large gneiss boulder (?) located 45 ft east of dirt road, 275 ft north of the south end of ridge, 6 ft above ground, and marked with a standard gravity marker stamped "PB1603 1976". Meter read facing north.

PB1603A 979,454.568 mGal

25 ft north of and 15 ft above PB1603. Meter read facing north.


(Adapted from Roberts, C.W. and Jachens, R.C., 1986)

| GRAVITY BASE STATION # PB1715 | |
|---|---|
| **NAME** Fargo Canyon | **STATE** California |
| **LATITUDE** 33°45.54'N | **LONGITUDE** 116°05.35'W |
| **ELEVATION** | |
| **OBSERVED** IGSN71 datum **GRAVITY** 979,487.005 mGal | |

**LOCATION DESCRIPTION:**

In Fargo Canyon, on fresh granite outcrop on east side of canyon 1.7 mi north of sharp bend in road (where road turns from due east-west to northeast), about 200 ft south of southernmost of two palo verde trees at eastern edge of wash and 0.06 mi north of south end of first granite outcrop on east side of wash, 25 ft east of east edge, about 8 ft above the wash, and marked with a standard gravity marker stamped "PB1715 1976". (Site is 4.8 mi from junction with Dillon Road). Read meter facing west.

PB1715A 979,487.206 mGal

On granite outcrop about 15 ft west of, and about 3 ft lower than PB1715. Read with meter facing west.

(Adapted from Roberts, C.W. and Jachens, R.C., 1986)

| GRAVITY BASE STATION # PB1716 | |
|---|---|
| **NAME** Valerie | **STATE** California |
| **LATITUDE** 33°34.19'N | **LONGITUDE** 116°12.86'W |
| **ELEVATION** | |
| **OBSERVED IGSN71 datum GRAVITY** 979,554.344 mGal | |

**LOCATION DESCRIPTION:**

At the base of Santa Rosa Mountains, 8 mi west of Mecca and 2 mi west of Valerie, on boulder over USGS BM "110 DOR 1976", and marked with a standard gravity marker stamped "PB1716 1976". Meter read facing west. This is the prime base for the John Fett's Cottonwood Pass and Frink lines (John Fett, written communication 1976).

PB1716A 979,554.400 mGal

On north end of boulder 85 ft north of PB1716. Read with meter facing west.

(Adapted from Roberts, C.W. and Jachens, R.C., 1986)

| GRAVITY BASE STATION # CH322 (USC&GS A-64) | |
|---|---|
| NAME Oceanside | STATE California |
| LATITUDE 33°11.70'N | LONGITUDE 117°22.81'W |
| ELEVATION 14.4 m 47.4 ft | |
| OBSERVED Woollard & Rose Datum GRAVITY 979,571.46 mGal | |

LOCATION DESCRIPTION:

In Oceanside at the corner of Cleveland and 2nd Streets, at the northeast corner of Athison, Topeka and Santa Fe (A.T.& S.F.) railroad park, 100 ft east of the station. Reading on the disk.

(Adapted from Chapman, R.H.,1966)

| GRAVITY BASE STATION # CH323 (US-241) | |
|---|---|
| **NAME** Oceanside Pendulum | **STATE** California |
| **LATITUDE** 33°11.84'N | **LONGITUDE** 117°22.42'W |
| **ELEVATION** 38.9 m 127 ft | |
| **OBSERVED** Woollard & Rose Datum **GRAVITY** 979,566.24 mGal | |

**LOCATION DESCRIPTION:**

At Oceanside High School at 1st and Horne Streets near the southwest corner of the building at the base of the stairs on the concrete walk against the building at basement level. Pendulum station was in the vicinity.

(Adapted from Chapman, R.H.,1966)

| GRAVITY BASE STATION # CH324 (Woollard Site) | |
|---|---|
| **NAME**<br>Oceanside High School | **STATE**<br>California |
| **LATITUDE**<br>33°11.84'N | **LONGITUDE**<br>117°22.42'W |
| **ELEVATION**<br>38.7 m 127 ft | |
| **OBSERVED** Woollard & Rose Datum<br>**GRAVITY** 979,564.35 mGal | |

**LOCATION DESCRIPTION:**

At Oceanside High School, on the east corner of 1st and Horne Streets, on the curb next to a hydrant.

(Adapted from Chapman, R.H.,1966)

| GRAVITY BASE STATION # CH325 (USC&GS Z-1) | |
|---|---|
| NAME<br>Riverside Library | STATE<br>California |
| LATITUDE<br>33°58.96'N | LONGITUDE<br>117°22.28'W |
| ELEVATION<br>261.4 m 857.7 ft | |
| OBSERVED Woollard & Rose Datum<br>GRAVITY 979,548.18 mGal | |

LOCATION DESCRIPTION:

At the south entrance on the concrete balustrade of the Riverside County Library in Riverside. Reading on the disc about 3 ft above the ground.

(Adapted from Chapman, R.H.,1966)

| GRAVITY BASE STATION # CH326 (USC&GS Y-1) | |
|---|---|
| NAME<br>Riverside Court House | STATE<br>California |
| LATITUDE<br>33°58.79'N | LONGITUDE<br>117°22.45'W |
| ELEVATION<br>258.3 m 847.6 ft | |
| OBSERVED Woollard & Rose Datum<br>GRAVITY 979,548.81 mGal | |

LOCATION DESCRIPTION:

At Riverside on 10th Street at the County Court House, just below a copper bolt set in the center of a small projection in the north wall, 8 ft west of the edge of the steps leading to the basement. Reading on the sidewalk, 0.7 ft below bolt.

Adapted from Chapman, R.H.,1966)

| GRAVITY BASE STATION # CH327 (UCR Base) | |
|---|---|
| NAME<br>Riverside, UCR Base | STATE<br>California |
| LATITUDE<br>33°58.46'N | LONGITUDE<br>117°19.51'W |
| ELEVATION<br>326.8 m 1072.3 ft | |
| OBSERVED Woollard & Rose Datum<br>GRAVITY 979,532.14 mGal | |

LOCATION DESCRIPTION:

At Riverside at the University of California Physical Science Building, on a cross chiseled into the concrete in the balustrade adjacent to the steps leading to a southeast entrance.

(Adapted from Chapman, R.H.,1966)

| GRAVITY BASE STATION # CH328 (USC&GS K-71) | |
|---|---|
| NAME<br>Banning City Hall | STATE<br>California |
| LATITUDE<br>33°55.54'N | LONGITUDE<br>117°52.63'W |
| ELEVATION<br>715.4 m 2347 ft | |
| OBSERVED Woollard & Rose Datum<br>GRAVITY 979,404.16 mGal | |

LOCATION DESCRIPTION:

At Banning City Hall on Ramsey Street, between 1st and 2nd Streets, set in the south wall 17 ft west of the southeast corner. Reading on sidewalk, 2.1 ft below disc.

REPORTED DESTROYED 5/91

(Adapted from Chapman, R.H.,1966)

| GRAVITY BASE STATION # CH329(USC&GS N-753) | |
|---|---|
| NAME<br>Palm Springs | STATE<br>California |
| LATITUDE<br>33°39.40'N | LONGITUDE<br>116°30.56'W |
| ELEVATION<br>126.5 m 415 ft | |
| OBSERVED Woollard & Rose Datum<br>GRAVITY 979,523.14 mGal | |

**LOCATION DESCRIPTION:**

At Palm Springs Airport at the east end of Main Street, in the dividing strip midway between the two traffic lanes. Reading on the disc.

**REPORTED DESTROYED 5/91**

(Adapted from Chapman, R.H.,1966)

| GRAVITY BASE STATION # CH330(USC&GS H-588) | |
|---|---|
| NAME<br>Indio, Roosevelt HS | STATE<br>California |
| LATITUDE<br>33°42.88'N | LONGITUDE<br>116°13.10'W |
| ELEVATION<br>-4.6 m -15.0 ft | |
| OBSERVED Woollard & Rose Datum<br>GRAVITY 979,537.72 mGal | |

**LOCATION DESCRIPTION:**

At Roosevelt School in Indio on the southeast corner of Towne Avenue and State Highway 111. Reading over the disc which is in a hole in the sidewalk, 1.5 ft north of the fence and 12 ft east of the northeast corner of a block wall.

**REPORTED DESTROYED 5/91**

(Adapted from Chapman, R.H.,1966)

| GRAVITY BASE STATION # CH331(US -1019) | |
|---|---|
| NAME<br>Mecca Pendulum Station | STATE<br>California |
| LATITUDE<br>33°33.32'N | LONGITUDE<br>116°04.12'W |
| ELEVATION<br>-62.9 m -206.5 ft | |
| OBSERVED Woollard & Rose Datum<br>GRAVITY 979,551.22 mGal | |

**LOCATION DESCRIPTION:**

Approximately 1 mile south of Mecca, about 180 ft north of Avenue 68 and 60 ft east of northeast-southwest road which connects Avenue 68 with State Highway 111. A standard gravity disc stamped "Mecca 1939". Reading on ground beside disc.

Adapted from Chapman, R.H.,1966)

| GRAVITY BASE STATION # Borrego Springs JA (120G38) | |
|---|---|
| NAME<br>Borrego Springs | STATE<br>California |
| LATITUDE<br>33°15.4'N | LONGITUDE<br>116°19.5'W |
| ELEVATION<br>157.6 m 517 ft | |
| OBSERVED IGSN71 datum<br>GRAVITY 979,472.817 mGal | |

LOCATION DESCRIPTION:

Station is located at Rawhide Restaturant at Borrego Airfield 2.5 mi east of town of Borrego Springs, on cement porch on south side of building, the main entrance to restaurant 20 ft west of door, at far west corner of 3 ft high yellow brick planter.

(Adapted from Defense Mapping Agency, 1982)

| GRAVITY BASE STATION # Indio J (IGB: 12036K) | |
|---|---|
| NAME<br>Indio | STATE<br>California |
| LATITUDE<br>33°44.8'N | LONGITUDE<br>116°17.1'W |
| ELEVATION<br>20.7 m 67.9 ft | |
| OBSERVED IGSN71 datum<br>GRAVITY 979,556.074 mGal | |

LOCATION DESCRIPTION:

The station is about 4 miles northwest of Indio, north of the Jefferson Street interchange of Interstate Highway 10, at the Bermuda Dunes Airport. Observations were made at the east end of the airport, at the north side of the airport lounge-office, east of the north set of doors on the walkway.marked by a disc The station is at the north side of the center of the westernmost planters.

(Adapted from Defense Mapping Agency, 1982)

| GRAVITY BASE STATION # Palm Springs JA (12036 J) | |
|---|---|
| **NAME** Palm Springs | **STATE** California |
| **LATITUDE** 33°49.5'N | **LONGITUDE** 116°30.5'W |
| **ELEVATION** 136.6 m 448.2 ft | |
| **OBSERVED GRAVITY** IGSN71 datum 979,507.897 mGal | |

**LOCATION DESCRIPTION:**

The station is at the east edge of Palm Springs at the Palm Springs Airport at the Combs Gates General Aviation Terminal (210 North El Cielo Street). Observations were made at the airfield (east) side of the building, at the north side of the entrance vestibule, next to the wall on the tarmac (covered with black top)

(Adapted from Defense Mapping Agency, 1982)

| GRAVITY BASE STATION # Perris JA (120G31) | |
|---|---|
| NAME Perris | STATE California |
| LATITUDE 33°45.8'N | LONGITUDE 117°13.1'W |
| ELEVATION 431.3 m 1415 ft | |
| OBSERVED IGSN71 datum GRAVITY 979,494.941 mGal | |

**LOCATION DESCRIPTION:**

Station is located 1 mi south of town of Perris at the Perris airfield on a concrete step in the entrance to a storage room, at the north east corner of the brick restroom building, just south of the main office building. No mark.

(Adapted from Defense Mapping Agency, 1982)

| GRAVITY BASE STATION # Oceanside JA | |
|---|---|
| NAME Oceanside | STATE California |
| LATITUDE 33°13.0'N | LONGITUDE 117°21.1'W |
| ELEVATION 7.9 m 26 ft | |
| OBSERVED GRAVITY IGSN71 datum 979,559.752 mGal | |

LOCATION DESCRIPTION:

Station is located at the Oceanside Airport in the town of Oceanside on a concrete porch on the north side of the airport offices building, centered under an ATC telephone box, against wall. No mark.

(Adapted from Defense Mapping Agency, 1982)

# Appendix 4 INFORMATION ABOUT AVAILABLE DISKETTE

**PRINCIPAL FACTS FOR GRAVITY DATA COMPILED FOR THE SANTA ANA 1° BY 2° QUADRANGLE, CALIFORNIA**

**By**

**R.F. Sikora, V.E. Langenheim, Shawn Biehler, L.A. Beyer, and R.H. Chapman**

**Open-File Report 93-217-B**

Part B of this report is a 3.5-inch diskette, double-sided, high-density (1.44 MB), containing the data files in ASCII format.

Requirements for part B: *IBM PC* ® or compatible, *DOS* ® *v.2.0* or higher, with a 3.5-inch disk drive or a *Macintosh* ® with a *Super Drive* ® and *Apple File Exchange* ® software to convert from *PC* to *MAC*. On a PC the file should be read into and out of a text editor to align columns. On a Macintosh® some editing will be needed to align columns after converting from PC to MAC.

Files contained on diskette:

| File Name | Description of file | Number of stations |
|---|---|---|
| readme.ana | Description of diskette | |
| ucr.ana | University of California at Riverside | 5,077 |
| cdmg.ana | California Division of Mines and Geology | 533 |
| moyle.ana | Moyle and Downing | 479 |
| usgsland.ana | U.S. Geological Survey (land) | 384 |
| usgssea.ana | U.S. Geological Survey (offshore) | 261 |
| dma.ana | Defense Mapping Agency | 354 |
| hull.ana | Hull, A.G. | 197 |
| blanck.ana | Blanck Jr., E.L. | 162 |

*FORTRAN* format for data: (a8,f3.0,f4.2,f4.0,f4.2,f6.1,f7.2,a4,f6.2,f6.2, f5.2,a1,f5.2,f6.2)