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RESOURCE INVESTIGATION OF LOW- AND MODERATE-TEMPERATURE GEOTHERMAL AREAS IN PASO ROBLES, CALIFORNIA

Part of the Fourth Year Report, 1981-82, of the
U.S. Department of Energy-California State-Coupled Program
for
Reservoir Assessment and Confirmation

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EXECUTIVE SUMMARY

This report presents the results of the California Division of Mines and Geology's (CDMG) geothermal resource investigation of the Paso Robles area, California. The study was undertaken to learn more about the known geothermal resource in this area and to assess the potential of the resource for development and use by the local community. The project was conducted in compliance with the terms of the fourth-year contract (1981-82) with the U.S. Department of Energy (DOE) under the state-coupled program and performed under CDMG's Phase II site-specific geothermal resources studies program.

The presence of surficially discharging warm springs in the Paso Robles area was noted as far back as the early 1800's. The present study revealed the existence of a large warm water aquifer at the base of the Paso Robles Formation and delineated the broad areal distribution of this aquifer south and eastward from the City of Paso Robles. The maximum water temperature recorded in the study area was 47.8°C (118°F); however, geothermometry calculations indicate that a maximum temperature for the reservoir water may be on the order of 102° - 116°C (216° - 240°F). Thus, allowing for mixing of waters within the reservoir, it appears that thermal waters in the 38°C (100 F) range with flows of 17,468 liters/minute (4,615 gallon/minute) may be accessible at depths of 305 meters (1000 feet) or less over a 109 square kilometers (42 square mile) area.

The geology, geophysical data, and oil-well drilling logs reflect the pre-Tertiary basement complex and the structural trends of the overlying Tertiary sedimentary rocks. The resulting cross sections indicate a deep, eastward-plunging synclinal basin with sediments onlapping against basement highs on the west. Thus, depth to the geothermal resource varies from shallow, flowing springs in the Paso Robles area to depths in excess of 457 meters (1500 feet) in the eastern part of the study area.

The areal occurrence of complex rock types and the phenomenon of mixing of thermal waters with overlying cool water aquifers resulted in water chemistry data that was inconclusive for delineating the thermal source. However, the elevated boron concentrations and the relatively uniform fluid temperature of the reservoir suggest that highly permeable formations at the base of the Paso Robles Formation are acting as transporting aquifers for meteoric waters that have undergone deep circulation, with resultant heating, and are upwelling along faults.

This study has delineated a large-volume, relatively shallow, low-temperature geothermal resource in the Paso Robles area. Utilization of this resource appears to be feasible for a wide variety of direct uses at this time.

Recommended further work: A deep exploration well should be drilled adjacent to the Rinconada fault to see if this fault is a source for the thermal waters and if higher temperatures can be produced from below the mixing zone.

ABSTRACT

The California Division of Mines and Geology (CDMG) selected the Paso Robles area for detailed geothermal resource investigation because the area was known to contain potential geothermal resource sites and a population large enough to benefit from the use of a low- or moderate-temperature geothermal energy source. Also, the City of Paso Robles had expressed serious interest in developing the area's geothermal resource. The main known thermal areas are located in the City of Paso Robles and to the southeast of town.

Ninety-eight geothermal wells and springs were identified and plotted, and a geologic map and cross sections were compiled. Detailed geophysical, geochemical, and geological surveys were conducted.

The geological and geophysical work delineated the basement highs and trough-like depressions that can exercise control on the occurrence of the thermal waters. The Rinconada fault was also evident. Cross sections drawn from oil well logs show the sediments conforming against these basement highs and filling the depressions. It is along the locations where the sediments meet the basement highs that three natural warm springs in the area occur.

Deep circulation of meteoric waters along faults seems to be a reasonable source for the warm water. The Santa Margarita, Pancho Rico, and Paso Robles Formations would be the first permeable zones that abut the faults through which water could enter. Temperatures and interpretation of well logs indicate the warmest aquifer at the base of the Paso Robles Formation. Warm water may be entering higher up in the section, but mixing with water from cooler zones seems to be evident. Geothermometry indicates reservoir temperatures could be as high as 91°C (196°F).

INTRODUCTION

This report presents the results of the California Division of Mines and Geology's (CDMG) geothermal resource investigation of the Paso Robles area, California. The project was conducted in compliance with the terms of the fourth-year contract (1981-82) with the U.S. Department of Energy (DOE) under the state-coupled program. The investigation was performed under CDMG's Phase II site-specific geothermal resources studies program. Phase II type studies involve the generation of new data and evaluation and interpretation of the data to make quantitative and qualitative statements about the resource potential of a given geothermal reservoir.

The purpose of this study is to provide insight into the properties of the geothermal resources at Paso Robles. Areal extent, depth, maximum temperature, volume, and water quality are properties that must be ascertained before effective and economical development of a low- or moderate-temperature geothermal resource is undertaken. This report outlines the steps taken to determine these properties and presents results, conclusions, and recommendations obtained from the study. Included are a new study of the historical development of the resource, detailed and regional geology investigations, geophysical surveys, regional seismicity study, geothermometry calculations, and results of geochemical sampling and temperature measuring of geothermal wells and springs in the area. Down-hole geothermal well data are included in the appendixes of this report. At the end of the report is a list of references. The reference list should prove useful for finding further geotechnical information about the area.

This report presents new material as well as a compilation of previously performed studies singularly assembled for the purpose of investigating the geothermal resources of the Paso Robles area. The report should be useful in a number of ways: data presented and conclusions drawn from the data provide a direct insight into the physical and geochemical character of the geothermal resources of Paso Robles. The geothermal data can be analyzed in different ways by other geothermal resource investigators—for example, in geothermal marketing studies.

This report is the first comprehensive, detailed geothermal study of the Paso Robles area. Subseqent studies will undoubtedly provide additional data that will call for refinement or revision of the understanding of the resources provided in this report.

HISTORICAL USE OF THE GEOTHERMAL RESOURCE

Introduction

One of the major and least expensive elements of a geothermal resource area evaluation program should be the researching and compiling of the historic development of that resource. This is an especially applicable exploration technique of low- and moderate-temperature geothermal resource areas of California.

Most often, in the past, California's warm or hot springs were developed as resort spas or tuberculosis sanitariums where guests arrived for relaxation and to take "the treatments". Much literature has survived from that era advertising and extolling the chemical and physical properties of various hot springs. A search of such material and other information can yield valuable clues to the past character of a particular geothermal area. Areal extent of the resource, changes in flow rates over the years, changes in water quality, changes in temperature, and changes in hot water table elevations can often be discerned from the historical record of a geothermal area.

THE GEOTHERMAL RESOURCE

The warm springs of Paso Robles have long been a traveler's layover. Situated on the major north-south coastal route, Indians of the Salinan and Chumash tribes, as well as missionaries, crossed this location often. The gently rolling hills, the Salinas Valley, the shade trees, and the "healing waters" made it a natural camp. Even the grizzly bears, previous monarchs of the valley, sought the pleasures of a bath. According to Angel (1883), "There was formerly a large cottonwood tree growing on the bank of the springs with a limb extending low over the water. A huge grizzly was in the habit of making nocturnal visits to the spring, plunging into the pool, and with his forepaws, grasping the limb, swinging himself up-and-down in the water, evidently enjoying both his swing and the pleasant sensation of his dips in the warm water with unspeakable delight."

In 1797, Franciscan padres built Mission San Miguel near the springs to take advantage of the waters curative powers. They constructed a crude abutment of logs around the edge of the main spring and an aqueduct that brought the water to the mission. Later, the main spring became the center of the town of Paso Robles. With the demise of the Mission, the Mexican government granted the original 10,519 hectare (25,993 acres) of the Rancho de Paso Robles (Ranch of the Pass of the Oaks) to Pedro Narvaez in 1844. In 1857, with the decaying logs of the padres still at the spring, the Blackburn brothers and partner purchased the rancho for $8,000. A rough bathhouse was built over the main sulphur spring, a stagecoach station was established, and a small hotel was built to accommodate occasional travelers. By 1870, Walter Murray wrote, "Here, there is never less than 50 persons... These springs are much celebrated for their medicinal qualities and are justly famous for the cures they have wrought... Invalids have come thither for relief from very distant parts, as Oregon and the eastern states."

As the population grew, so did the facilities. In 1883, the main sulphur spring flowed into an 2.4 meters (8 foot) square reservoir that fed a long double row of bathrooms. It was reported to be flowing at a rate of 284 liters/minute (75 gpm) with a temperature of 43°C (110°F). There were two dining rooms, one for first-class, the other for second-class guests; a store, a billiard saloon, express, telegraph, and post offices, a reading room, barber shop, and a physician's home and office (Figure 2).

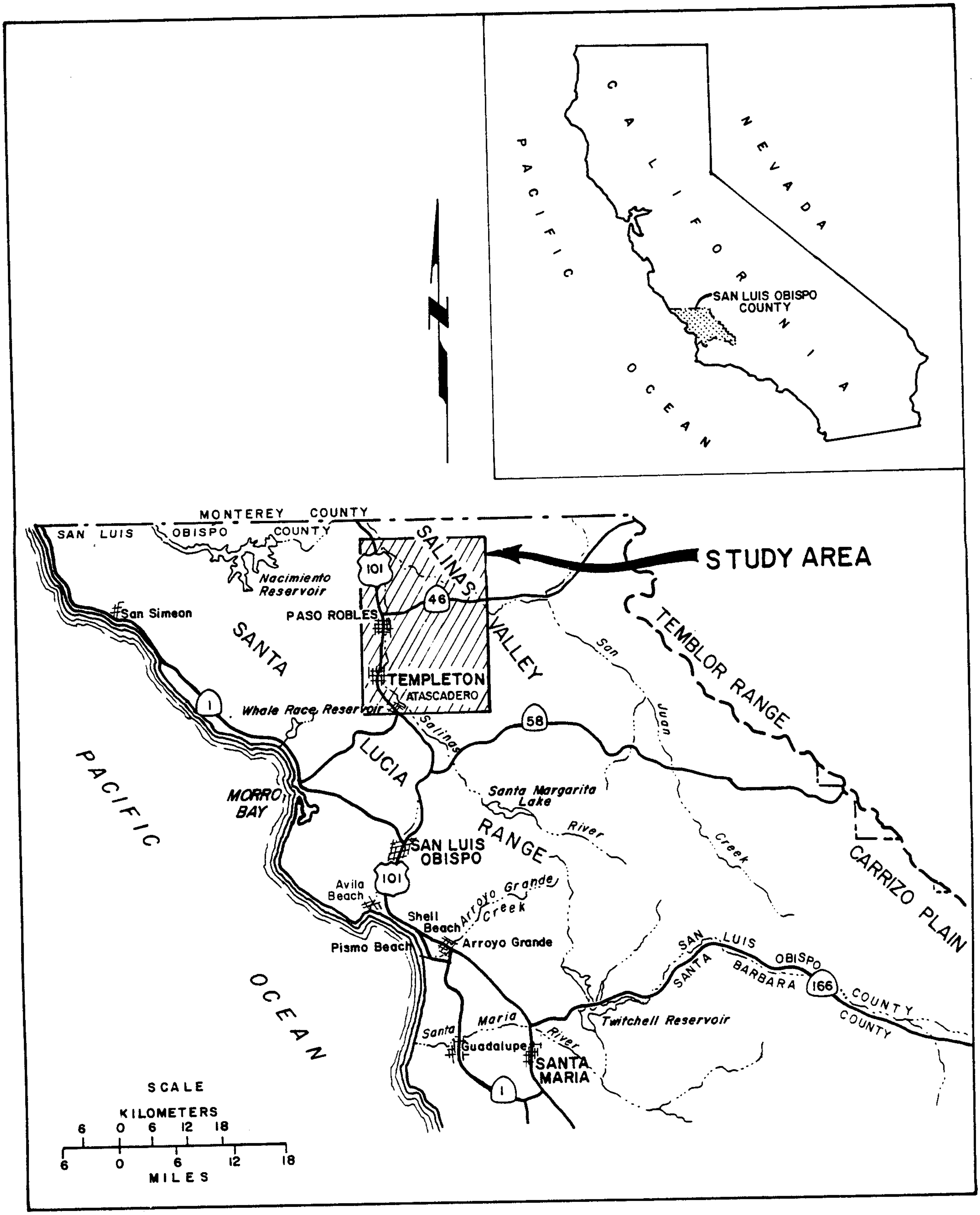
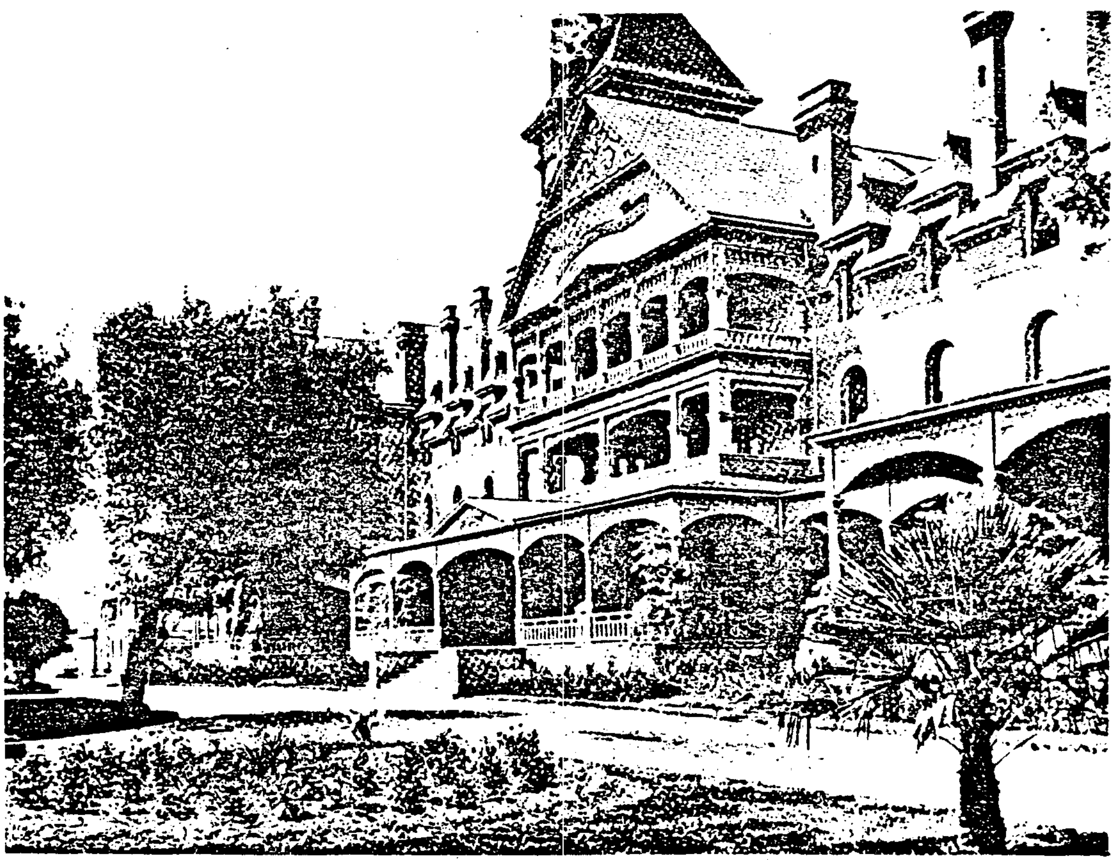


Figure 1. Location of study area

EL PASO DE ROBLES HOTEL as depicted by Angel in 1883. Hotel can be seen in center of sketch. The bathhouse is located at lower right. Cabins for first class guests appear in a long line at the back of the hotel. Notice the invalid in wheel chair near the bathhouse, a typical guest at the spa.



Construction of the grand new hotel, El Paso de Robles, started in 1889 and it was opened for business in 1891. It was designed by the famous architect, Stanford White. Bricks in present day inn were recovered from this building when it burned in 1941.

Figure 2. El Paso De Robles Hotel in 1883 and 1891

The Paso Robles area contained two main springs: the main sulphur spring that was described above with lesser springs close by, and what has been called the mudbath springs approximately 4 km (2.5 miles) north, which also had several other active springs. The second area was also developed as part of the resort complex. The house which covers the mudbath spring was divided through the center by a raised platform. One side was a "plunge bath of tepid gas and sulphur impregnated water, the other is the famous mud bath." The mud was taken from the bogs, dried, screened, and put into the vat which was 2 meters (6 feet) deep and 2.4 meters (8 feet) square. "From the bottom" of the vats "springs the water". Historical accounts at this time put the collective flow of these springs at 374 liters/minute (100 gpm) with temperatures of 50°C (122°F) in one and 60°C (140°F) in the other. Sand spring was located .8 kilometer (.5 mile) south of the Mud Bath in the "old course of the river." It was said to be at 63°C (148°F). "It has a very heavy flow of water highly charged with sulphur and soda and wells up through a bed of micaceous quicksand that is deep as the bottomless pit, so far as is known. The pressure of the water is so great in forcing its way upward that a person will not sink by gravitation to any depth; on the contrary it requires considerable exertion to force the body downward" (Angel, 1883). Another warm spring, about 61 meters (200 feet) north of the mud spring, was a soda spring with a temperature of 25°C (77°F) flowing at 15 liters/minute (4 gpm). At one time, this spring was bottled, artificially carbonated, and sold at the hotel by the Paso Robles Bottling Company.

The settlement of Hot Springs grew rapidly; in 1886, the Southern Pacific Railroad passed the hotel, and in 1889, the City of Paso Robles was incorporated. That same year, the Blackburns began construction of the Hotel El Paso de Robles near the main sulphur spring. Historical accounts of temperature become more consistent by this year and more in line with what is observed today. The main sulphur spring temperature was now 42°C (108°F). It is possible the temperature of the resources has decreased, but it is also possible that temperatures were exaggerated to promote a developing resort. With the anticipated success of the new hotel, the Sulphur Bathhouse Company was established in 1891. A well was sunk to 130 meters (427 feet), a temperature of 42°C (108°F) was encountered, and a rival bathhouse was opened. It was so popular that bonds were voted, and the Sulphur Bathhouse Company became the Municipal Bathhouse. Today, the well is abandoned, and the building is used as office space. The new hotel "the parlors being equal to those in the first hotels of San Francisco", opened in 1892 (Figure 2). It was destroyed by fire in 1940 and rebuilt in 1942 with the original brick. The wells are now abandoned.

Around the turn of the century, Waring observed a few of the springs drying up in the downtown area. Today, there are no natural springs downtown, and a few have disappeared near the mudbath springs. This may be due to a drop in the water table caused by use by the growing population and irrigation or changes in the thermal activity. St. Ysabel Spring (Figure 3), southeast of town, was never developed and is located in a farming area. It still is running at approximately 568 liters/minute (150 gpm) at 34°C (94°F).

The popularity of the spas waned, and many of the wells were abandoned to prevent sulphur and saline waters from entering the Salinas River. But there is much renewed interest. The old mudbath had been deserted and fallen into disrepair in past years but now has been reopened as the Paso Robles Hot Springs. The 464.5 square meter (5000 sq. feet) building is heated by the geothermal water by pipes running through the floor. During renovation, the original plunge baths were uncovered and restored.

The City of Paso Robles is looking into the possibility of utilizing geothermal energy to heat the city pool and to assist in running the sewage digester at the city water treatment facility.

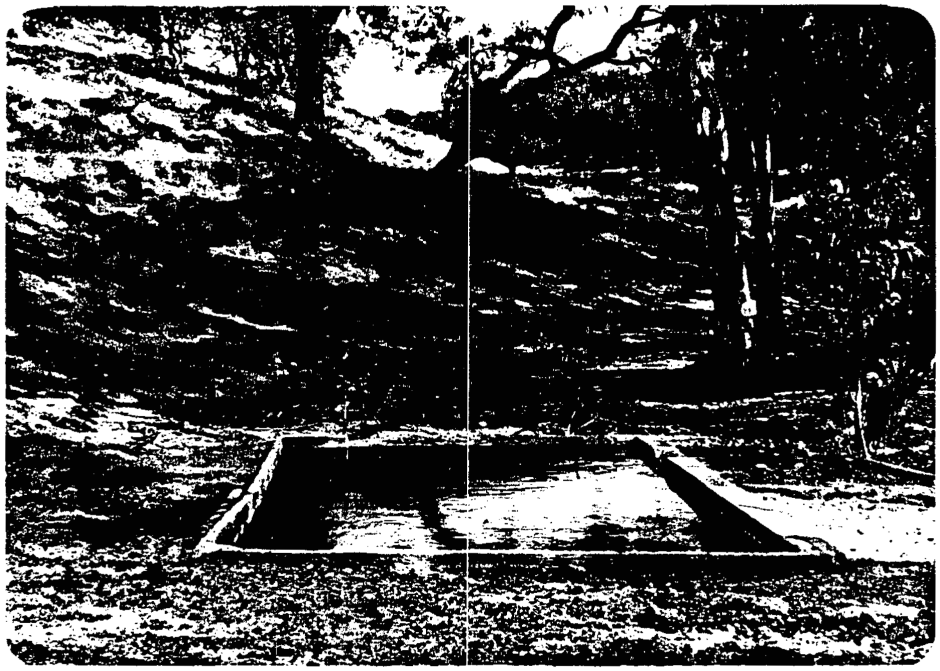


Figure 3. St. Ysabel Spring (photo by Gordon W. Chase)

GENERAL GEOLOGY

Introduction

The geological formations within or near the Paso Robles Geothermal Project area have been studied and mapped by Kilkenny (1948), Durham (1974), Dibble (1976), and the California Department of Water Resources (1981). This study was limited to providing insight into structural and lithologic controls of geothermal waters in the project area. Thus, the description of the geology contained within this report has, for the most part, been abstracted from previously published works.

GEOLOGY

The geology of Paso Robles, like that of the rest of California, cannot be separated from the crustal movement of plate tectonics. The northwest-trending Rinconada and the Sur-Nacimiento fault zones separate terranes with different basement complexes (Figure 4).

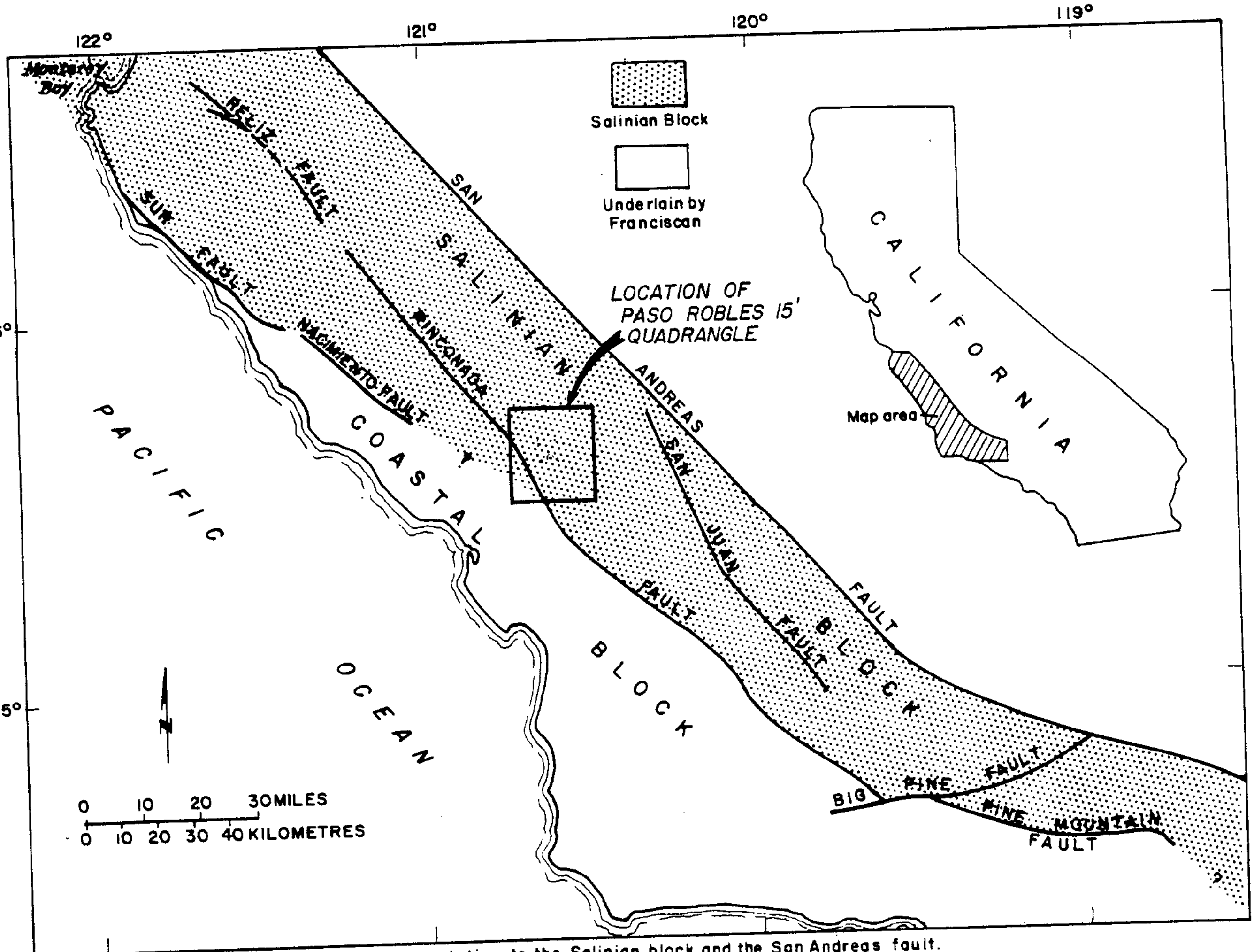
The terrane on the northeast is part of the Salinian block and has the San Andreas fault as its boundary to the east. The basement complex of plutonic and metamorphic rocks in this block are commonly composed of granodiorite, quartz monzonite, and granite. Metamorphic rocks that occur in the Salinian basement are often intruded by igneous rocks, which, on the basis of potassium-argon dating, give Cretaceous age dates. The basement complex is overlain unconformably by a thick marine and terrestrial sedimentary sequence.

In contrast, the terrane on the southwest is part of the coastal block and composed of the noncrystalline eugeosynclinal Franciscan Complex. The majority of the rocks are melange-related and consist of greenstone, graywacke, and serpentinite, dated from Late Jurassic to Early-Late Cretaceous. In some locations, the Franciscan Complex is overlain depositionally or tectonically by Cretaceous and Late Jurassic age sediments.

The coastal and Salinian blocks were positioned side-by-side along the Rinconada and Sur-Nacimiento fault zones probably during Late Cretaceous or Early Tertiary time. The slight lateral strike-slip movement along the Rinconada fault is suggested by the numerous severely compressed drag folds in the sedimentary rocks and the consistent east-west trend of their axes as compared to the northwest trend of the fault. This movement is also evident by displaced stratigraphic units. Those of Late Miocene and Early Pliocene age are separated by as much as 18 km (11 miles) near Paso Robles, and those of Late Cretaceous and Early Tertiary age are separated by nearly 60 km (40 miles).

During Late Cenozoic time, the rigid crystalline basement of the Salinian block reacted to stress and formed a series of high and interconnected trough-like depressions. The granitic high north of Paso Robles may be an extension of one of those highs (the La Panza high) located just south of the study area. The structural features of the sedimentary rocks in the study area appear to be closely related to the relief of the Salinian basement complex.

An unnamed Cretaceous formation occurs only on the coastal block; this unnamed formation consists of conglomerate, sandstone, siltstone, and mudstone. Composition of the clasts indicate the material came from the Salinian basement complex rather than from the Franciscan Complex. Biotite flakes are abundant in much of the sandstone which helps distinguish it from other sandstone units. Fossils demonstrate the marine origin of at least part of the unit while red beds indicate a nonmarine aspect.



Positions of the Rinconada and Reliz faults relative to the Salinian block and the San Andreas fault. After Dibblee (1976)

Figure 4. Positions of the Rinconada and Reliz Faults relative to the Salinian Block

Wells have failed to reach the base of the unit, but geophysical data indicate that it overlies, or is in fault contact with, Franciscan rocks. Flowing sulphur water was encountered in the "Peterson" 1 well at the contact between this formation and the overlying Monterey Formation. There was no mention of the temperature in the well record.

During Miocene time, the sea encroached to a large extent all through the study area, inundating the basement so that siliceous mud containing organic materials accumulated at shallow depths and, near areas of higher relief, sands were also deposited.

The Vaqueros Formation unconformably overlies the Salinian basement and consists mostly of sandstone with some mudstone and conglomerate. Calcite cementing is common. Oil wells that have been drilled into the Vaqueros find oil but cannot be made to produce because of lack of permeability. A tight formation would also be exclusive to thermal fluids.

The Miocene Monterey Formation conformably overlies the Vaqueros and is the most widespread marine unit in the region. The Monterey consists of two members in the Paso Robles area: the Sandholdt (lower), and the Hames (upper). Wells indicate the Monterey is up to 750 meters (2,460 feet) thick in the study area. The Sandholdt Member is composed of calcareous mudstone, shale, and some chert. Stratigraphically above the Sandholdt is the Hames Member, which consists of fine-grained porcelaneous rocks, siliceous mudstone, chert, and rare sands. Flows of basalt within the Monterey can be found a few kilometers west of Paso Robles.

The upper Miocene Santa Margarita Formation conformably overlies and is intertongued with the Hames Member of the Monterey Formation. It is silty, fine-grained and lenticular in nature. Light-gray and white in color, this quartzitic marine sandstone is fairly hard and resistant to erosion. Vitric tuff beds crop out at and near the base south of the study area. Fossils are common and some beds are composed almost entirely of fragments of mollusks, echinoids, and barnacles.

The upper Tertiary sedimentary sequence has been interpreted by various authors due to the lack of adequate geologic mapping and the difficulty in distinguishing beds belonging to this sequence in well logs. On the east side of the Salinas Valley, the sequence is called the Pancho Rico Formation by Reed (1925, p. 591, 606), Clark (1929), and Durham and Addicott (1962, p. A2). Other investigators recognize two distinctive lithologic units: a lower mudstone unit, and an upper sandstone unit. The units are included in several combinations by various individuals with the Monterey, Santa Margarita, and Pancho Rico Formations with the latter being the most common for both units. The mudstone is chalky diatomaceous and fine-grained with a creamy-white color. The sandstone unit is fossiliferous, yellowish-gray in color, and permeable as encountered in three wells drilled through it. North of the study area, where it is exposed, the sandstone unit thins to less 61 m (200 feet) and overlaps the Monterey Formation. The sandstone unit is gradational into both the lower clay unit and the overlying Paso Robles Formation near the Rinconada Fault.

The Paso Robles Formation consists of continental sediments that accumulated after the retreat of the Tertiary sea, an event associated with Late Pliocene uplifting of the Coast Ranges by folding and thrusting. Sub-aerial deposition of stream and lake deposits have left widespread outcrops that consist of sandstone and conglomerate mudstone and limestone. Bedded gypsum and lignite are also present in places. Depositional features include crude bedding, poor sorting, and channel structures, all of which are typical of nonmarine, fluviatile deposition in valleys and basins. Calcareous induration is common, but the friable, easily weathered nature of the formation prevents development of resistant outcrops, and one must look at road cuts and stream banks for exposures. The discontinuous nature of members in this formation accounts for the difficulty in correlating beds over any distance. The source rocks for the Paso Robles Formation consisted of the uplifted marine Miocene formations, such as the Monterey and Santa Margarita, as well as debris from the nearby Franciscan or granitic basement. Fossils are rare except where it grades into the upper Tertiary (Pancho Rico) sandstone unit. North of the study area, the lower part of the Paso Robles intertongues with the sandstone unit which contains mollusks of Early Pliocene age. The occurrence of mollusks at the base of the Paso Robles in the subsurface near Atascadero suggests the same relationship.

Well logs in the study area also show a permeable zone that is recognizable across the area at the base of the Paso Robles. In the cross sections (Plate 8), this zone is indicated by a cross hatch symbol.

The only material in the region younger than the Paso Robles is Quaternary alluvium, which consists of unconsolidated gravel, sand, and silt. Found mainly in present river valleys, the alluvium is poorly sorted, massive to crudely bedded, and contains channel structures and cross-stratification. Originating along the upper portions of the present-day stream, it is usually less than 9 meters (29 feet) thick but occurs in thicknesses of up to 40 meters (131 feet) near the Salinas River.

STRUCTURE

The high angle Rinconada fault (Dibblee, 1976) trends northwest to southeast (Plate 1). The relative displacement of this fault has brought granitic rocks of the basement complex on the northeast side in contact with Tertiary sediments on the southwest side. Further southeast along the fault, Miocene sediments are in contact with the Paso Robles Formation. South of Paso Robles, the fault crosses the Salinas River and is concealed by old and young alluvium. It continues further southeast in the Paso Robles Formation. Water levels in the young and old alluvium indicate no discontinuity in the flow of ground water where the fault crosses the Salinas River, but the fault may have an effect on ground water occurrence at depth. Water levels on the west side tend to be slightly higher than on the east.

The San Marcos fault has been defined in an area between Paso Robles and San Marcos Creek (Plate 1). The fault trace is parallel to the Rinconada fault and is defined mainly in middle Tertiary sediments and possibly cuts the Paso Robles Formation. South of Paso Robles, the fault is not well-defined because it is concealed by the Paso Robles Formation and old and young alluvium, and it lacks good surface exposure to show its southeast trend. Water levels indicate that this fault has no influence on the ground water flow in young and old alluvium.

A proposed fault occurs near Paso Robles and joins the Rinconada fault south of the city (Plate 1). This proposed fault segment, which trends north, is not apparent on the surface possibly because of concealment by old alluvium. It was proposed because of the warm springs in the area, but there may be other explanations for the spring occurrences. Gravity and magnetic data (Plates 5 and 6), combined with well log data (Plate 3), indicate basement to be high near the springs with the sediments lapping out on these highs. The warm springs appear to occur where a sandy aquifer (Pancho Rico Formation?) pinches out, and the base of the Paso Robles Formation terminates against the basement highs (Plate 8). This holds true for the historical springs in Paso Robles and the St. Ysabel Spring to the southeast of town.

The Miocene sediments are folded extensively, but progressing up section, the sediments have been subjected to less-and-less structural deformation. Where the Paso Robles Formation has been deformed, the strata form very gentle folds or are slightly tilted.

SEISMICITY OF THE PASO ROBLES 15-MINUTE QUADRANGLE

A high rate of seismicity is often observed in association with geothermal resource areas. The record of seismicity commonly is utilized as an exploration tool as well as a diagnostic tool for geothermal resource investigations. The distribution of earthquake epicenters (especially microearthquakes) in space and time has been a primary tool for geothermal exploration. Monitoring the character and velocity changes of seismic waves generated by earthquakes (and other energy sources) provides an accurate determination of a variety of diagnostic wave propagation properties of rocks in geothermal resource areas. It is noteworthy that the study of earthquakes in the Paso Robles area did not yield any important clues to the nature and/or character of the geothermal reservoir.

In all, only 17 seismic events have been recorded in the Paso Robles study area from 1800-1974, and there are no apparent relationships between seismic events and geothermal occurrence. The following table is a reproduction of the computer listing of all the earthquakes included in the study area. Table 1 provides earthquake data on location, time, depth, magnitude, etc. A magnitude (MAG) 9.99 means that no data were available to determine the actual magnitude of the event.

The California Division of Mines and Geology Earthquake Catalog of California has been compiled from a great many sources of information. The primary source of data in the region since 1910 is the University of California, Berkeley. Three other sources are also referenced in Table 2.

Only events equal to or greater than magnitude 4.0 or intensity V are accounted for during the period 1800-1931 primarily because of the lack of uniformity in reporting earthquakes and because the modern-day accuracy and methodology of seismographic instrumentation and interpretation were not available until 1932, when statewide seismograhic coverage was established. Thereafter, data have been continuously measured and tabulated.

Quality (QUAL) ratings presented in the Earthquake Catalog of California are somewhat arbitrary and are not directly comparable from one source to another. The following key explains the criteria that the California Institute of Technology uses to assign hypocenter quality judgments. Also, the codes accompanying the magnitude (MAG) and intensity (INT) values in the table are explained.

Key to Record Parameter Codes

I. Quality of Hypocenter (QUAL) as used by Cal Tech (Ref 2)
   - A. - Epicenter specially investigated
   - B. - Epicenter probably within 5 km (3 miles) origin time to nearest second
   - C. - Epicenter probably within 15 km (9.3 miles) origin time to a few seconds
   - D. - Epicenter not known with 15 km (9.3 miles) rough location

II. Type of Magnitude (MAG)
   - A. - Local Richter
   - B. - Surface wave
   - C. - Body wave
   - D. - Local estimated from intensity
   - E. - Local estimated from duration

III. Type of Intensity (INT)
   - A. - No intensity given but felt
   - B. - Rossi-Forel
   - C. - Modified Mercalli

TABLE 1

EARTHQUAKES FROM 1800-1974 IN THE PASO ROBLES 15 MINUTE QUADRANGLE

CALIFORNIA DIVISION OF MINES AND GEOLOGY
EARTHQUAKE CATALOG SYSTEM

PROGRAM RETRIEVE
VER. CON109H-12▪

DATE: 05/25/82
REQUEST: 1-A
PAGE: 5

DATA RETRIEVAL REQUEST FOR: PASO ROBLES 15MIN QUAD SEISMICITY

	ID NO.	LATITUDE	LONGITUDE	DATE	TIME	DEPTH	QUAL	REF	MAG	REF	INT	REF	ID NO.
	2500142	35.500	120.500	6/ 4/1953	11 40 0.0	0.0	D	1	9.99	1	5C	006	2500142
*	2500145	35.500	120.500	9/ 3/1953	11 0 0.0	0.0	D	1	9.99	1	0A	006	2500145
*	2500804	35.500	120.600	1/ 1/1830	0 0 0.0	0.0		008	9.99		6C	008	2500804
	2500161	35.500	120.650	1/ 1/1957	9 25 0.0	0.0	D	1	9.99	1	0A	006	2500161
*	2500162	35.500	120.650	2/ 9/1957	8 10 0.0	0.0	D	1	9.99	1	4C	006	2500162
*	2500021	35.500	120.670	4/21/1932	3 36 20.0	0.0	D	1	3.00	1	0A	006	2500021
*	2500754	35.502	120.553	8/30/1973	19 12 46.4	6.5	D	9	1.53	009	0		2500754
	2500095	35.650	120.650	5/ 3/1939	12 39 0.0	0.0	D	1	9.99	1	0A	006	2500095
	2500137	35.650	120.650	12/ 6/1952	23 50 0.0	0.0	D	1	9.99	1	4C	006	2500137
	2500092	35.650	120.650	2/ 5/1939	3 30 0.0	0.0	D	1	9.99	1	0A	006	2500092
	2500106	35.650	120.650	9/13/1943	12 40 0.0	0.0	D	1	9.99	1	0A	006	2500106
*	2500165	35.650	120.650	1/18/1958	8 12 0.0	0.0	D	1	9.99	1	0A	006	2500165
*	2500002	35.670	120.670	9/ 8/1915	12 45 0.0	0.0		1	9.99A		5B	004	2500002
	2500134	35.700	120.500	3/ 9/1952	17 14 12.0	0.0	D	2	3.20	002	0		2500134
*	2500133	35.700	120.500	3/ 9/1952	0 25 48.0	0.0	D	2	3.40	002	0		2500133
*	2500180	35.720	120.540	1/26/1965	8 36 30.7	0.0		1	3.00	1	0		2500180
*	2500024	35.750	120.750	10/24/1932	4 45 0.0	0.0	D	1	9.99	1	0A	006	2500024

The Earthquake Catalog of California 1800 - 1974 - Magnetic Tape, on either 7- or 9-track tape, can be obtained by mail or in person from California Division of Mines and Geology, Sacramento District Office 2815 "O" Street, Sacramento, CA 95816. It costs $45.00 (plus 6% tax for California orders) prepaid for U.S. orders, and $80.00 prepaid for foreign orders.

TABLE 2

REFERENCES OF THE

CALIFORNIA DIVISION OF MINES AND GEOLOGY EARTHQUAKE CATALOG

NUMBER	
1	University of California, Berkeley (1976). Magnetic tape catalog of earthquakes in northern California, 1910-1974.
2	California Institute of Technology (1976). Magnetic tape catalog of earthquakes in southern California, 1932-1975.
9	U.S. Geological Survey (1976). Magnetic tape catalog of earthquakes in west-central California, 1969-1973.
008	Toppozada, T.R., Real, C.R., and Parke, D.L., 1981, Preparations of Isoseismal Maps and Summaries of Reported Effects for Pre-1900 California Earthquakes: California Division of Mines and Geology, OFR81-11SAC, 182 p.

HYDROLOGY

The study area is part of the Salinas River drainage basin. On the northeast, the drainage divide is formed by the Diablo and Temblor Ranges. The southeast border is the drainage divide west of the Carrizo Plain. The La Panza Range is the boundary to the south, with the western boundary being the San Lucia Range.

In the Paso Robles area, the mountainous terrain consists of consolidated older rocks which are not considered to be good water producers, although they will yield small amounts of lower quality water from fractures. The main water-bearing formation is the Paso Robles, with a small amount being produced from alluvium.

The basin receives its water in several manners. In some areas, mainly to the west and south, the Paso Robles Formation has been exposed by folding and subsequent erosion. This allows direct penetration into the sand and gravel members of the formation making rainfall a source of recharge to the aquifer. The basin also receives recharge from the downward perculation of water in stream channels during storm runoff and rainfall infiltration through the soil. Irrigation adds a small amount to the system. The direction of ground water flow is the same as surface drainage, from the periphery of the basin to the Salinas River.

The Paso Robles Formation represents products of erosion of upland areas, alluvial fans, flood plains, and lake deposits. The lenticular nature, gravel and clay beds range from less than 1 to as much as 7 meters (3 to 25 feet) thick and can pinch out in less than 100m (328 feet), makes individual aquifers impossible to identify over a large area.

Permeabilities range from 4,130 (1,091 gal) to 44,570 (11,774 gal) liters per day per square meter, and water levels vary from .46 m (1.5 feet) to 367 m (1,200 feet) or deeper. The thickness of the reservoir itself varies. South of San Miguel and southeast of Paso Robles, the basin becomes shallower. Here, the sediments, nonmarine and marine, lap against the bedrock highs. It is interesting to note that these are the general areas of the main geothermal resources (Plate 8). An average thickness of the Paso Robles Formation is approximately 400 meters (1,250 feet), and in the northeast portion of the study area, it becomes over 1,200 meters (4,000 feet) thick. Production in the basin is mostly from unconfined aquifers, but, as far as it is known, the artesian wells that do exist are warm; however, not all warm wells are artesian.

GEOCHEMISTRY

Introduction

Geochemical analyses of fluids from a geothermal resource provide a means for determining many diagnostic properties of the reservoir. The chemical composition of thermal waters provides the only indirect means of quantitatively estimating geothermal reservoir temperature. Analyses of mineral segregation in thermal fluids may indicate structural features or barriers within a geothermal reservoir. Geochemistry may also be able to provide some clues to the type of thermal system being investigated including such parameters as heat source, path of fluids, etc.

California Department of Water Resources provided most of the geochemical analyses for this report. Other analyses were provided by well owners, California Division of Oil and Gas, and California Division of Mines and Geology. The individual analyses are grouped in Appendix A at the end of this report. Sample locations are plotted on Plate 4.

Discussion

The warm water resource of the Paso Robles area is distinguishable from the local cold ground water to a certain extent by its chemistry. In the study area, with the exception of some of the warm wells, the poorest quality ground water is still acceptable for both domestic and agricultural use. One distinguishing characteristic of the warm water resource of the Paso Robles area is the salinity of the water. The Regional Water Quality Control Board ordered the abandonment of many unused flowing wells because some of the outflow was finding its way into the sewage treatment facility and ultimately contaminating the Salinas River.

The California Department of Water Resources (1977) grouped the Paso Robles springs with other waters of "poor quality", citing high concentrations of fluoride, boron, sodium, and chloride, as well as high total-dissolved-solids (TDS) content.

Sulfur has been mentioned as a warm water phenomenon, but there are also cold wells that contain sulfur in the area. In the Paso Robles basin, there are several potential sources that may contribute to the sulfur problem. The gypsum ($CaSO_4 \cdot 2H_2O$) and anhydrite ($CaSO_4$) contained in the Paso Robles Formation, because of their relatively high solubility, could readily enter the groundwater system. The Monterey Formation is also known for poor water quality with one of the common contaminents being sulfur; the sulfur probably results from the decomposition of formational organic matter.

Another sulfur source is the blue clayey sediments reported in water well drillers' logs. Found at various depths throughout the basin, these sediments contain organic matter which, under anaerobic conditions and bacterial activity, produce hydrogen sulfide (H_2S). H_2S odor commonly occurs in wells penetrating the blue clayey sediments. Because the rate of bacterial action increases with a rise in temperature, it has been observed that wells producing water of high temperature generally have a high H_2S odor. Some wells that pentrate blue clayey sediments produce sulfurous water of low temperature and/or have no H_2S odor.

In the Paso Robles area boron in some wells exceeds 10 ppm. The high boron concentrations detected in the springs may be entering the system from two points. Boron is commonly associated with water movement along faults and also could be derived from marine sediments, both of which occur in the study area.

Most of the geochemical samples were taken from wells drilled specifically for water. Since the wane of warm spring spas, when warm water was encountered in drilling, the hole was backfilled in an attempt to seal off the thermal waters; therefore, a mixing problem exists in these wells. Geochemical samples from these wells will be contaminated by waters from fresh water aquifers. This could be an explanation for the differences in the geochemistry of the warm wells. Thermal wells that have penetrated through thicker sedimentary sections possessing cool water zones have mineral concentrations similar to cold water wells in the basin. Those wells and springs that penetrate through thin overburden cover exceed the standards set by the California Department of Health Services.

Conclusions

As shown above, the geochemistry of the Paso Robles area is influenced by several factors. Because of the many rock types that could influence the geochemistry of the water and the mixing problem with cool aquifers, it is difficult to trace the source of the warm water using geochemistry. The warm springs do help the picture of the resource by eliminating all or most of the influence of the upper aquifers. How much mixing from other sources, if any, has occurred before the water reached this point cannot be ascertained. The high boron content in the springs points to two interesting possibilities. If some, or all, of the boron is entering the system from a marine sediment, that could indicate the sands below the Paso Robles Formation as the source or the transporting aquifer. If some, or all, of the boron is indicating faults as conduits for warmer water to rise from depth, this could explain the high reservoir temperature derived from the geothermometry.

GEOTHERMOMETRY

The use of chemical geothermometers (geothermometry) is an indirect method of estimating the temperature of a subsurface reservoir where the geothermal fluids are assumed to have equilibrated. Geothermometry methods are based on temperature-dependent, water-rock reactions which determine the chemical and isotopic composition of geothermal fluids. The most common soluble chemical constituents of thermal waters are SiO_2, Na, K, Ca, Cl, HCO_3, and CO_3. The three most generally used geothermometers are the silica, Na-K-Ca, and sulfate-isotope geothermometers. Na-K-Ca and silica were the only two applied in this study. The validity of the estimated temperatures calculated by utilizing these geothermometry algorithms is based on the following assumptions:

1) Temperature-dependent reactions at depth control the concentration of the geothermometer chemical indicator.

2) The reservoir contains an adequate supply of the reactants.

3) Water-rock equilibrium is established in the reservoir.

4) The constituents used in the geothermometer do not re-equilibrate with the confining rock as the water flows to the surface.

5) Mixing of thermal and nonthermal groundwater does not occur.

Problems and inaccuracies arise with the calculated reservoir temperature when one or more of the above assumptions are violated. The geochemical data utilized for the geothermometry calculations in this report come from wells that were drilled for a fresh and cold water supply (Appendix C). As explained earlier, these wells were typically perforated over a large percentage of their total depth to maximize water production. Hence, the waters in each well are a mixture of waters from distinct aquifers. The thermal aquifers are mixed (at unknown proportions) with waters from fresh-water aquifers. This is a direct violation of assumption No. 5 above. It is assumed that this contamination problem occurs in all water wells thought to contain geothermal waters in the Paso Robles area.

To try to minimize this problem, the averages below were arrived at by considering only artesian wells. The exception is the Paso Robles Hot Springs well where the warm water may be close to the surface. All geothermometric results are presented in Appendix C. The geothermometric results should be considered with great care and some skepticism due to the mixing problem.

The Na-K-Ca geothermometry calculations for the 16 artesian wells in the study area (after averaging) ranged from 102°C (216°F) to 116°C (241°F). The silica calculations for these wells were 104°C (219°F) to 84°C (183°F). For an overall estimated subsurface reservoir temperature Na-K-Ca methods gives 91°C (196°F). Silica gave an estimate of 83°C (182°F). The Na-K-Ca method has proven to be more reliable for low-temperature reservoirs and silica more suited for a temperature range of 150°C-225°C (302°C-437°F).

Conclusions

Geothermometry is an indirect method for estimating the temperature of a subsurface reservoir. Taking into account the previously mentioned limitations of this method, the reduced temperatures recorded at the surface, as compared to the reservoir estimate, may be the result of other interfering parameters. Thus, mixing with cooler aquifers and loss of heat from conduction to rocks the water encounters in moving up along a fault may be major factors.

DIRECT TEMPERATURE MEASUREMENTS OF THE PASO ROBLES AREA

Introduction

The most important property of a geothermal reservoir is its temperature. Wells and springs with temperatures of 20°C (68°F) and greater were considered to be geothermal by CDMG and several methods were employed to collect direct temperature measurements in the study area.

First, locations of geothermal wells and temperatures were researched in the literature. All temperatures reported in these publications were considered to be surface water temperatures unless otherwise recorded.

Second, local governments and businesses were contacted to provide locations and temperatures of geothermal wells and springs known to them. All temperatures reported were considered to be surface water temperatures unless otherwise stated.

Third, CDMG recorded temperatures with a standard hand-held maximum recording thermometer in the wells and springs. The data were collected in the discharge of artesian and pumping wells, as well as in flowing springs. Finally, local water well drillers were helpful in relating their experiences in the area.

CDMG also recorded downhole water temperatures. A CDMG crafted, thermistor-tipped, temperature probe attached to 1,200 feet (366 meters) of graduated electrical conducting cable was manually lowered into accessible water wells. Changes in electrical resistance of the thermistor due to water temperature differences were recorded by a standard digital multi-test meter operated in the resistance-measuring mode. Actual temperatures were then read from a temperature versus resistance graph that was calibrated for the thermistor used for field work. Later, temperature logs were drafted depicting curves of water temperature versus depth of probe penetration in each well. These logs are presented in Appendix B.

All surface temperature data, whether old or newly collected from the literature, personal communication, or directly measured by CDMG, are presented in Appendix B and the explanation of Plate 2.

Great care must be observed when discussing the temperatures posted on Plate 2 in a collective way. Temperatures presented in the explanation have been recorded over a large time span. It is quite reasonable to assume that surface temperature of wells recorded in the past may not be the same temperatures that would be measurable today even if these old wells could be found. Other factors that can affect temperatures are the depth of the wells and the time of year in which the temperatures were measured. Many wells flow into tanks. When possible, the temperatures were taken directly from the well, but this was not always the case. As an example, spring numbers 9 and 155 are the same spring. It flows from under the Paso Robles Hot Springs building into a ditch. This is the location at which the temperature measurement was taken. In January, the temperature measured 27.2°C (81°F); in July, it was 43°C (110°F). On Plate 2, the distinction was made between wells greater than 30°C (86°F) and less than 30°C (86°F) to try to eliminate this problem.

Discussion

In the Paso Robles Hot Springs area, the recorded surface temperatures of the warm wells and springs range from 21°C (70°F) - 48°C (118°F). The higher temperature at well 306 of 48°C (118°F) is historical along with springs 148 and 307. Temperature logs were run in well numbers 10 and 49. Well number 49 is the stand-by well for the Hot Springs. It had been standing idle for several months when the temperature probe was run. At approximately 12 meters (40 feet), the temperature began to increase; the maximum of 42°C (108°F) was reached at 26 meters (85 feet) and remained almost constant to the bottom. Well number 10 had been pumped 30 minutes before the survey and steadily increased in temperature to 43°C (109°F) at a total depth of 17 meters (55 feet). In cross section A-A' (Plate 8), this would correspond approximately with a sand unit (Pancho Rico Formation?) above the Santa Margarita Formation. Other wells that the depths are known, such as, numbers 49, 300, 301, 306, and 21 would also pass through this zone.

In well number 40, a temperature log was recorded. Its most rapid rise in temperature began at approximately 18 meters (60 feet) and leveled off to a slow rise from 49 meters (160 feet) to a maximum temperature of 32.8°C (91°F) at total depth of 198 meters (650 feet). The Rinconada fault is located approximately 1 km (3,381 feet) to the southwest of the well. From the driller's log, the well appears to be drilled through a thin layer of Paso Robles Formation and then enters the Monterey Formation to total depth. Proximity to the fault may contribute to this well's temperature.

Only 152 meters (500 feet) of the total depth, 244 meters (800 feet), of well number 303 was logged. The well has not been pumped for several years. The temperature increase was gradual and steady to 152 meters (500 feet) where a maximum temperature of 36.7°C (98°F) was reached. An artesian flow was encountered from 219 meters (720 feet) to 244 meters (800 feet). Cross section E-E' (Plate 8) shows well 303 as missing, by approximately 15 meters (50 feet), the sand unit (Pancho Rico Formation?) which may be the main warm water aquifer. Keep in mind the well is projected on the cross section and conditions at the well location could vary from its projected location.

Well number 50 was logged to its total depth of 122 meters (400 feet). It had its maximum increase above pumped level at 41 meters (135 feet), then a steady increase to bottom. Maximum temperature was 27.3°C (81°F) at 104 meters (304 feet).

Southeast of the City of Paso Robles is spring number 90 with a temperature of 34.4°C (94°F). If the spring is projected to cross section line C-C' (Plate 8), its location is shown to be where the sediments lap out onto the basement. This appears to be a reasonable cause for the existence of the spring.

Well numbers 53, 86, 311, and 308 all seem to have similar characteristics. Wells 53 and 308 have electric logs. In addition, well 308 has a temperature log. In well 308 at 216 meters (710 feet), a permeable sand is encountered. The temperature log for this well also exhibits a sudden rise in temperature at this interval for a good correlation of production interval and temperature source. The temperature begins to increase at 213 meters (700 feet), and, at bottom, 345 meters (1,132 feet), it is 47.2°C (117°F). In well 53, the same sand occurs at 229 meters (750 feet) with smaller sand above. This well is 1,053 meters (3,455 feet) deep, but according to records, a 19 meter (64 foot) plug was placed in sand at 230 meters (756 feet). Twenty-four hours later, sulfur water surfaced at 18,927 liters per minute (5,000 gpm) at 37°C (98°F). It is possible that this plug does not now exist.

Three warm wells, numbers 310, 111, and 119, are unique in that they are in the deepest part of the sedimentary basin. They would not be deep enough to extend out of the Paso Robles Formation. Structure is not well known in this subsurface in this area. Faults concealed below the sediments could be a source but this is not known.

Conclusions

Down hole temperature logs were extremely helpful in delineating the geothermal resources. The correlation of temperature log with an electric log in well 308 pinpointed a warm production zone (Pancho Rico?) effectively. The wells that penetrated this zone, for which a bottom-hole temperature was recorded, were fairly consistent in temperature range 42°C-47°C (107°F-117°F). Except for the three wells in the northeast part of the study area, this was the norm for the warmer temperatures.

GEOPHYSICS

Introduction

Geophysical surveys were undertaken by the Division of Mines and Geology in the Paso Robles geothermal area in order to provide additional information concerning the geology and the hot water resource. Reconnaissance aeromagnetic and gravity surveys were already available in the area. Therefore, in 1979-80, as part of the U.S. Department of Energy's (DOE) second-year contract, the Division's geophysical work was planned to provide ground magnetic and gravity data. Because there was a delay in obtaining the electrical resistivity equipment in time for use in the earlier study, this survey was carried out in 1982.

The following discussion includes both the data obtained earlier and the new resistivity work. Appropriate excerpts from the previous report (Chapman and others, 1980) are included in the material presented below:

Field Methods and Reduction of Data

Gravity Survey

Approximately 250 irregularly distributed gravity stations were occupied in the Paso Robles area (Plate 5) at surveyed elevation points, bench marks, and topographic elevation points from the U.S. Geological Survey 15-minute and 7 1/2-minute quadrangle (topographic) maps. Elevations for approximately 210 stations were surveyed and are probably determined to an accuracy of better than 3 meters (1 foot). The majority of these stations are spaced 244 meters (800 feet) apart along roadsides in the south half of the Paso Robles 15-minute quadrangle map. Approximately 25 gravity stations occupied U.S. Geological Survey and U.S. Coast and Geodetic Survey bench marks, and approximately 10 stations were based on vertical control data by the City of Paso Robles. In addition, approximately 5 gravity stations in the area were located at points where elevations were estimated from 12 meters (40-foot) contours on U.S. Geological Survey 7 1/2-minute topographic maps. The estimated accuracy of these stations is $\pm$ 6 meters (20 feet).

La Coste-Romberg geodetic meter G129 was used for the gravity survey. Gravity observations at occupied stations were tied to base station number 262 previously established in Paso Robles by the California Division of Mines and Geology (Chapman, 1966, p. 39).

After corrections for instrument drift and tidal effects, values of observed gravity were reduced to Bouguer anomalies for a density of 2.67 grams per cubic centimeter (g/cm^3) by means of a U.S. Geological Survey gravity reduction computer program. Inner-zone terrain corrections through Zone F were made manually for each station by the method of Hayford-Bowie (Swick, 1942) to a radius of 2.29 km (1.4 miles). The remaining corrections, out to a radius of 166.7 km (104 miles), were subsequently computed by the use of a U.S. Geological Survey terrain correction program (Plouff, 1977).

The inner-zone terrain corrections for most stations were found to be less than 0.10 milligals (mgal) through Hayford-Bowie Zone F. Corrections which exceed 0.10 mgal were made for a total of 15 stations. The maximum value of the manually calculated inner-zone terrain corrections for stations in this survey was 1.27 mgal. The values of the total terrain corrections for stations range from 2.10 mgal to 0.62 mgal.

The California Division of Mines and Geology gravity data were supplemented with approximately 70 gravity stations from original data used to compile the San Luis Obispo sheet of the Bouguer Gravity Map of California (Burch and others, 1971). The total of 320 gravity stations yields an average density of about one station per 2 square kilometers (.7756 miles) within the boundaries of the Paso Robles 15-minute quadrangle map. However, the distribution of stations is not uniform. The gravity station distribution is more dense in the south-central portion of the survey area than elsewhere.

Aeromagnetic Survey

A portion of an aeromagnetic map by Hanna (1970) for the Paso Robles 15-minute quadrangle map is given in Plate 6. The contours show the total-intensity magnetic field of the earth relative to an arbitrary datum with a contour interval of 40 gammas. The aeromagnetic survey was flown at a barometric elevation of 1981 meters (6,500 feet) along northeast-southwest flight lines spaced 1.6 km (1 mile) apart. A regional magnetic field gradient of 9 gammas per 1.6 km (1 mile) in the direction N16E was removed from the original data.

Ground Magnetic Survey

Approximately 56 km (35 miles) of ground magnetic traverses (lines M1-M15) were made across the Paso Robles area in the 1980 study. An additional 13 km (8 miles) of ground magnetics (lines E1-E4, and L-1) were added during 1982 near the Paso Robles State School for Boys (Plate 7). Total field intensity data were obtained with a Geometrics Model G816, proton magnetometer with a sensitivity of ±1 gamma. The station spacing was usually 30 meters (100 feet) along each traverse. A magnetic contour map based on these data is given in Plate 7.

Electrical Resistivity

Six vertical electrical soundings (VES) were recorded in the Paso Robles area during 1982 (Figure 5A). The vertical electrical sounding data were obtained using a Schlumberger electrode configuration. The six Schlumberger soundings used spacings (AB/2) ranging from 244 meters (800 feet) to 457 meters (1,500 feet). The basic data were plotted in the field as the survey progressed so that questionable readings could be resurveyed. These data were processed by an automatic interpretation program (Zohdy, 1973) which produced a smoothed, calculated curve with associated true resistivities and thicknesses.

Copper-plated steel electrodes were used with saline water to reduce ground contact resistance. At Station VES-1A, a Geotronics FT-4 transmitter with a maximum power of 3.2 kw was used, powered by a Geotronics 5 kw motor-generator. A Bison model 2390 signal enhancement reciever was used at a frequency of one (1) Hz. Data from Stations VES-2 through VES-6 were recorded using an ABEM Terrameter SAS-300 which is a combination transmitter and receiver with an attached power source. The frequency used with this equipment was also one (1) Hz.

In the sounding technique, an electrode configuration is expanded about a central point in order to measure progressively deeper values of electrical resistivity. The Schlumberger electrode configuration consists of two sets of electrodes. The inner (potential) electrodes are located relatively close to the central point and spaced at an equal distance on each side of it. The spacing of the outer (current) electrodes controls the depth of investigation. These electrodes are also spaced at equal distances designated as AB/2 on each side of the central point. The results are plotted as a curve showing resistivity as a function of electrode spacing, AB/2 (or depth).

The figures containing the Schlumberger VES plots show the following data from top to bottom:

Plot
- Observed data (apparent resistivity)
- Calculated data (apparent resistivity smoothed)

Bar Graph
- True resistivity (ohm-feet)
- Depth (feet)

Interpretation of Data

Gravity Data

Rock densities. Values of rock densities for the Central Coast Ranges and the San Joaquin Valley have been given by Byerly (1966, p. 85-86). Most densities used in this report are based on Byerly with some modifications. In addition, a density profile (Nettleton, 1940, p. 57-58) was utilized to determine the density of the Paso Robles Formation. In this procedure, the gravity values for stations across a topographic feature are reduced, including terrain effects, for a sequence of different density values. The density value that produces the "smoothest" gravity profile across the topographic feature should be the proper density for use in the reductions. The density profile used crosses a hill assumed to be composed entirely of rocks from the Paso Robles Formation. A density of 2.05 g/cm^3 was determined from this procedure. A summary of the density values for the rocks in the Paso Robles area are given in Table 3:

Table 3. Rock densities in the Paso Robles area

AGE	FORMATION	DENSITY (g/cm^3)
Quaternary and Tertiary	Paso Robles Formation	2.05
	Santa Margarita Formation	2.35
Tertiary	Monterey Formation	1.95
	Vaqueros Formation	2.40
Tertiary and Cretaceous	Franciscan Complex	2.67
Pre-Tertiary	Granitic Basement	2.67

Gravity contour maps. Plate 5 is a map of the Paso Robles 15-minute quadrangle showing station locations and Bouguer gravity contours at an interval of 2 mgal.

The gravity field in this part of the California Coast Ranges is characterized by an overall decrease in gravity values of about 1.5 mgal per mile toward the northeast (Burch and others, 1971). Superimposed on this regional gradient are a number of local anomalies, most of which have a general northwest trend. In general, the local gravity anomalies tend to reflect the thicknesses of the Tertiary and Quaternary sedimentary rocks and other sediments that overlie the relatively dense granitic and Franciscan complex basement rocks in the area.

Prominent positive gravity anomalies with amplitude of about 20 mgal each evidently reflect the exposures of granitic rocks located northwest of Paso Robles and near the southeastern corner of the map. The cause of a smaller positive anomaly near Templeton is not known but could be a buried hill, ridge, granitic or Franciscan basement rocks (Durham, 1974, Plate 2). Just southeast of Paso Robles, there is a southwestern re-entrant in the gravity contours resulting in a negative anomaly located between the two prominent positive anomalies mentioned above. On Plate 5, this negative anomaly appears to be a southwestern extension of a major negative anomaly that is present in the northern part of the map. South of Paso Robles, this negative anomaly is bounded on the southwest by a steep, nearly straight, northwest-trending gravity gradient. This gradient apparently coincides well with the southeastern extension of the Rinconada fault (Plate 3 and Durham, 1974, Plate 1). This suggests a large vertical offset in the basement rocks along this fault zone, as indicated by Durham (1974, Plate 3, Section M-M).

Trend-surface analyses for degrees 1 through 4 were made for the data on Plate 5. The results of these analyses (not shown) do not provide significant new information about the gravity field except that the removal of low degree trend surfaces suggests a separate negative closure in the area south of Paso Robles.

Interpretation of the gravity data is aided by Plate 3 which is a contour map of the Franciscan/granitic basement surface based on well data. Although the data points are scattered, the basement contour map has a noticeable similarity to the gravity map. In particular, the northeastward-trending negative gravity anomaly south of Paso Robles apparently corresponds with a buried depression or valley in the basement rocks in the same general area.

Most of the warm water wells are located within either negative gravity anomalies and basement depressions east and southeast of Paso Robles or along gravity gradients in the transition zones from negative to positive anomalies at Paso Robles and east southeast of Paso Robles (Plate 2). These gravity gradients could be caused, at least in part, by faults that offset the relatively dense basement rocks.

Whether the apparent association between some of the hot water wells and the negative anomalies is real or not is uncertain. It is possible that parts of the negative gravity anomalies are caused by hydrothermal alteration of the basement rocks on a large scale in this area. However, it also may be that the gravity anomalies are caused entirely by the configuration of the basement surface as defined by logs of deep petroleum exploration wells in the area (Plate 2). In either case, some of the faults suggested by the gravity data may serve to control the lateral extent and locations of the geothermal reservoirs in the area.

Magnetic Data

Aeromagnetic map. The aeromagnetic map (Plate 6) has a marked similarity to the gravity map (Plate 5) in the Paso Robles area. Northwest-trending postive aeromagnetic anomalies of more than 100 gammas are associated with the granitic rocks just northwest of Paso Robles and near the southeastern corner of the map. Similarly, there is a magnetic low in the shape of a saddle between the two positive anomlies southeast of Paso Robles, and a negative anomaly in the northeastern part of the map.

The positive magnetic anomalies are evidently caused by the granitic basement rocks which must be moderately magnetic in this area. The negative anomalies may be related, at least in part, to the relatively large depth of burial of these rocks in some parts of the area. The size of the relative negative anomalies suggests, however, that changes in the composition of these rocks may also be involved. This evidence tends to support the gravity data that may also suggest a possible difference in the basement rocks southeast of Paso Robles, possibly caused by hydrothermal alteration related to this part of the geothermal area.

Ground magnetic data. The ground magnetic contours (Plate 7) show general agreement with the aeromagnetic map at least within the area surveyed. For example, the northwestward-trending positive anomaly, extending from northwest of Paso Robles southeast to the southeastern part of the map, is clearly shown. Also, the negative anomaly in the northeastern part of Plate 7 corresponds to the aeromagnetic low in the same area.

Although the ground magnetic data show more detail than is shown on the aeromagnetic map, there is no obvious correlation with the known geothermal area. In detail, however, the ground magnetic data may show some indications of changes in the rock types in the near-surface Tertiary sedimentary rocks and may also show some evidence for faulting, both of which may be related to geothermal occurence. However, there is no obvious relationship between the magnetic anomalies and mapped geologic units.

Electrical Resistivity Data

The individual resistivity soundings were located near:

Well Numbers 53 & 86	-VES-1A, 3, & 6*
Spring Number 90	-VES-4
Paso Robles Hot Springs Area	-VES-5
Well Number 308	-VES-2

*For well numbers see Plate 2.

The observed data from these soundings, along with calculated data, true resistivity, and depths from the automatic interpretation program are shown on Figures 5 through 10.

A comparison of the basic data plots for the soundings from the spring areas (Figures 8 & 9) shows that the true resistivity values are generally in the 5-30 ohm-feet range from a depth of about 12 meters (40 feet) to the total depth investigated. VES-4, located in a small canyon approximately 30 meters (100 feet) above the Salinas River, shows a near-surface thin crust of high resistivity. VES-5 is parallel to a bog area and only about 6 meters (20 feet) above the river level. The data for show maximum near-surface resistivities of only 40 ohm-feet. The deeper levels of both plots show resistivities which may infer a clay environment or other low-resistivity materials. These resistivity values would not suggest sandy aquifers. Sounding VES-2 is in the Geneseo school area, approximately one-half mile west-northwest of well number 308. This location is on a bluff north of the river (Figure 5A) and about 18 meters (60 feet) higher in elevation. The data plot shown on Figure 6 is oscillatory in character beyond the 61 meters (200 feet) (AB/2) spacing. This suggests that the signal-to-noise ratio may decrease at the larger electrode spacings. Therefore, an average was taken for this segment of the curve for purposes of interpretation. Again, as at the soundings from the springs (VES-4 and VES-5), the relatively low true resistivity below a depth of about (33 feet) (10-25 ohm-feet) does not suggest a sandy environment. An electrolytic solution (saline water), if present, would also contribute to a low value of true resistivity.

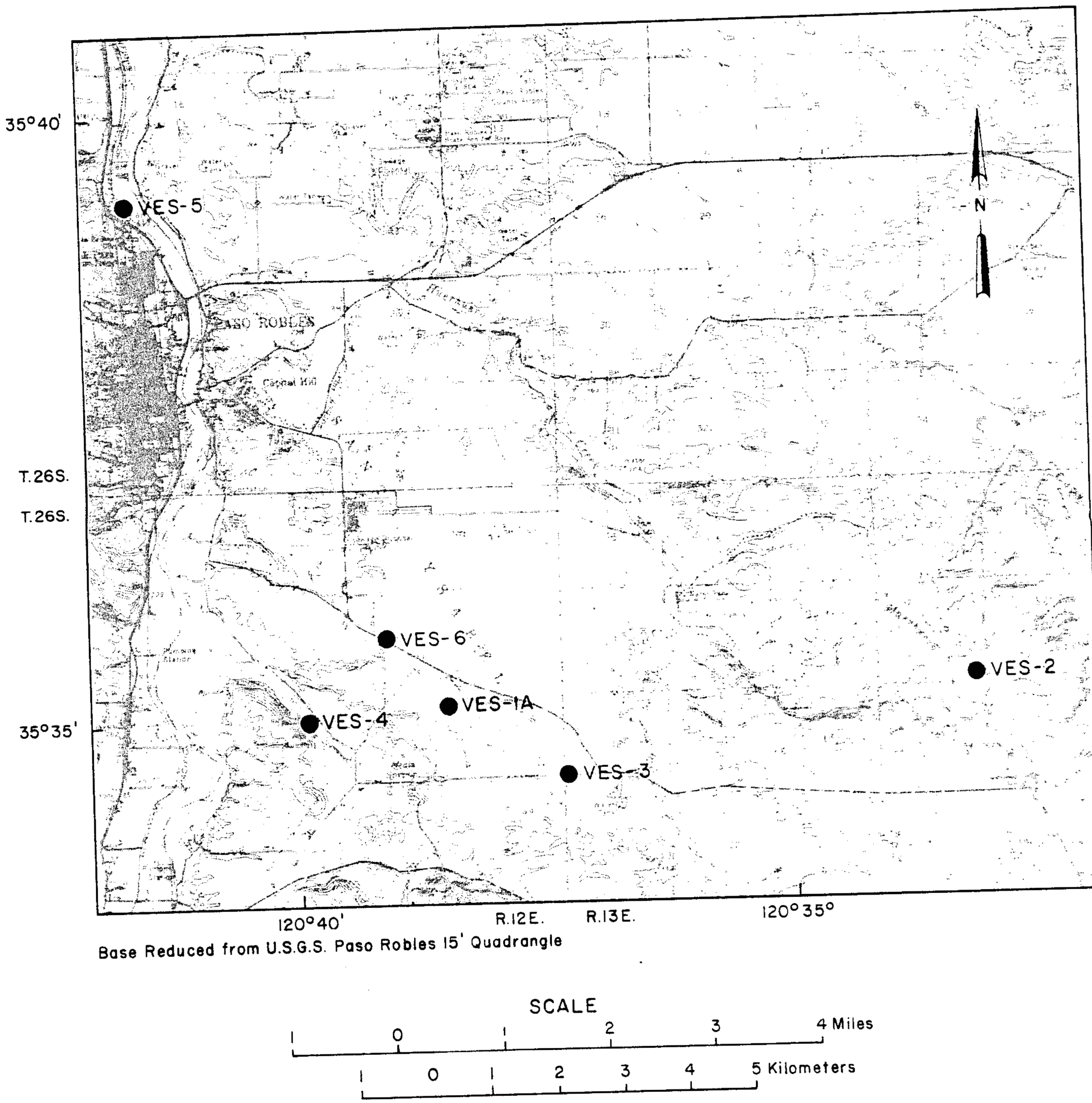


Figure 5A. Locations of Schlumberger sounding stations

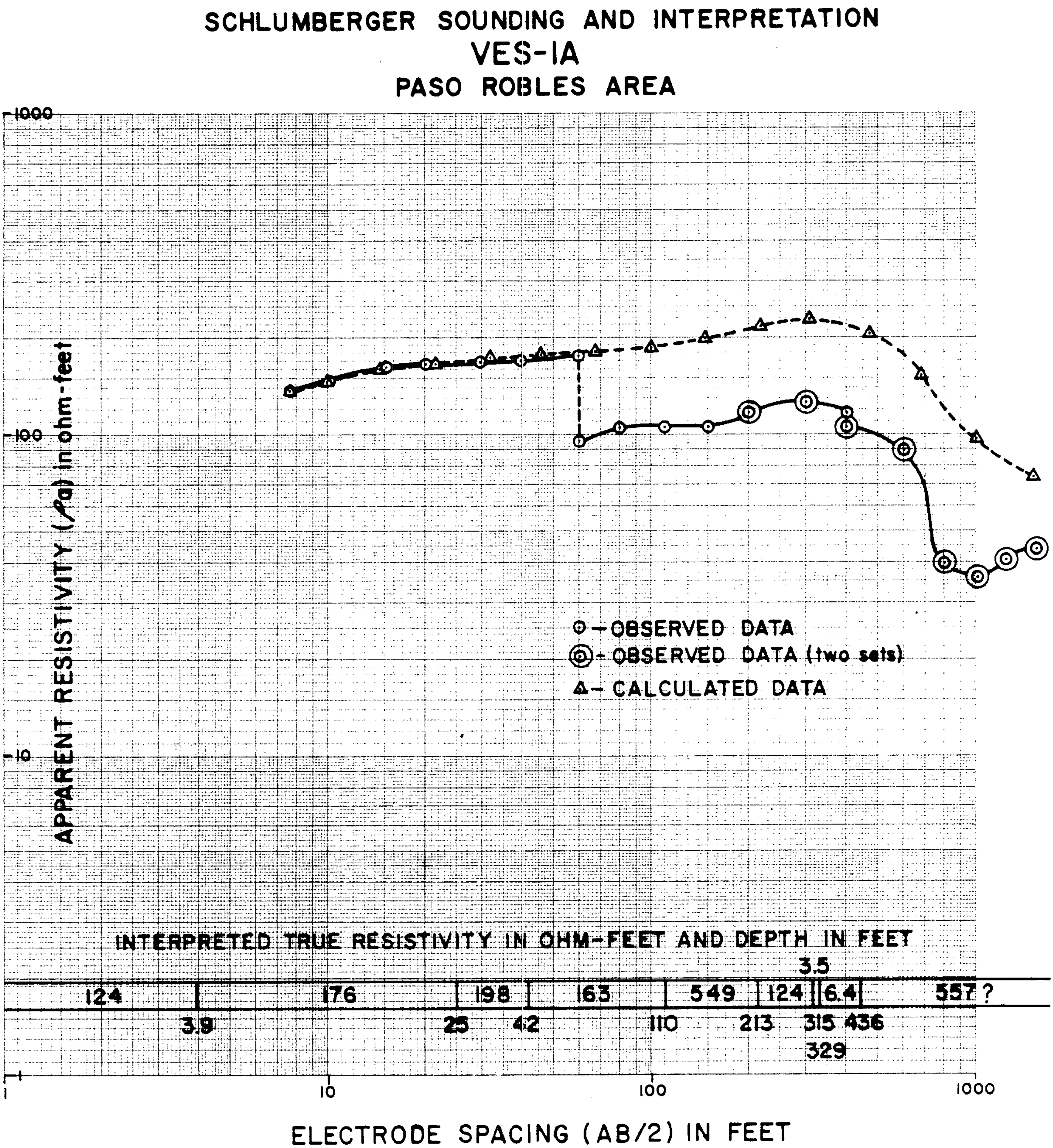


Figure 5. Schlumberger sounding and interpretation VES-1A

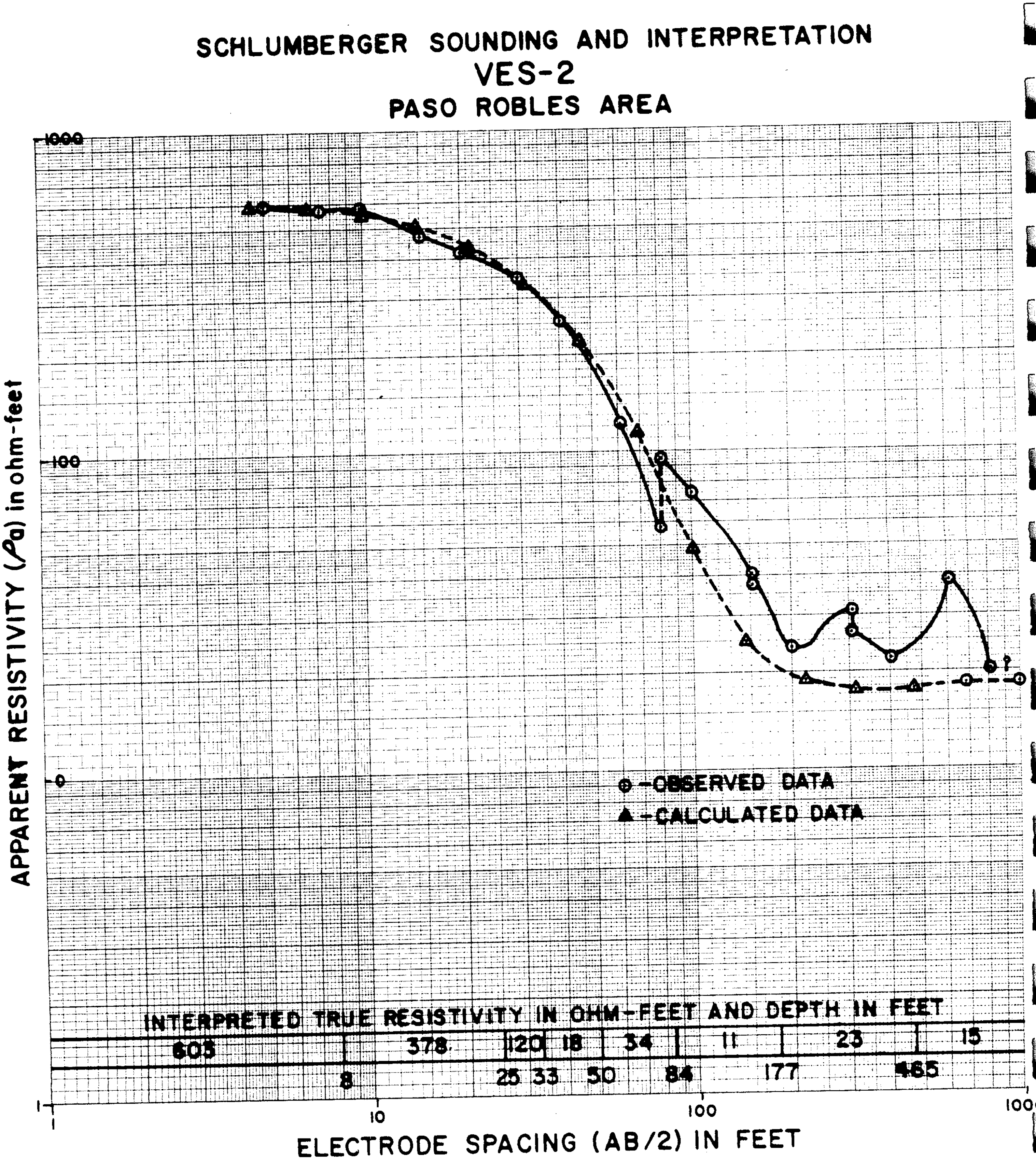


Figure 6. Schlumberger sounding and interpretation VES-2

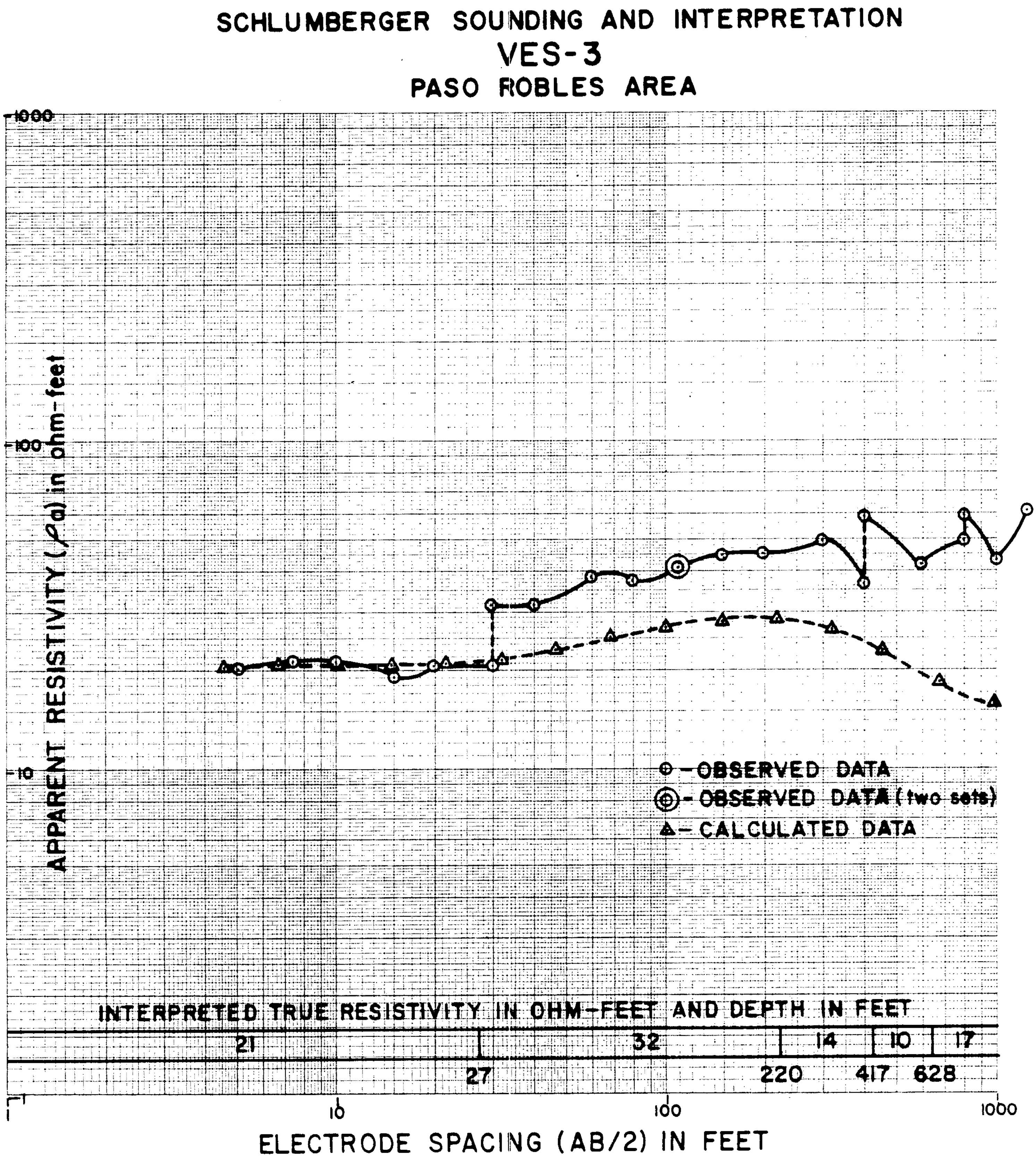


Figure 7. Schlumberger sounding and interpretation VES-3

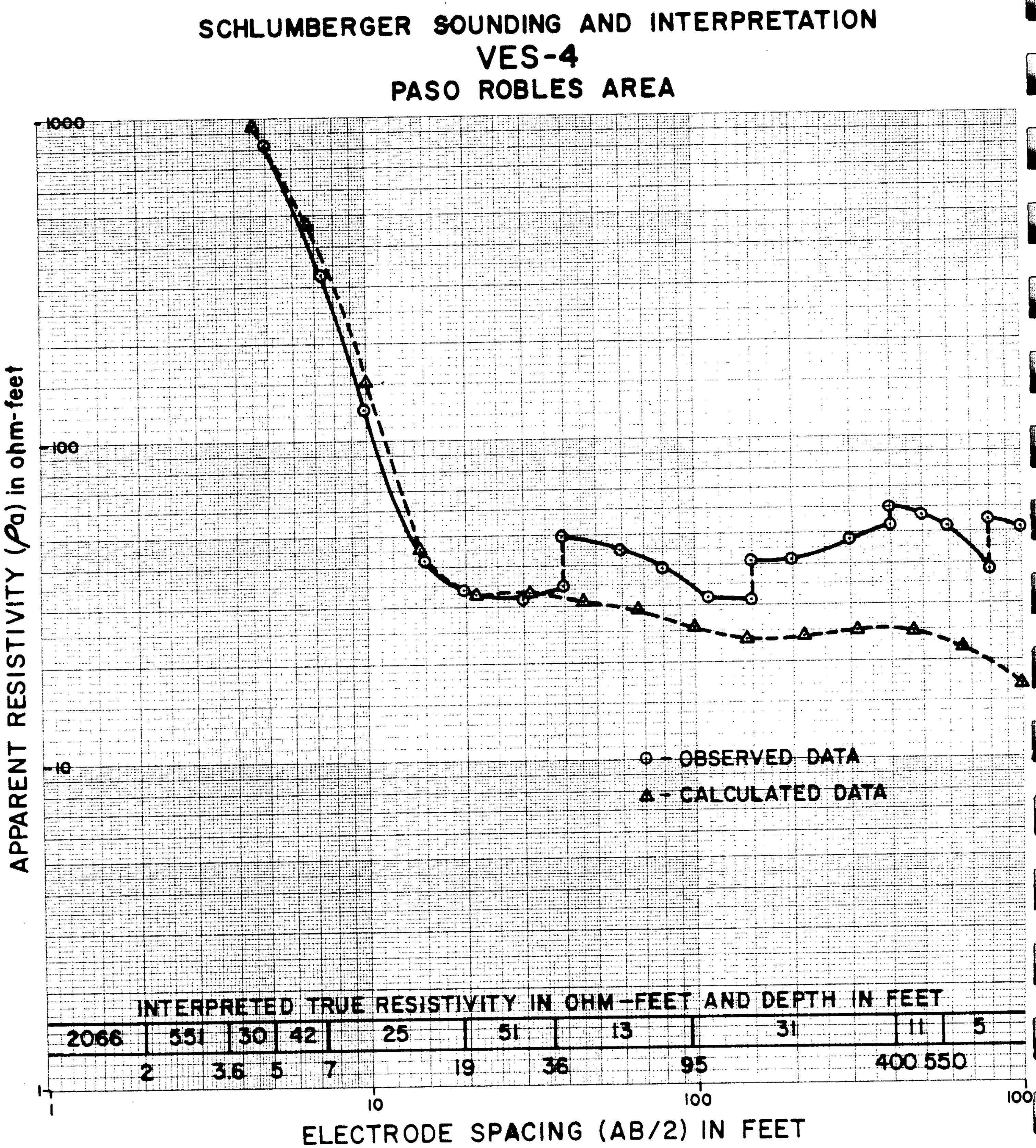


Figure 8. Schlumberger sounding and interpretation VES-4

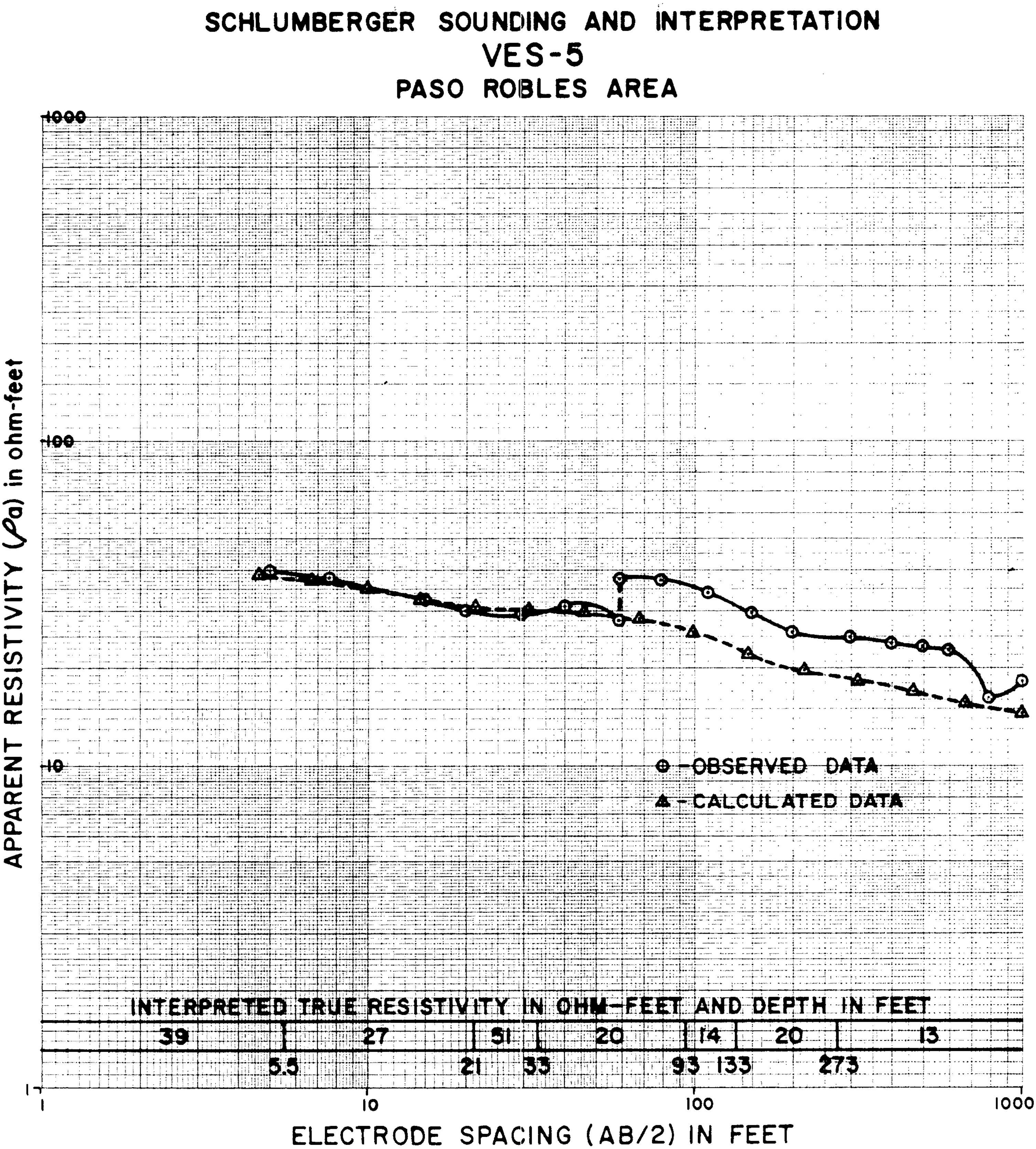


Figure 9. Schlumberger sounding and interpretation VES-5

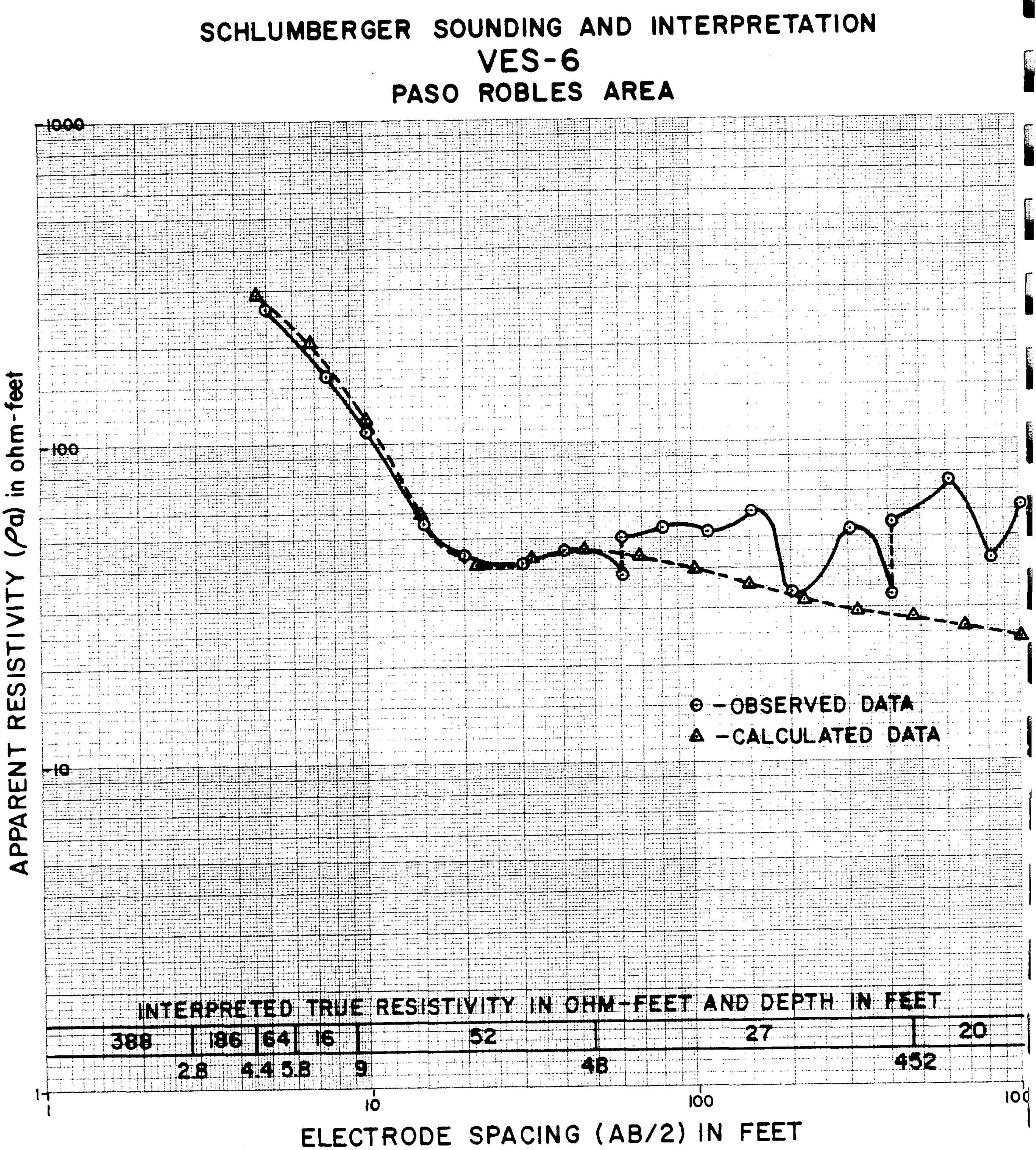


Figure 10. Schlumberger sounding and interpretation VES-6

Three electrical soundings, VES-1A, 3 and 6 (Figure 5A) are in the general area of well numbers 53 and 86. VES-1A, is 305 meters (1,000 feet) south of the number 53 well and about 46 meters (150 feet) southwest of the number 86 well. The true resistivity (Figure 5) gradually increases to over 500 ohm-feet (549) between the depths of 33 meters (110 feet) and 65 meters (213 feet). Below 65 meters (213 feet), there is a layer about 30 meters (100 feet) thick with a resistivity of about 124 ohm-feet. The resistivity drops sharply to an average of about 6 ohm-feet from a depth of 96 meters (315 feet) to a depth of 133 meters (436 feet). Below 133 meters (436 feet), the resistivity increases to over 500 ohm-feet, and probably higher. This higher resistivity suggests a possible sandy layer, perhaps the aquifer that produces warm water in the nearby drill holes.

The sounding on Neal Road, VES-3, (Figure 5A), is 2134 meters (7,000 feet) southeast of VES-1A. It has a similar profile (Figure 7), increasing in true resistivity, to a depth of 220 feet. However, the resistivity level is lower by almost a factor of one magnitude than the data from VES-1A. Below a depth of 67 meters (220 feet), the resistivity range is 10-15 ohm-feet. No reliable increase in resistivity is shown at greater depth on the sounding. This indicates that VES-3 has a completely different set of electrical resistances than VES-1A; therefore, the lithology could be expected to be different.

Sounding VES-6 (Figure 5A) is located 1372 meters (4,500 feet) northwest of VES-1A on Creston Road. From a spacing of about 15 meters (50 feet) [(AB/2)] to 305 meters (1,000 feet), the sounding data is oscillatory in character. As before, an average curve was used for purposes of interpretation. The true resistivity interpreted for this sounding (Figure 10) indicates a thin high resistance near-surface zone followed by a general decrease to 20 ohm-feet at 137 meters (450 feet) depth and deeper. Below a depth of 3 meters (10 feet), there is no suggestion of a sandy type section.

Conclusions

Gravity and magnetic data in the Paso Robles area generally reflect the regional trends of the basement rocks and the thickness of the overlying Tertiary sedimentary rocks. At least some of the geothermal areas are characterized by magnetic and gravity lows or by steep gravity gradients flanking these lows. Part of the cause of the negative anomalies is probably a relatively deep structural basin. However, the anomalies may also be caused in part by a change in character of the basement rocks such as might result from hydrothermal alteration on a large scale. Some of the steep gravity gradients may be caused by faults. These faults may control the locations of some of the geothermal resources in the area.

Detailed magnetic and gravity data show possible correlation in some places with known and possible faults, and the magnetic data may also suggest local differences in the Tertiary rocks. For example, the gravity data show good evidence for the Rinconada fault in this area. However, the local magnetic anomalies show no simple relationship to mapped geologic units.

Data from a limited number of resistivity soundings in the Paso Robles area indicate that, except for a thin near-surface layer of high resistivity, the area is characterized in general by low values of resistivity. These low values of resistivity range between about 5 ohm-feet and 30 ohm-feet and probably indicate sediments containing a high proportion of clay or saline water, but not necessarily hot water. One sounding (VES-1A), located near the Franklin wells (53 and 86, Figure 5), is an apparent exception. This sounding indicates both a relatively thick near-surface layer of high resistivity and a deeper layer of high resistivity. The deeper layer of high resistivity could represent the warm water aquifer known to be present in this area. However, insufficient data were obtained near the Franklin wells to confirm this possible interpretation.

The results of the geophysical surveys in the Paso Robles area indicate that these methods have provided information useful in the search for additional possible geothermal resources. Gravity and magnetic data provided information on geologic structure and rock types that may be related to, or may help to localize the search for, geothermal resources. The results of the electrical resistivity survey are mostly inconclusive, but may suggest that at least some of the hot water aquifers can be detected by this method.

CONCLUSIONS AND ASSESSMENT OF THE GEOTHERMAL RESOURCE

A geothermal resource assessment, by necessity, must be updated, re-evaluated, and refined as additional data become available. Therefore, some of the material presented in this report may be modified in the future.

Conclusions

Since the missions were established in the very early 1800's, warm springs in Paso Robles have been historically noted. There were three general warm spring areas, on the northern edge of the present City of Paso Robles, in the center of town, and to the southeast of town (Plate 1). The geothermal springs and wells that produce geothermal water today are located approximately in the same vicinity as they were historically, although the natural springs in the downtown area of Paso Robles have dried up.

The geology and geophysical data collected reflect the trends of the Pre-Tertiary basement and thickness of the overlying Tertiary sedimentary rocks. The mapped gravity and magnetic lows are probably the result of a deep structural basin, as indicated in the well logs. These anomalies could, in part, also be due to a change in character of the basement rocks such as might result from hydrothermal alteration. The recorded gravity and magnetic highs indicate the basement relief; the steep northwest trending gravity gradient shows, in the Paso Robles vicinity, good evidence for the Rinconada fault. Cross sections (A-E) drawn from oil well logs show the sediments on-lapping against these basement highs, and it is coincident with these locations that the three natural warm springs in the area occur. Data from a limited number of electrical resistivity soundings inicate that the area is characterized in general by low values of resistivity. These low values of resistivity probably indicate sediments that contain a high proportion of clay or saline water, but not necessarily hot water.

Geochemistry, as discussed earlier, was available for many wells in the area. The several rock types that could influence the water chemistry and the mixing problem with cool aquifers make it difficult to trace the source of the warm water using geochemistry. Thermal wells that have penetrated through thicker sedimentary sections possessing cool water zones have mineral concentrations similar to cold water wells in the basin. In cases of warm water occurrence those wells and springs that penetrate through thin overburden cover have elevated concentrations. The high boron concentrations detected in the springs may be entering the system from two sources. If some or all of the boron is entering the system from a marine sediment, that could indicate the marine formations below the Paso Robles Formation as a source or the transporting aquifer. If some or all of the boron is indicative of faulting as a conduit for warmer water to rise from depth, this could explain the high reservoir temperature derived from the geothermometry.

Geothermometry calculations using the Na-K-Ca method are considered to be the most accurate for low-to-moderate temperatures. These showed temperatures of 102°C (216°F) to 116°C (241°F). It is interesting though that the silica geothermometer also comes close to the same temperature with 83°C (182°F). The reduced temperature measured on or near the surface 42°C-47°C (107°F-118°F) may be the result of mixing with cooler aquifers, loss of heat from conduction over distance, or other factors.

Downhole temperature logs were extremely helpful in delineating the geothermal resource. The correlation of a temperature log with an electric log in well 308 pin-pointed a warm production zone (Pancho Rico?) effectively. If the warm water is entering the system from depth, the Santa Margarita, Pancho Rico, and Paso Robles Formations would be the first permeable zones, in the order that the warm water could enter. The permeability of the Santa Margarita Formation is unknown so no determination could be made as to the amount of warm water, if any, that may exist in that formation. Well 308 did not drill through this formation. In wells that passed through the bottom of the Paso Robles (top of Pancho Rico?), a fairly consistent bottom-hole temperature range 42°C-47°C (107°F-117°F) was recorded. High permeability which results in the rapid flow of the geothermal fluids may be responsible for these consistent temperatures. At Paso Robles Hot Springs, the thickness of the warm water aquifer appears to be thin, perhaps on the order of a few tens of meters and occurs at a shallow depth ±15 meters (±50 feet). Southeast of town, the resource is deeper, 457 meters+ (1500 feet+) and thicker, possibly a few hundred feet thick ±213 meters (±700 feet). Discharge volume differs also, probably due to the thickness of the producing zone. The total estimated flow of the thermal water, taking into account well capacity in the area, is 17,449 l/min (4610 gal/min). It should be noted that this figure would include cold water that has mixed with the warm water. When considering recoverable thermal waters, economic feasibility is a major concern. Plate 2 shows an outline of the most promising area where a possibility exists that thermal waters in the 38°C (100°F) range may be accessible around 305 meters (1,000 feet). For a list of potential uses for various temperature ranges see Figure 11. The total area outlined is approximately 109 square kilometers (42 square miles).

Recommendations

There is a warm water aquifer present at the base of the Paso Robles Formation that has a broad areal distribution extending south and eastward from the City of Paso Robles. Additional tests using the resistivity method, including dipole-dipole traverses, are needed to determine the usefulness of this technique for identification of conditions favored for geothermal occurrences. As an aid to site specific development downhole temperature surveys, that measure temperatures on a grid pattern as indicated by thermistors placed in shallow drill holes 2m deep (6.5 feet), can also be used to determine the best locations for resource development. Use of this technique is recommended for future studies in Paso Robles and the nearby surrounding area.

Reports of warm water southeast of the study area in Creston merits investigation. It is possible that another sizable geothermal resource area may be present in that vicinity.

In the Paso Robles area development and use of the water from the existing warm artesian springs and wells would eliminate surface discharge and waste of the geothermal fluids and heat. It is suggested that high concentrations of deleterious substances should be diluted before disposal. Finally, a deep exploration well should be drilled adjacent to the Rinconada fault to yield information on the source of the geothermal fluids, the highest temperatures and the quantity and quality of the less diluted thermal waters, if deep circulation along the fault, as is believed, is a factor in the geothermal occurrence at Paso Robles.

Acknowledgment

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We especially wish to express our gratitude to the residents of the area that allowed us access to their property.

Temperature °F	Temperature °C	Use
392	200	
374	190	
356	180	Evaporation of Highly Concentrated Solutions. Refrigeration by Ammonia Absorption. Digestion in Paper Pulp. Kraft.
338	170	Heavy Water via Hydrogen Sulfide Process. Drying of Diatomaceous Earth.
320	160	Drying of Fish Meal. Drying of Timber.
302	150	Aluminia via Bayers Process.
284	140	Drying Farm Products at High Rates. Canning of Food.
266	130	Evaporation in Sugar Refining. Extraction of Salts by Evaporation and Crystalization.
248	120	Fresh Water by Distillation. Most Multiple Effect of Evaporations. Concentration of Saline Solutions.
230	110	Refrigeration by Medium Temperatures. Drying and Curing of Light Aggregate Cement Slabs.
212	100	Drying of Organic Materials. Seaweed. Grass. Vegetables, etc. Washing and Drying of Wool.
194	90	Drying of Stock Fish. Intensive De-Icing Operations.
176	80	Space Heating. Greenhouses by Space Heating.
158	70	Refrigeration by Low Temperature.
140	60	Animal Husbandry. Greenhouses by Combined Space and Hotbed Heating.
122	50	Mushroom Growing. Balneological Baths.
104	40	Soil Warming.
86	30	Swimming Pools. Biodegradation. Fermentation. Warm Water for Year Around Mining in Cold Climates. De-Icing.
68	20	Hatching of Fish. Fish Farming.

Temperature Range of Conventional Power Production (180 °C to 140 °C)

Temperature of Saturated Steam (200 °C to 100 °C)

Water Temperature (20 °C to 120 °C)

From: Lindal, B., 1974, Geothermal energy for process use: Proceedings of the International Conference on Geothermal Energy, Oregon Institute of Technology.

Figure 11. Temperature ranges for direct uses

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APPENDIX A
GEOCHEMISTRY ANALYSIS

WELL NO.	MDB&M LOCATION	REFERENCE*[1]	DATE SAMPLED	SURFACE TEMPERATURE °C	°F	TOTAL DEPTH FEET	pH (LAB)	TDS	SiO_2	Ca	Mg	Na	K	HCO_3	SO_4	Cl	NO_3	B	F	CHEMICAL CHARACTERISTICS
								ppm												
4	26S/12E - 04D0A	1	11-13-78	---	---	---	8.1	980	---	114	65	44	1.7	290	210	157	22	.2	.5	Mg-Ca HCO_3
5	26S/12E - 08G0A	1	03-24-80	16.7	62	---	8.4	425	---	44	30	67	3	319	47	50	.8	.3	.3	Na-Mg HCO_3
6	26S/12E - 08R	1	03-24-80	18.9	66	---	8.6	515	---	22	11	154	3	383	76	29	.1	.8	.3	Na HCO_3
7	26S/12E - 18L01S	1	01-23-80	---	---	---	8.3	2300	---	54	10	762	9.8	78	520	861	1.4	8.5	4.2	Na Cl
8	26S/12E - 20A0XS	1	01-24-80	21.1	70	Spring	7.6	1210	---	126	41	215	3.8	327	219	282	1.9	2.8	3.5	Na-Cl Cl-HCO_3
9	26S/12E - 20A01S	1	01-24-80	27.2	81	Spring	8.3	1550	---	127	33	360	6.4	242	330	453	2.5	4.8	3	Na Cl
10	26S/12E - 20A02S	1	01-24-80	43	109.3**[2]	55	7.4	2420	---	112	0	725	11	75	554	850	1.2	8	5	Na Cl
11	26S/12E - 20F01	1	11-04-80	23.3	74	424	8.2	408	---	70	28	26	.6	261	49	57	.5	.2	.6	Ca-Mg HCO_3
12	26S/12E - 20L	1	11-05-80	21.1	70	240	8.0	313	---	58	28	16	.6	249	25	35	3	.1	.5	Ca-Mg HCO_3
13	26S/12E - 20M	1	01-30-81	---	---	---	7.8	405	---	72	26	20	.7	294	29	44	.3	0.2	.6	Ca HCO_3
14	26S/12E - 20P0B	1	01-30-81	---	---	---	7.6	766	---	78	21	144	1.6	232	132	183	13.2	3.0	2.5	Na Cl-HCO_3
15	26S/12E - 20N0A	1	03-19-79	---	---	---	7.4	578	---	94	36	28	.9	240	77	84	3.9	.2	.2	Ca HCO_3-Cl
16	26S/12E - 20N0B	1	03-27-80	20	68	---	8.3	594	---	84	24	90	1.5	290	93	120	.5	1.1	.8	Ca-Na HCO_3-Cl
17	26S/12E - 20Q	1	01-28-81	---	---	---	7.7	1530	---	131	43	345	4.6	239	315	515	2.2	5.4	3.2	Na Cl
18	26S/12E - 20Q0A	1	11-05-80	23.3	74	---	8.0	1700	---	142	41	340	5.2	232	326	520	.9	5.4	2.9	Na Cl
19	26S/12E - 20P0A	1	09-26-79	20	60	---	8.0	893	---	74	35	150	---	150	117	231	13	---	.5	Na Cl
20	26S/12E - 21D0A	1	01-29-81	---	---	---	8.0	1270	---	60	31	357	4.8	546	221	264	1.6	1.5	1.7	Na HCO_3-Cl
21	26S/12E - 21D01S	1	01-24-80	38.8	102	300	8.1	1380	103	5.0	1.0	500	5.9	478	278	250	.7	3.0	2.9	Na HCO_3-Cl
22	26S/12E - 21L02S	1	11-16-78	36.1	97	---	8.3	1150	97	34	18	370	4.8	478	229	177	0	1.2	2.2	Na HCO_3-Cl
23	26S/12E - 21P01S	1	11-16-78	40.5	105	---	8.4	1160	105	4.8	0	420	7.0	485	219	153	2.4	1.2	2.6	Na HCO_3-SO_4
24	26S/12E - 22B0A	1	02-08-79	---	---	---	7.7	298	---	37	11	34	1.7	100	16	37	31	.2	.2	Ca-Na HCO_3-Cl
25	26S/12E - 22J01	1	10-14-80	---	---	---	7.3	595	---	28	15	134	---	210	100	50	13	---	.4	Na HCO_3-SO_4
26	26S/12E - 25E0A	1	03-30-79	---	---	---	7.1	403	---	38	20	42	1.4	220	41	30	12	.2	.2	Ca-Na HCO_3
27	26S/12E - 25M0A	1	09-26-66	---	---	---	7.7	504	---	22.5	11.6	152.5	1.3	262	90	31.5	0	---	.3	Na HCO_3
28	26S/12E - 26A0A	1	12-14-78	---	---	---	7.6	455	---	35	19	64	2.0	250	76	46	18	.7	.4	Na-Ca HCO_3
29	26S/12E - 26E01	1	11-17-78	---	---	---	8.4	532	---	20	7.8	160	3.1	326	76	49	7.8	.6	.3	Na HCO_3
30	26S/12E - 26E0A	1	08-20-80	---	---	---	8.5	514	---	22	12	152	2.9	311	108	49	.7	.7	.3	Na HCO_3
31	26S/12E - 27G0A	1	08-20-80	27.7	82	---	8.1	929	---	11	5.0	340	4.5	533	142	144	.4	1.3	1.0	Na HCO_3-Cl
32	26S/12E - 27H0A	1	08-20-80	22.2	72	---	8.7	513	---	29	16	133	2.6	308	86	55	9.1	.5	.3	Na HCO_3
33	26S/12E - 28A0A	1	01-29-81	---	---	---	7.9	397	---	45	26	57	2.0	254	27	66	21	.2	.4	Na-Ca HCO_3
34	26S/12E - 28B0A	1	01-28-81	---	---	---	8.2	886	---	24	13	290	5.3	511	145	119	5.9	1.6	.7	Na HCO_3
35	26S/12E - 28C01S	1	11-16-78	25.5	78	55+	8.2	1180	82	7.5	.1	430	8.2	504	209	163	0	1.2	2.4	Na HCO_3
36	26S/12E - 28F01S	1	11-17-78	26.1	79	---	8.2	1160	79	5.5	1.2	430	5.6	474	211	180	3.0	1.1	2.6	Na HCO_3-Cl
37	26S/12E - 28L01S	1	11-17-78	27.2	81	---	8.8	1050	82	8.3	3.5	400	8.1	488	165	168	2.4	1.2	2.2	Na HCO_3
38	26S/12E - 28Q0X	1	01-29-81	---	---	---	7.5	877	---	122	41	120	2.5	494	202	81	16.8	.4	.5	Ca-Na HCO_3
39	26S/12E - 29C0A	1	03-27-80	---	---	---	7.9	244	---	83	9	488	3	161	267	621	3	6.6	4.2	NaCl
40	26S/12E - 29C0B	1	01-30-81	32.8	91**[2]	650	8.7	16	---	5	1.	490	9.3	194	0	675	.9	6.8	3.4	NaCl
41	26S/12E - 31J	1	10-09-78	---	---	---	8.5	620	---	60	61	17	1.2	370	165	50	35	.2	.2	Mg HCO_3
42	26S/12E - 31K	1	03-27-80	14.4	58	---	7.5	776	---	151	73	21	1.5	620	149	41	.3	0	.3	Ca HCO_3
43	26S/12E - 32E	1	11-05-80	22.2	72	---	7.7	581	---	109	51	20	1.7	424	117	41	1.5	0	.4	Ca-Mg HCO_3
44	26S/12E - 32M	1	11-05-80	21.1	70	---	7.6	617	---	117	55	22	22	447	132	46	.1	0	.3	Ca-Mg HCO_3

WELL NO.	MDB&M LOCATION	REFERENCE*[1]	DATE SAMPLED	SURFACE TEMPERATURE °C	SURFACE TEMPERATURE °F	TOTAL DEPTH FEET	pH (LAB)	TDS	SiO_2	Ca	Mg	Na	K	HCO_3	SO_4	Cl	NO_3	B	F	CHEMICAL CHARACTERISTICS
								ppm												
45	26S/12E - 33B01	1	05-28-65	---	---	---	7.5	820	---	106	43	113	3	356	252	95	1.	.44	.9	Ca-Mg HCO_3-SO_4
46	26S/12E - 33F0B	7,8,11	09-20-62	42.5	108.6	427	8.4	1470	---	19	1	525	12	728	142	320	2.1	2.4	1.5	---
47	26S/12E - 33J02	1	06-12-59	---	---	---	7.4	337.4	---	28	31.7	73.6	3	122	91.2	49.6	2.2	---	---	Na-Mg HCO_3-SO_4
48	26S/12E - 33Q04	1	10-14-80	---	---	---	7.5	875	---	80	56	102	---	260	125	125	26	---	.4	Mg-Na HCO_3-Cl
49	26S/12E - 20A	3	01-07-81	41.6	107**[2]	95	6.7	1680	---	18	5.3	500	12	70	140	500	45	2	2.4	---
50	26S/12E - 04K	3	05-07-75	27.3	81.1**[2]	400	7.7	805	---	21	6.9	275	4.2	210	92	100	9	1.19	.8	---
51	26S/12E - 22R	3	06-06-77	28.3	83	1004	7.5	525	---	29	14	149	2	210	84	56	7	1.6	.3	---
52	27S/12E - 02C	3	07-17-?	26	78.8	800	8.5	650	---	17	6	119	3.1	360	64	77	7	1.45	.3	---
53	27S/12E - 11R01	3	08-12-71	36.7	98	756	8.2	650	8	5.4	1.2	256	2.6	485	70	180	3	1.47	1.2	---
54	27S/12E - 29	4	07-26-62	38.9	102**[2]	886	8.1	---	---	14	1	435	---	842	41	178	---	---	.45	---
55	26S/12E - 14H	3	10-29-76	20	68	1220	7.6	473	---	29	17	131	2.6	---	123	40	5.3	1.9	.2	---
56	27S/12E - 01E0A	1	12-06-78	---	---	---	7.3	525	---	58	26	32	2.2	240	51	80	18	.3	.4	Ca-Mg HCO_3
57	27S/12E - 02D01	1	10-14-80	---	---	---	8.2	683	---	10	5.6	210	---	350	43	87	4	---	.6	Na HCO_3
58	27S/12E - 02E01	1	10-14-80	---	---	---	7.8	385	---	42	25	35	---	210	21	53	13	---	.3	Ca-Mg HCO_3
59	27S/12E - F02	1	10-14-80	---	---	---	7.5	490	---	44	34	52	---	190	17	80	18	---	.3	Mg-Na HCO_3
60	27S/12E - 03P	1	12-16-76	---	---	---	7.3	490	---	31	25	71	2.1	250	44	60	.9	1.8	.2	Na-Mg HCO_3
61	27S/12E - 04D0X	1	11-06-80	21.1	70	350	7.9	455	---	65	41	30	2	328	19	69	14	.1	.5	Mg-Ca HCO_3
62	27S/12E - 04E0A	1	01-30-81	---	---	---	7.8	441	---	96	23	22	1.4	334	8.0	60	28.2	0	.5	Ca HCO_3
63	27S/12E - 04E0B	1	01-30-81	---	---	---	7.6	659	---	98	52	52	3.3	383	8.0	170	24.6	.1	.4	Ca-Mg HCO_3
64	27S/12E - 04N0A	1	04-09-79	---	---	---	7.8	950	---	138	22	42	2.4	310	69	217	38	.2	.1	CaCl-HCO_3
65	27S/12E - 04K02	1	10-14-80	---	---	---	7.7	805	---	62	40	127	---	310	95	132	27	---	.6	Na-Ca HCO_3-Cl
66	27S/12E - 04K0X	1	11-07-80	17.8	64	---	7.7	1020	---	149	62	95	2.8	401	150	208	63	.3	.2	Ca-Mg HCO_3-Cl
67	27S/12E - 05B	1	01-30-81	---	---	---	7.8	470	---	70	44	40	5.5	469	30	29	.4	0	.2	Mg-Ca HCO_3
68	27S/12E - 05F0A	1	11-05-80	21.1	70	350	8.2	312	---	48	31	15	2.5	252	12	37	12.4	0	.9	Mg-Ca HCO_3
69	27S/12E - 05G0A	1	08-20-80	26.1	79	---	8.1	354	---	54	34	16	3	278	22	36	9.8	0	.6	Mg-Ca HCO_3
70	27S/12E - 05G0B	1	08-20-80	18.3	65	320	8.4	665	---	77	42	20	5	326	74	49	3.1	0	.3	Ca-Mg HCO_3
71	27S/12E - 05H0C	1	12-14-75	---	---	---	7.3	490	---	56	32	68	12	340	64	23	10	.1	.1	Na-Ca HCO_3
72	27S/12E - 05K0X	1	03-27-80	21.1	70	Perforated to 235	8.1	500	---	77	48	28	4.6	350	33	86	9.9	0	.6	Mg-Ca HCO_3
73	27S/12E - 05R	1	03-27-80	---	---	---	7.8	690	---	81	47	106	10.2	---	135	54	1.9	.1	.4	Na-Ca HCO_3
74	27S/12E - 06H0A	1	03-27-80	18.3	65	---	7.6	1280	---	185	48	170	4	290	154	414	63.6	.1	.4	Ca-NaCl
75	27S/12E - 06H0B	1	03-27-80	13.3	56	---	7.9	386	---	79	13	15	.9	231	7	28	54	0	.6	Ca HCO_3
76	27S/12E - 09M02	1	10-14-80	---	---	---	7.8	543	---	92	35	10	---	210	100	50	18	---	.3	Ca HCO_3-SO_4
77	27S/12E - 09N	1	02-05-80	---	---	---	8.2	875	---	15	9.2	260	---	450	10	141	9	---	.5	Na HCO_3
78	27S/12E - 10A0X	1	08-21-80	24.4	76	220	7.9	368	---	57	30	24	1.0	281	15	45	7.3	.1	.3	Ca-Mg HCO_3
79	27S/12E - 10B0A	1	11-06-80	28.3	83	---	8.1	547	---	14	8.0	188	4.5	407	58	61	.3	.7	.6	Na HCO_3
80	27S/12E - 10B0C	1	11-06-80	23.3	74	350	8.1	477	---	44	27	84	3.1	362	37	49	1.9	.3	.3	Na-Mg HCO_3
81	27S/12E - 10B0D	1	11-06-80	21.1	70	300	7.9	345	---	57	32	28	1.0	299	24	46	6.4	.1	.3	Ca-Mg HCO_3
82	27S/12E - 10H0A	1	11-06-80	---	---	---	8.2	642	---	18	11	195	4.2	399	63	92	.5	.7	.6	Na HCO_3
83	27S/12E - 10J0A	1	11-06-80	20.5	69	---	7.5	767	---	79	26	173	4.0	513	80	129	.3	1	.3	Na HCO_3
84	27S/12E - 11L0A	1	11-06-80	34.4	94	1120	8.2	767	---	5	1.0	276	2.9	399	126	113	.4	1.1	1.4	Na HCO_3
85	27S/12E - 12P0A	1	11-06-80	23.3	74	275	8.2	329	---	45	29	39	1.4	291	34	31	.4	.1	.3	Mg-Ca HCO_3
86	27S/12E - 14A01S	1	01-24-80	37.2	99	840	8.3	749	99	5	1.0	260	3.4	310	124	105	.8	1.3	1.4	Na HCO_3

87	27S/12E - 14M0A	1	11-07-80	21.1	71	200	7.6	860	---	38	14	250	10.1	465	157	108	.5	1.1	1.3	Na HCO_3
88	27S/12E - 14M0B	1	11-07-80	17.8	64	---	8.1	410	---	88	12	33	.9	172	25	108	27	.1	.2	CaCl-HCO_3
89	27S/12E - 14N0A	1	11-07-80	20	68	92	8.0	516	---	74	16	84	2.3	212	142	80	1.3	.4	.5	Ca-Na HCO_3-SO_4
90	27S/12E - 15G01S	1	01-23-80	34.4	94	Spring	8.3	862	91	4	1.0	320	3.1	365	141	134	.3	1.3	1.8	Na HCO_3
91	27S/12E - 15J	1	11-07-80	---	---	---	7.5	542	---	52	15	100	2.7	253	98	70	0	.4	.4	Na HCO_3
92	27S/12E - 20G01	1	06-29-77	---	---	---	7.0	823	---	27	33	70	2.1	330	114	74	4	.7	.3	---
93	27S/12E - 20G03	1	04-16-80	---	---	---	8.6	87.5	---	79	44	122	---	340	130	62	4	0	.4	---
94	27S/12E - 22K	1	04-11-78	---	---	---	7.9	735	---	51	27	137	1.8	341.6	165	34	4	.5	.2	Na HCO_3
95	27S/12E - 22M01	1	04-11-78	20	68	500	8.1	578	---	61	26	53	1.8	291.6	49	77	22	.2	.2	Ca-Na HCO_3
96	27S/12E - 28A01	1	04-11-78	---	---	---	8.0	840	---	75	13	126	5.9	292.8	158	81	12	.2	.3	Na HCO_3-SO_4
97	27S/12E - 28Q01	1	04-11-78	---	---	---	7.9	403	---	45	21	34	1.8	280.6	19	34	15	.2	.2	Ca-Mg HCO_3
98	27S/12E - 29P02	1	12-06-76	---	---	---	7.6	720	---	97.5	39	84.5	---	315	213.6	73.9	2.2	---	.6	Ca-Na HCO_3-SO_4
99	27S/12E - 29P04	1	07-07-77	---	---	---	7.5	805	---	63	41	32	2.4	250	172	72	4	.8	.3	Ca-Mg HCO_3-SO_4
100	27S/12E - 29P06	1	07-07-77	---	---	---	7.7	667	---	38.8	73.4	76	.01	239	188.1	54.6	.02	---	.44	Mg HCO_3-SO_4
101	27S/12E - 31D0A	1	05-02-79	---	---	---	8.1	963	---	118	53	28	28	420	300	82	13	.3	.1	Ca-Mg HCO_3-SO_4
102	27S/12E - 31K0A	1	07-19-79	---	---	---	8.3	1155	---	96	32	220	---	350	263	103	18	---	.4	Na HCO_3-SO_4
103	27S/12E - 33G01	1	04-11-78	---	---	---	7.6	368	---	57	20	14	.7	317.2	3.0	24	10	.2	.3	Ca HCO_3
104	25S/12E - 26D01	2	06-08-67	21	69	280	7.7	385	---	47	38	39	2	271	36	53	25	.19	.4	---
105	25S/12E - 26K01	2	05-31-54	21	70	250	7.8	289	---	31	21	48	1	238	22	32	6.2	.32	.2	---
106	25S/12E - 26L01	2	05-05-66	21	70	Perforated 200-400	8.1	326	---	36	26	39	2	244	19	41	.0	.23	.2	---
107	25S/12E - 26N01	2	10-20-64	21	70	---	8.3	408	---	20	20	99	2	278	54	32	5	.74	.2	---
108	25S/12E - 27F03	2	06-08-67	22	72	---	8.0	562	---	46	50	73	2	327	102	71	15	.40	.6	---
109	25S/12E - 28B01	2	05-04-65	22	72	---	7.9	912	47	52	76	145	5	378	221	144	16	.59	.2	---
110	25S/13E - 35D01	2	08-29-68	24	75	380	7.9	407	---	27	40	69	2	334	46	39	.6	.42	.5	---
111	25S/13E - 35E01	2	07-22-54	30	86	380	7.9	508	---	48	28	63	3	332	44	43	1.2	.32	.4	---
112	26S/12E - 03K03	2	04-26-65	21	70	210	8.2	316	---	39	22	39	9	230	15	58	7	.16	.2	---
113	26S/12E - 14G01	2	10-20-75	28.9	84	790	8.0	639	---	29	12	182	1.2	334	172	44	.0	1.07	.4	---
114	26S/12E - 21L02S	2	01-09-68	48	118	---	7.0	2359	---	103	3	690	21	106	543	814	2	10.8	5.8	---
115	26S/12E - 21L01	2	08-03-64	21	70	---	7.4	1121	---	85	27	330	6	574	168	270	3	.85	.6	---
116	26S/12E - 22P02	2	10-15-76	23.3	74	300	8.1	369	---	39	26	69	2	276	30	61	16	.30	.3	---
117	26S/13E - 04K01	2	09-02-53	21	70	320	8.0	1186	---	82	61	191	3	315	310	201	21.7	.65	.6	---
118	26S/13E - 10D01	2	08-28-57	24	75	1012	8.1	438	---	20	12	138	8	305	109	37	6.8	1.15	.3	---
119	26S/13E - 11L01	2	11-10-71	32	90	---	8.0	652	---	11	10	208	1.9	373	160	32	.2	1.17	.6	---
120	26S/13E - 28J01	2	09-22-68	23	74	440	7.4	324	28	34	26	49	2	254	24	45	0	.3	0	---
121	26S/13E - 28L02	2	10-20-76	16.7	62	400	8.0	290	---	36	25	47	2	248	24	47	1.4	.17	.3	---
122	27S/12E - 04B01	2	08-19-53	20	68	---	7.5	725	---	41	14	198	2	389	131	90	3.1	.75	.9	---
123	27S/12E - 04K05	2	06-08-67	24	76	---	7.6	645	---	86	48	48	2	338	49	116	23	.14	.3	---
124	27S/12E - 34P01	2	06-07-67	22	72	---	7.9	491	---	82	30	52	2	316	45	82	16.5	.04	.2	---
125	27S/13E - 09K01	2	10-20-75	27.2	81	---	8.2	584	---	8.6	2.8	198	2	369	86	50	.7	3.18	1.7	---
126	25S/12E - 21L01	2	06-06-67	19	67	---	7.9	1891	---	162	114	267	7	405	610	337	24.5	1.19	.6	---
127	25S/12E - 28N01	2	10-31-67	18	65	---	8.0	854	---	67	58	134	5	278	268	128	2	.43	.4	---
128	25S/12E - 28N04	2	04-13-72	16	61	---	8.0	1339	---	163	87	163	2.5	498	428	182	12	.54	.5	---

WELL NO.	MDB&M LOCATION	REFERENCE*[1]	DATE SAMPLED	SURFACE TEMPERATURE °C	°F	TOTAL DEPTH FEET	pH (LAB)	TDS	SiO_2	Ca	Mg	Na	K	HCO_3	SO_4	Cl	NO_3	B	F	CHEMICAL CHARACTERISTICS
									ppm											
129	25S/12E - 32A01	2	06-06-67	17	63	---	7.9	646	---	54	45	108	2	303	179	72	8	.50	.5	---
130	25S/12E - 32K01	2	10-08-75	17.8	64	Perforated 100-120	8.1	544	---	57	32	74	2	274	116	53	27	.93	.4	---
131	25S/12E - 33Q02	2	06-06-67	16	60	105	7.6	1524	---	153	112	227	2	655	415	277	.0	.58	.1	---
132	25S/12E - 35C01	2	10-21-64	---	---	100	8.2	1282	---	92	59	300	6	575	345	196	12	1.09	.2	---
133	25S/13E - 19R01	2	11-05-70	11.1	52	230	8.3	295	---	33	28	35	1.8	234	11	38	25.5	.02	.6	---
134	27S/13E - 13Q01	2	06-07-67	22	72	148	10	228	---	4	1	71	3	67	29	35	.0	.06	.2	---
135	26S/13E - 30B01	2	10-06-75	23.9	75	---	8.2	427	---	22	11	110	.8	281	67	29	3.1	1.2	.5	---
136	27S/13E - 17Q01	2	06-07-67	22	71	104	7.7	378	---	50	27	53	2	296	18	62	8.5	.05	.2	---
137	27S/13E - 20R01	2	06-07-67	22	72	---	7.7	341	---	49	28	31	2	285	13	30	12	.0	.2	---
138	27S/13E - 26Q01	2	06-07-67	21	70	---	8.1	312	---	53	21	29	2	228	39	31	11.5	.04	.2	---
139	28S/12E - 10A03	2	10-31-73	21.1	70	---	7.9	389	---	60	31	28	1.5	245	90	30	7	0	.2	---
140	28S/13E - 04K02	2	06-07-67	20	68	552	7.9	425	---	60	27	30	1	290	7	75	9	.05	.6	---
141	28S/13E - 04K03	2	06-07-67	21	70	---	8	381	---	51	30	49	2	320	10	56	7.5	.08	.4	---
142	26S/12E - 09F03	2	06-08-67	18	65	123	7.6	435	---	65	27	43	2	256	97	37	2	.04	.4	---
143	26S/12E - 09L01	2	04-01-65	---	---	---	7.5	590	---	66	28	98	2	303	115	87	10	.41	.5	---
144	25S/12E - 19B01	2	10-08-53	---	---	---	8.3	473	---	64	39	35	.4	238	31	92	16.5	.6	.5	---
145	25S/12E - 35E01	2	06-08-67	20	68	30	7.8	1447	---	98	69	290	4	374	442	268	6.5	.90	.6	---
146	26S/12E - 03L01	2	04-26-65	---	---	---	8.1	986	---	91	48	170	19	328	274	183	0	.78	.2	---
147	26S/12E - 05A02	2	06-06-67	20	68	---	8.2	522	---	88	28	42	2	229	137	53	11	.11	.3	---
148	26S/12E - 20AS	3	01-07-81	25	77	Spring	8.2	2240	---	14	2.3	740	10	---	175	700	17	2	3.2	---
149	26S/12E - 09R01	2	06-08-67	18	64	---	7.6	886	---	103	47	147	2	475	153	141	24	.35	.3	---
150	26S/12E - 14G02	2	04-02-64	---	---	---	8.3	455	---	20	12	120	1.7	233	76	38	77.5	---	.4	---
151	26S/12E - 16C01	2	07-15-64	---	---	---	7.5	752	38	97	43	102	2	457	103	114	11	.3	.5	---
152	26S/12E - 16C02	2	07-15-64	---	---	---	7.6	1170	39	46	15	368	4	550	230	189	1	1.9	3	---
153	26S/12E -16C04	2	06-08-67	20	68	156	8.1	1265	43	174	61	94	2	324	144	217	185	.25	.4	---
154	26S/12E - 16F01	2	07-15-64	---	---	---	7.4	682	43.	98	34	61	2	265	82	119	67	.21	.3	---
155	26S/12E - 20A01S	2	06-06-67	43	110	Spring	7.3	2353	---	108	2	680	9	105	531	817	1	4.55	5	---
156	26S/12E - 20A02S	2	09-20-62	42	106	55	7.1	3760	85.	116	1	720	11	56	558	840	2.9	9.2	4.9	---
157	26S/12E - 21D01	2	06-02-71	22	71	---	8.5	1020	---	34	16	320	4.5	473	198	170	0	1.4	2	---
158	26S/12E - 21D02	2	11-09-71	20	68	---	8.0	1190	---	88	42	306	6	485	168	336	5.5	.78	.9	---
159	26S/12E - 21L02S	2	09-19-62	42	108	---	8.7	---	79.	5	1	465	5	578	252	184	1	2	2.7	---
160	26S/12E - 21L99	2	10-20-66	---	---	---	8.4	641	---	39	17	170	3	405	68	86	2.4	.9	---	---
161	26S/12E - 22P01	2	11-01-72	20	66	390	7.9	411	---	32	24	82	1.9	282	37	60	13	.24	.3	---
162	28S/12E - 10H03	2	07-15-64	20	68	96	8.2	574	---	32	74	39	1	342	110	58	7	.07	.1	---
163	28S/12E - 10R02	2	10-09-64	---	---	40	7.9	578	27	79	49	40	1	323	134	52	2	.08	.5	---
164	26S/12E - 33Q01	2	11-09-71	18	65	80	8.3	869	---	108	48	142	2.7	502	183	127	6	.51	.6	---
165	26S/12E - 33Q02	2	05-06-65	18	64	80	7.8	464	---	75	28	25	1	297	38	50	0	.12	.2	---
166	26S/13E - 04F01	2	09-04-53	---	---	---	8.0	540	---	45	17	115	2	289	90	69	13.6	.65	.5	---
167	26S/13E - 04J01S	2	10-08-64	---	---	---	8.1	965	50	111	33	165	4	378	280	109	18	1.25	.3	---
168	26S/13E - 10D02	2	09-06-67	20	68	---	8.0	906	29	112	68	60	3	393	170	123	19	.43	0	---
169	26S/13E - 11C01	2	09-04-53	---	---	---	7.7	1189	---	112	73	202	6	565	250	217	.6	.9	.4	---
170	26S/13E - 11F01	2	11-05-73	26.6	80	890	8.5	650	---	12	9.5	212	2	355	167	30	.4	1.2	.7	---

171	26S/13E - 11F02	2	09-04-53	---	---	---	7.5	1034	---	95	60	145	3	317	291	168	9.3	1.05	.4	---
172	26S/14E - 18J01	2	10-06-66	24	75	---	8.6	443	---	25	15	110	3	228	109	33	1.2	.5	---	---
173	26S/14E - 18G01	2	10-06-66	25	77	---	8.5	416	---	30	9	104	3	254	61	33	4.1	.5	---	---
174	27S/12E - 03C01	2	06-09-54	18	64	131	8.0	1376	---	114	62	59	2	257	10	309	13.6	.15	.2	---
175	27S/12E - 03C02	2	10-01-64	---	---	400	7.9	473	48	58	38	42	2	308	15	81	9	.10	.4	---
176	27S/12E - 04F01	2	10-05-50	---	---	40	7.3	---	22	90	38	108	---	421	128	98	---	.35	---	---
177	27S/12E - 04F04	2	10-76	15.5	60	60	7.8	678	---	58	33	145	2.3	317	185	101	5.3	.70	.5	---
178	27S/12E - 04P02	2	05-03-65	17	62	19	8	576	---	54	22	125	2	338	133	57	.0	.37	.6	---
179	28S/12E - 11N07	2	10-21-68	19	67	---	7.7	540	---	79	44	43	2	312	118	59	1.6	.08	.3	---
180	26S/12E - 27H0B	1	08-20-80	20	68	400	8.5	514	---	22	12	152	2.9	---	108	49	.7	.7	.3	---
181	27S/12E - 21B01	2	10-27-77	14	58	---	7.7	800	---	149	58	48	3	385	240	102	5	.12	.5	---
182	27S/12E - 21G01	2	05-06-65	16	61	130	7.7	990	---	94	77	125	3	429	237	128	35	.42	.2	---
183	27S/12E - 21N01	2	05-06-65	16	60	---	8.1	706	---	129	50	45	1	367	248	52	3	.17	.2	---
184	27S/12E - 21N04	2	10-03-66	16	60	---	8.4	611	---	113	47	41	2	310	217	48	2.5	.1	---	---
185	26S/12E - 33F0D	5	03-65	40.5	105	230	7.4	1164	---	19	18.1	432.6	---	890.6	4.3	---	0	---	---	---
186	27S/12E - 29P02	2	11-04-71	18	64	---	8	657	---	126	41	40	1.5	316	207	62	6	.07	.5	---
187	27S/12E - 29P03	2	05-06-65	16	61	36	7.6	646	---	102	64	42	2	338	235	65	1	.11	.2	---
188	27S/12E - 29P04	2	07-10-63	15	59	---	7.5	548	18	87	37	32	2	293	154	30	2.7	.13	.2	---
189	27S/12E - 32C03	2	07-11-63	17	62	40	7.4	654	23	113	38	37	1	314	169	41	3.2	.11	.2	---
190	27S/12E - 32C04	2	07-11-63	16	60	42	7.6	1084	21	131	79	46	2	360	352	62	14	.1	.2	---
191	27S/12E - 32E01	2	07-08-60	---	---	---	---	1408	32	194	66	47	1	328	467	83	10.4	.13	.2	---
192	27S/12E - 32F02	2	05-06-65	16	60	60	7.5	650	---	85	61	41	2	329	?	50	3	.14	.2	---
193	27S/12E - 32Q01	2	07-10-63	17	63	28	8.0	620	19	69	49	35	1	253	180	?	0	.08	.2	---
194	27S/12E - 32Q03	2	05-07-65	16	60	---	7.6	526	---	64	50	35	1	250	157	46	3	.08	.2	---
195	27S/12E - 33N01	2	05-07-65	17	63	248	7.7	870	---	106	75	59	3	420	231	89	2	.14	.1	---
196	27S/13E - 09P01	2	10-04-64	---	---	120	8.2	418	45	13	9	130	2	359	20	21	5	.37	.3	---
197	27S/13E - 24N01	2	09-11-53	---	---	---	7.9	356	---	58	17	32	2	229	23	46	12.4	.25	.3	---
198	27S/13E - 36R01	2	09-27-63	---	---	---	7.4	520	60	105	17	40	2.6	312	48	69	19	.06	.5	---
199	28S/12E - 04G01	2	05-06-65	16	60	---	7.4	536	---	61	38	32	1	263	103	37	0	.05	.2	---
200	28S/12E - 04J02	2	07-10-63	14	58	86	7.7	480	22	106	34	25	1	229	136	22	2.3	.09	.1	---
201	28S/12E - 10G01	2	05-31-54	16	61	---	7.5	408	---	59	29	30	1	255	78	33	4.3	.00	.1	---

FOOTNOTES:

*[1] REFERENCES

1. California Department of Water Resources, 1981, Water quality in The Paso Robles Area: Memorandum Report, 116 p.
2. California Department of Water Resources, 1979, Ground water in The Paso Robles Basin: District Report, 88 p.
3. Thorpe Labs, 1981, Personal communication, Paso Robles, California.
4. California Division of Oil and Gas, Open Well Records.
5. Horn Kohl Labs Inc., 1980, Personal communication, Bakersfield, California.
6. California Division of Mines and Geology, 1982, field investigation.

**[2] Bottom Hole Temperature

APPENDIX B
TEMPERATURE LOGS

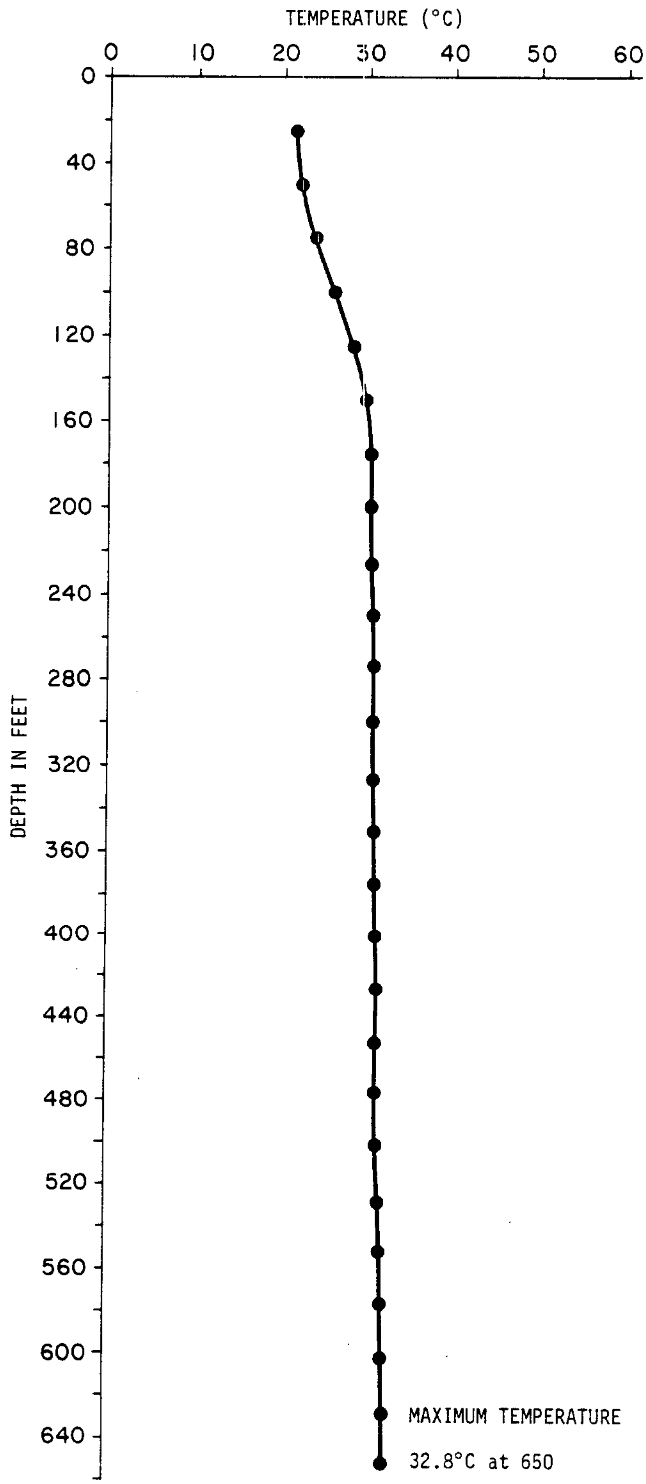
TEMPERATURE SURVEY

WELL NO: 40 RECORDED BY: E. Leivas

LOCATION: 26S/12E - 29COB DATE: 07-06-81

TOTAL DEPTH: 650

WATER LEVEL: 24



TEMPERATURE SURVEY

RECORDED BY: L. F. Campion

L. G. Youngs

WELL NO: 50 (Borcherdt)

DATE: 04-06-82

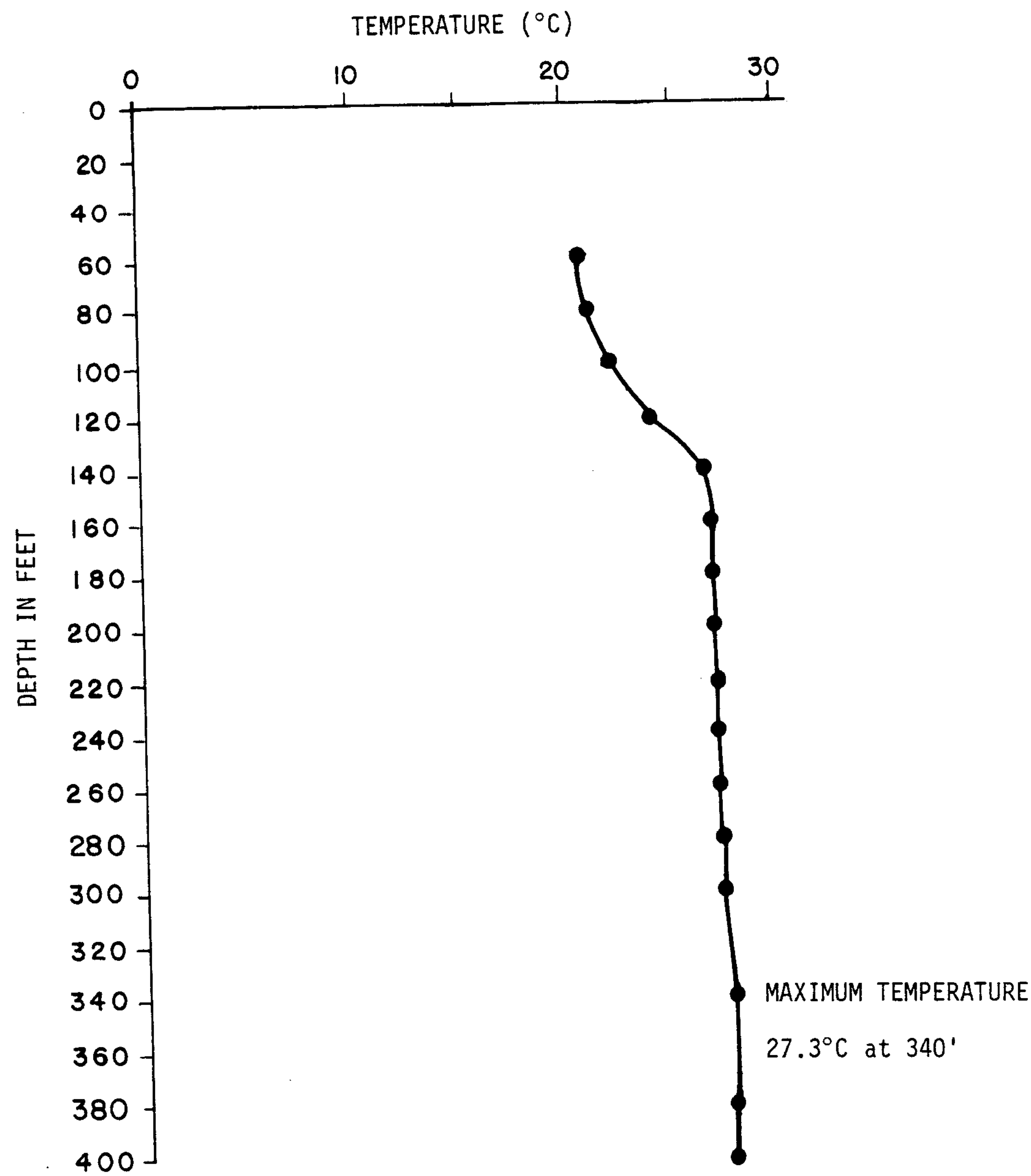
LOCATION: 27S/12E - 22R

TOTAL DEPTH: 400'

WATER LEVEL: 46'

LAST PUMPED: November, 1981

PUMP AT: 135'

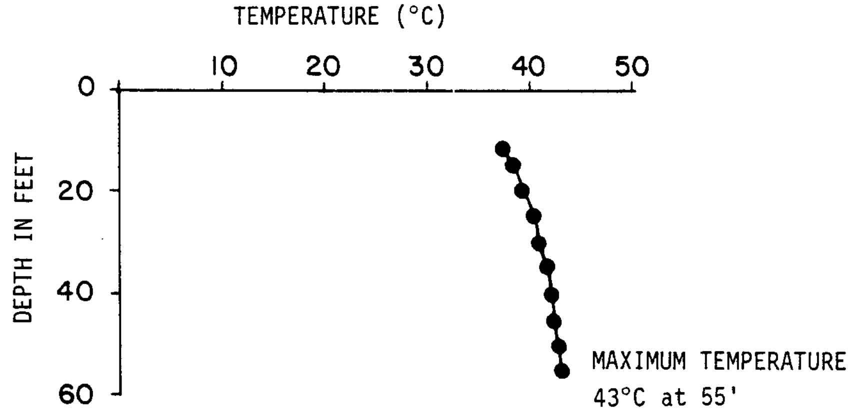


TEMPERATURE SURVEY

RECORDED BY: L. F. Campion
L. G. Youngs

WELL NO: 10 (*[1] P.R.H.S. Main) DATE: 03-10-82

LOCATION: 26S/12E - $28L_1S$
TOTAL DEPTH: 55'
WATER LEVEL: 11'
LAST PUMPED: 30 minutes before survey
PUMP AT: 42'



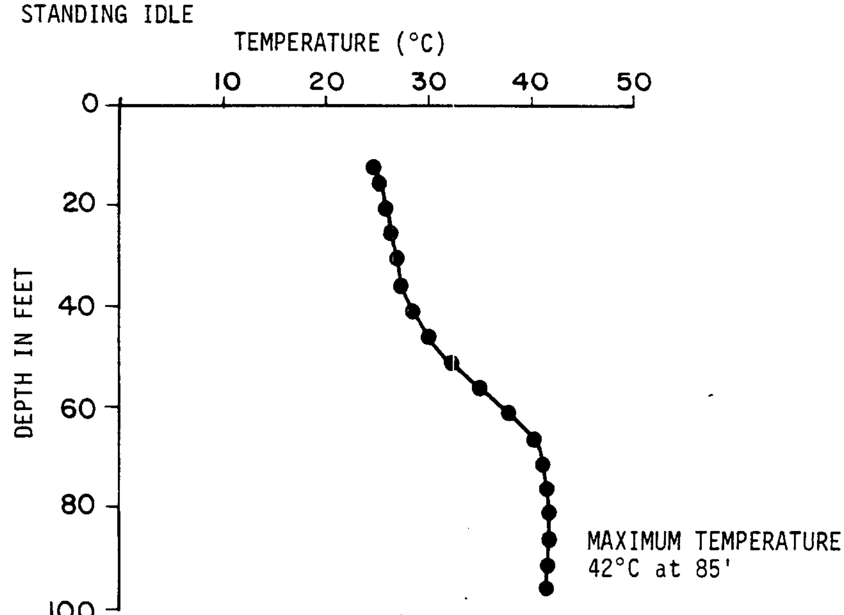
*[1] P.R.H.S. - PASO ROBLES HOT SPRINGS

TEMPERATURE SURVEY

RECORDED BY: L. F. Campion
L. G. Youngs

WELL NO: 49 (*[1] P.R.H.S. Stand by) DATE: 03-10-82

LOCATION: 26S/12E - 20A
TOTAL DEPTH: 95'
WATER LEVEL: 12'
STANDING IDLE



*[1] P.R.H.S. - PASO ROBLES HOT SPRINGS

TEMPERATURE SURVEY

WELL NO: 303 (Borkey)

LOCATION: 26S/12E - Sec 22L

TOTAL DEPTH: 800'

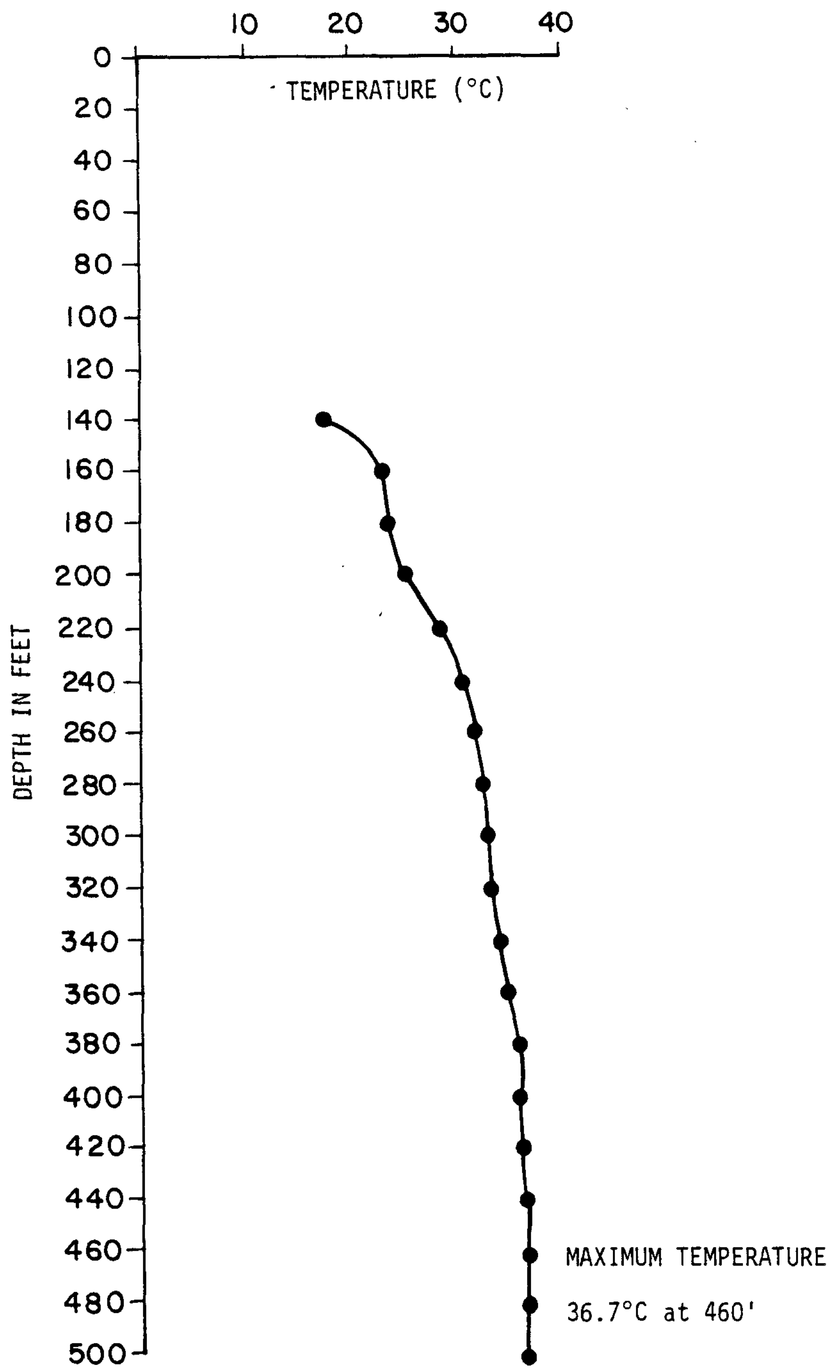
WATER LEVEL: 140'

LAST PUMPED: 1975

RECORDED BY: L. F. Campion

L. G. Youngs

DATE: 03-10-82



APPENDIX C

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

```
RECORD NO.......       4
NAME OF SOURCE..  26S/12E-4DA
STATE.......... CALIF
COUNTY......... SLO

WATER TEMPERATURE...          PH.....   8.1

WATER CHEMISTRY
   SIO2...      0.0
   NA.....     44.00
   K......      1.70
   CA.....    114.00
   MG.....     65.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.        NA-K...........    116.
            ADIABATIC.....     0.        NA-K-CA(1/3)...    104.
            CHALCEDONY....     0.        NA-K-CA(4/3)...     10.
            CRISTOBALITE..     0.        MG CORRECTED
            AMORPHOUS.....     0.        NA-K-CA(1/3)...     26.
```

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 5
NAME OF SOURCE.. 26S/12E-8GA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.4

WATER CHEMISTRY

SIO2...	0.0
NA.....	67.00
K......	3.00
CA.....	44.00
MG.....	30.00

GEOTHERMOMETERS (DEGREES C)

SILICA - CONDUCTIVE....	0.	NA-K...........	124.
ADIABATIC.....	0.	NA-K-CA(1/3)...	122.
CHALCEDONY....	0.	NA-K-CA(4/3)...	42.
CRISTOBALITE..	0.	MG CORRECTED	
AMORPHOUS.....	0.	COOL	

RECORD NO....... 6
NAME OF SOURCE.. 26S/12E-8R
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.6

WATER CHEMISTRY

SIO2...	0.0
NA.....	154.00
K......	3.00
CA.....	22.00
MG.....	11.00

GEOTHERMOMETERS (DEGREES C)

SILICA - CONDUCTIVE....	0.	NA-K...........	82.
ADIABATIC.....	0.	NA-K-CA(1/3)...	104.
CHALCEDONY....	0.	NA-K-CA(4/3)...	63.
CRISTOBALITE..	0.	MG CORRECTED	
AMORPHOUS.....	0.	NA-K-CA(1/3)...	33.
		NA-K-CA(4/3)...	49.

RECORD NO....... 7
NAME OF SOURCE.. 26S/12E-18L1S
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.3

WATER CHEMISTRY

SIO2...	0.0
NA.....	762.00
K......	9.80
CA.....	54.00
MG.....	10.00

GEOTHERMOMETERS (DEGREES C)

SILICA - CONDUCTIVE....	0.	NA-K...........	65.
ADIABATIC.....	0.	NA-K-CA(1/3)...	103.
CHALCEDONY....	0.	NA-K-CA(4/3)...	99.
CRISTOBALITE..	0.	MG CORRECTED	
AMORPHOUS.....	0.	NA-K-CA(1/3)...	80.
		NA-K-CA(4/3)...	81.

RECORD NO....... 8
NAME OF SOURCE.. 26S/12E-20AXS
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.6

WATER CHEMISTRY

SIO2...	70.00
NA.....	215.00
K......	3.80
CA.....	126.00
MG.....	41.00

GEOTHERMOMETERS (DEGREES C)

SILICA - CONDUCTIVE....	118.	NA-K...........	78.
ADIABATIC.....	117.	NA-K-CA(1/3)...	94.
CHALCEDONY....	90.	NA-K-CA(4/3)...	40.
CRISTOBALITE..	68.	MG CORRECTED	
AMORPHOUS.....	0.	NA-K-CA(1/3)...	52.

REFERENCE:
RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

```
RECORD NO.......       9
NAME OF SOURCE..  26S/12E-20A1S
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...          PH.....   8.3

WATER CHEMISTRY
   SIO2...        81.00
   NA.....       360.00
   K......         6.40
   CA.....       127.00
   MG.....        33.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....   126.        NA-K...........      78.
            ADIABATIC.....   123.        NA-K-CA(1/3)...     101.
            CHALCEDONY....    98.        NA-K-CA(4/3)...      59.
            CRISTOBALITE..    75.        MG CORRECTED
            AMORPHOUS.....     7.        NA-K-CA(1/3)...      61.
```

```
RECORD NO.......       10
NAME OF SOURCE..  26S/12E-20A2S
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...          PH.....   7.4

WATER CHEMISTRY
   SIO2...       113.00
   NA.....       725.00
   K......        11.00
   CA.....       112.00
   MG.....         0.0
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....   144.        NA-K...........      71.
            ADIABATIC.....   139.        NA-K-CA(1/3)...     104.
            CHALCEDONY....   118.        NA-K-CA(4/3)...      86.
            CRISTOBALITE..    94.        MG CORRECTED
            AMORPHOUS.....    23.        NONE
```

```
RECORD NO.......       11
NAME OF SOURCE..  26S/12E-20F1
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...          PH.....   8.2

WATER CHEMISTRY
   SIO2...         0.0
   NA.....        26.00
   K......         0.60
   CA.....        70.00
   MG.....        28.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.        NA-K...........      90.
            ADIABATIC.....     0.        NA-K-CA(1/3)...      83.
            CHALCEDONY....     0.        NA-K-CA(4/3)...      -7.
            CRISTOBALITE..     0.        MG CORRECTED
            AMORPHOUS.....     0.        NA-K-CA(1/3)...      47.
```

```
RECORD NO.......       12
NAME OF SOURCE..  26S/12E-20L
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...          PH.....   8.0

WATER CHEMISTRY
   SIO2...         0.0
   NA.....        16.00
   K......         0.60
   CA.....        58.00
   MG.....        28.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.        NA-K...........     115.
            ADIABATIC.....     0.        NA-K-CA(1/3)...      95.
            CHALCEDONY....     0.        NA-K-CA(4/3)...      -8.
            CRISTOBALITE..     0.        MG CORRECTED
            AMORPHOUS.....     0.        NA-K-CA(1/3)...      35.
```

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 13
NAME OF SOURCE.. 26S/12E-20M
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.8

WATER CHEMISTRY

SIO2...	0.0
NA.....	20.00
K......	0.70
CA.....	72.00
MG.....	26.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	111.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	94.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	-6.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	47.

RECORD NO....... 14
NAME OF SOURCE.. 26S/12E-20PB
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.6

WATER CHEMISTRY

SIO2...	0.0
NA.....	144.00
K......	1.60
CA.....	78.00
MG.....	21.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	59.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	77.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	23.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	67.

RECORD NO....... 15
NAME OF SOURCE.. 26S/12E-20NA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.4

WATER CHEMISTRY

SIO2...	0.0
NA.....	28.00
K......	0.90
CA.....	94.00
MG.....	36.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	106.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	93.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	-3.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	45.

RECORD NO....... 16
NAME OF SOURCE.. 26S/12E-20NB
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.3

WATER CHEMISTRY

SIO2...	0.0
NA.....	90.00
K......	1.50
CA.....	84.00
MG.....	24.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	75.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	85.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	17.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	61.

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 17
NAME OF SOURCE.. 26S/12E-20Q
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.7

WATER CHEMISTRY

SIO2...	0.0
NA.....	345.00
K......	4.60
CA.....	131.00
MG.....	43.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	66.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	90.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	49.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	53.

RECORD NO....... 18
NAME OF SOURCE.. 26S/12E-20QA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.0

WATER CHEMISTRY

SIO2...	0.0
NA.....	340.00
K......	5.20
CA.....	142.00
MG.....	41.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	72.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	94.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	50.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	58.

RECORD NO....... 19
NAME OF SOURCE.. 26S/12E-20PA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.0

WATER CHEMISTRY

SIO2...	0.0
NA.....	150.00
K......	0.0
CA.....	74.00
MG.....	35.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	0.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	0.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	0.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NONE	

RECORD NO....... 20
NAME OF SOURCE.. 26S/12E-21DA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.0

WATER CHEMISTRY

SIO2...	0.0
NA.....	357.00
K......	4.80
CA.....	60.00
MG.....	31.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	66.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	95.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	65.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	34.
			NA-K-CA(4/3)...	46.

REFERENCE:
RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

```
RECORD NO.......      21
NAME OF SOURCE..  26S/12E-21D1S
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...           PH.....   8.1

WATER CHEMISTRY
   SIO2...      103.00
   NA.....      500.00
   K......        5.90
   CA.....        5.00
   MG.....        1.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....   139.       NA-K...........      61.
            ADIABATIC.....   134.       NA-K-CA(1/3)...     110.
            CHALCEDONY....   112.       NA-K-CA(4/3)...     137.
            CRISTOBALITE..    88.       MG CORRECTED
            AMORPHOUS.....    18.       NA-K-CA(1/3)...      93.
                                    NA-K-CA(4/3)...     93.
```

```
RECORD NO.......      22
NAME OF SOURCE..  26S/12E-21L2S
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...           PH.....   8.3

WATER CHEMISTRY
   SIO2...       97.00
   NA.....      370.00
   K......        4.80
   CA.....       34.00
   MG.....       18.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....   136.       NA-K...........      65.
            ADIABATIC.....   131.       NA-K-CA(1/3)...      98.
            CHALCEDONY....   109.       NA-K-CA(4/3)...      77.
            CRISTOBALITE..    85.       MG CORRECTED
            AMORPHOUS.....    15.       NA-K-CA(1/3)...      33.
                                    NA-K-CA(4/3)...     41.
```

```
RECORD NO.......      23
NAME OF SOURCE..  26S/12E-21P1S
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...           PH.....   8.4

WATER CHEMISTRY
   SIO2...      105.00
   NA.....      420.00
   K......        7.00
   CA.....        4.80
   MG.....        0.0
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....   140.       NA-K...........      75.
            ADIABATIC.....   135.       NA-K-CA(1/3)...     121.
            CHALCEDONY....   114.       NA-K-CA(4/3)...     144.
            CRISTOBALITE..    89.       MG CORRECTED
            AMORPHOUS.....    19.       NONE
```

```
RECORD NO.......      24
NAME OF SOURCE..  26S/12E-22BA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...           PH.....   7.7

WATER CHEMISTRY
   SIO2...        0.0
   NA.....       34.00
   K......        1.70
   CA.....       37.00
   MG.....       11.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.       NA-K...........     131.
            ADIABATIC.....     0.       NA-K-CA(1/3)...     118.
            CHALCEDONY....     0.       NA-K-CA(4/3)...      25.
            CRISTOBALITE..     0.       MG CORRECTED
            AMORPHOUS.....     0.       NA-K-CA(1/3)...      51.
```


REFERENCE:
RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

```
RECORD NO.......       25
NAME OF SOURCE..  26S/12E-22J1
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...          PH.....   7.3

WATER CHEMISTRY
   SIO2...        0.0
   NA.....      134.00
   K......        0.0
   CA.....       28.00
   MG.....       15.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....    0.     NA-K...........     0.
            ADIABATIC.....    0.     NA-K-CA(1/3)...     0.
            CHALCEDONY....    0.     NA-K-CA(4/3)...     0.
            CRISTOBALITE..    0.     MG CORRECTED
            AMORPHOUS.....    0.     NONE
```

```
RECORD NO.......       26
NAME OF SOURCE..  26S/12E-25EA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...          PH.....   7.1

WATER CHEMISTRY
   SIO2...        0.0
   NA.....       42.00
   K......        1.40
   CA.....       38.00
   MG.....       20.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....    0.     NA-K...........   108.
            ADIABATIC.....    0.     NA-K-CA(1/3)...   105.
            CHALCEDONY....    0.     NA-K-CA(4/3)...    22.
            CRISTOBALITE..    0.     MG CORRECTED
            AMORPHOUS.....    0.     NA-K-CA(1/3)...    29.
```

```
RECORD NO.......       27
NAME OF SOURCE..  26S/12E-25MA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...          PH.....   7.7

WATER CHEMISTRY
   SIO2...        0.0
   NA.....      152.50
   K......        1.30
   CA.....       22.50
   MG.....       11.60
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....    0.     NA-K...........    49.
            ADIABATIC.....    0.     NA-K-CA(1/3)...    75.
            CHALCEDONY....    0.     NA-K-CA(4/3)...    39.
            CRISTOBALITE..    0.     MG CORRECTED
            AMORPHOUS.....    0.     NA-K-CA(1/3)...    41.
```

```
RECORD NO.......       28
NAME OF SOURCE..  26S/12E-26AA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...          PH.....   7.6

WATER CHEMISTRY
   SIO2...        0.0
   NA.....       64.00
   K......        2.00
   CA.....       35.00
   MG.....       19.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....    0.     NA-K...........   105.
            ADIABATIC.....    0.     NA-K-CA(1/3)...   108.
            CHALCEDONY....    0.     NA-K-CA(4/3)...    35.
            CRISTOBALITE..    0.     MG CORRECTED
            AMORPHOUS.....    0.     NA-K-CA(1/3)...    28.
```

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 29
NAME OF SOURCE.. 26S/12E-26E1
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.4

WATER CHEMISTRY
SIO2... 0.0
NA..... 160.00
K...... 3.10
CA..... 20.00
MG..... 7.80
GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	82.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	105.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	66.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	43.
			NA-K-CA(4/3)...	59.

RECORD NO....... 30
NAME OF SOURCE.. 26S/12E-26EA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.5

WATER CHEMISTRY
SIO2... 0.0
NA..... 152.00
K...... 2.90
CA..... 22.00
MG..... 0.0
GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	81.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	103.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	61.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NONE	

RECORD NO....... 31
NAME OF SOURCE.. 26S/12E-27GA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.1

WATER CHEMISTRY
SIO2... 0.0
NA..... 340.00
K...... 4.50
CA..... 11.00
MG..... 0.0
GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	66.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	104.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	100.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NONE	

RECORD NO....... 32
NAME OF SOURCE.. 26S/12E-27HA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.7

WATER CHEMISTRY
SIO2... 0.0
NA..... 133.00
K...... 2.60
CA..... 29.00
MG..... 0.0
GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	82.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	101.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	52.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NONE	

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 33
NAME OF SOURCE.. 26S/12E-28AA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.9

WATER CHEMISTRY

SIO2...	0.0
NA.....	57.00
K......	2.00
CA.....	45.00
MG.....	0.0

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	111.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	110.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	30.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NONE	

RECORD NO....... 34
NAME OF SOURCE.. 26S/12E-28BA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.2

WATER CHEMISTRY

SIO2...	0.0
NA.....	290.00
K......	5.30
CA.....	24.00
MG.....	0.0

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	79.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	109.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	85.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NONE	

RECORD NO....... 35
NAME OF SOURCE.. 26S/12E-28C1S
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.2

WATER CHEMISTRY

SIO2...	82.00
NA.....	430.00
K......	8.20
CA.....	7.50
MG.....	0.0

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	126.	NA-K...........	81.
	ADIABATIC.....	124.	NA-K-CA(1/3)...	124.
	CHALCEDONY....	99.	NA-K-CA(4/3)...	138.
	CRISTOBALITE..	76.	MG CORRECTED	
	AMORPHOUS.....	7.	NONE	

RECORD NO....... 36
NAME OF SOURCE.. 26S/12E-28F1S
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.2

WATER CHEMISTRY

SIO2...	79.00
NA.....	430.00
K......	5.60
CA.....	5.50
MG.....	0.0

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	124.	NA-K...........	65.
	ADIABATIC.....	122.	NA-K-CA(1/3)...	111.
	CHALCEDONY....	96.	NA-K-CA(4/3)...	130.
	CRISTOBALITE..	74.	MG CORRECTED	
	AMORPHOUS.....	6.	NONE	

REFERENCE:
RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

```
RECORD NO.......      37
NAME OF SOURCE..  26S/12E-28L1S
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...            PH.....    8.8

WATER CHEMISTRY
   SIO2...       82.00
   NA.....      400.00
   K......        8.10
   CA.....        8.30
   MG.....        0.0
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....    126.        NA-K...........      84.
            ADIABATIC.....    124.        NA-K-CA(1/3)...     125.
            CHALCEDONY....     99.        NA-K-CA(4/3)...     133.
            CRISTOBALITE..     76.        MG CORRECTED
            AMORPHOUS.....      7.        NONE
```

```
RECORD NO.......      38
NAME OF SOURCE..  26S/12E-28QX
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...            PH.....    7.5

WATER CHEMISTRY
   SIO2...        0.0
   NA.....      120.00
   K......        2.50
   CA.....      122.00
   MG.....        0.0
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....      0.        NA-K...........      85.
            ADIABATIC.....      0.        NA-K-CA(1/3)...      93.
            CHALCEDONY....      0.        NA-K-CA(4/3)...      25.
            CRISTOBALITE..      0.        MG CORRECTED
            AMORPHOUS.....      0.        NONE
```

```
RECORD NO.......      39
NAME OF SOURCE..  26S/12E-29CA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...            PH.....    7.9

WATER CHEMISTRY
   SIO2...        0.0
   NA.....      488.00
   K......        3.00
   CA.....       83.00
   MG.....        9.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....      0.        NA-K...........      37.
            ADIABATIC.....      0.        NA-K-CA(1/3)...      71.
            CHALCEDONY....      0.        NA-K-CA(4/3)...      48.
            CRISTOBALITE..      0.        MG CORRECTED
            AMORPHOUS.....      0.        NONE
```

```
RECORD NO.......      40
NAME OF SOURCE..  26S/12E-29CB
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...            PH.....    8.7

WATER CHEMISTRY
   SIO2...        0.0
   NA.....      490.00
   K......        9.30
   CA.....        5.00
   MG.....        1.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....      0.        NA-K...........      81.
            ADIABATIC.....      0.        NA-K-CA(1/3)...     129.
            CHALCEDONY....      0.        NA-K-CA(4/3)...     158.
            CRISTOBALITE..      0.        MG CORRECTED
            AMORPHOUS.....      0.        NA-K-CA(1/3)...     102.
                                    NA-K-CA(4/3)...    107.
```


REFERENCE:
RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE
CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS:
U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

```
RECORD NO.......       41
NAME OF SOURCE..  26S/12E-31J
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...           PH.....   8.5

WATER CHEMISTRY
   SIO2...       0.0
   NA.....      17.00
   K......       1.20
   CA.....      60.00
   MG.....      61.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....      0.        NA-K...........    152.
            ADIABATIC.....      0.        NA-K-CA(1/3)...    120.
            CHALCEDONY....      0.        NA-K-CA(4/3)...      5.
            CRISTOBALITE..      0.        MG CORRECTED
            AMORPHOUS.....      0.        COOL
```

```
RECORD NO.......       42
NAME OF SOURCE..  26S/12E-31K
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...           PH.....   7.5

WATER CHEMISTRY
   SIO2...       0.0
   NA.....      21.00
   K......       1.50
   CA.....     152.00
   MG.....      73.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....      0.        NA-K...........    152.
            ADIABATIC.....      0.        NA-K-CA(1/3)...    117.
            CHALCEDONY....      0.        NA-K-CA(4/3)...     -1.
            CRISTOBALITE..      0.        MG CORRECTED
            AMORPHOUS.....      0.        NA-K-CA(1/3)...     29.
```

```
RECORD NO.......       43
NAME OF SOURCE..  26S/12E-32E
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...           PH.....   7.7

WATER CHEMISTRY
   SIO2...       0.0
   NA.....      20.00
   K......       1.70
   CA.....     109.00
   MG.....      51.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....      0.        NA-K...........    164.
            ADIABATIC.....      0.        NA-K-CA(1/3)...    125.
            CHALCEDONY....      0.        NA-K-CA(4/3)...      5.
            CRISTOBALITE..      0.        MG CORRECTED
            AMORPHOUS.....      0.        NA-K-CA(1/3)...     29.
```

```
RECORD NO.......       44
NAME OF SOURCE..  26S/12E-32M
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...           PH.....   7.6

WATER CHEMISTRY
   SIO2...       0.0
   NA.....      22.00
   K......      22.00
   CA.....     117.00
   MG.....      55.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....      0.        NA-K...........    437.
            ADIABATIC.....      0.        NA-K-CA(1/3)...    266.
            CHALCEDONY....      0.        NA-K-CA(4/3)...     70.
            CRISTOBALITE..      0.        MG CORRECTED
            AMORPHOUS.....      0.        NA-K-CA(1/3)...     43.
                                     NA-K-CA(4/3)...    49.
```

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

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GEOTHERMOMETRY

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RECORD NO.......       45
NAME OF SOURCE..  26S/12E-33B1
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...          PH.....    7.5

WATER CHEMISTRY
   SIO2...       0.0
   NA.....     113.00
   K......       3.00
   CA.....     106.00
   MG.....      43.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.      NA-K...........     97.
            ADIABATIC.....     0.      NA-K-CA(1/3)...    102.
            CHALCEDONY....     0.      NA-K-CA(4/3)...     32.
            CRISTOBALITE..     0.      MG CORRECTED
            AMORPHOUS.....     0.      NA-K-CA(1/3)...     40.
```

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RECORD NO.......       46
NAME OF SOURCE..  26S/12E-33FB
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...          PH.....    8.4

WATER CHEMISTRY
   SIO2...       0.0
   NA.....     525.00
   K......      12.00
   CA.....      19.00
   MG.....       1.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.      NA-K...........     90.
            ADIABATIC.....     0.      NA-K-CA(1/3)...    128.
            CHALCEDONY....     0.      NA-K-CA(4/3)...    130.
            CRISTOBALITE..     0.      MG CORRECTED
            AMORPHOUS.....     0.      NONE
```

```
RECORD NO.......       47
NAME OF SOURCE..  26S/12E-33J2
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...          PH.....    7.4

WATER CHEMISTRY
   SIO2...       0.0
   NA.....      73.60
   K......       3.00
   CA.....      28.00
   MG.....      31.70
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.      NA-K...........    119.
            ADIABATIC.....     0.      NA-K-CA(1/3)...    122.
            CHALCEDONY....     0.      NA-K-CA(4/3)...     51.
            CRISTOBALITE..     0.      MG CORRECTED
            AMORPHOUS.....     0.      COOL
```

```
RECORD NO.......       48
NAME OF SOURCE..  26S/12E-33Q4
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...          PH.....    7.5

WATER CHEMISTRY
   SIO2...       0.0
   NA.....     102.00
   K......       0.0
   CA.....      80.00
   MG.....      56.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.      NA-K...........      0.
            ADIABATIC.....     0.      NA-K-CA(1/3)...      0.
            CHALCEDONY....     0.      NA-K-CA(4/3)...      0.
            CRISTOBALITE..     0.      MG CORRECTED
            AMORPHOUS.....     0.      NONE
```

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

```
RECORD NO.......       49
NAME OF SOURCE..  35
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...         PH.....   6.7

WATER CHEMISTRY
   SIO2...        0.0
   NA.....      500.00
   K......       12.00
   CA.....       18.00
   MG.....        5.30
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.        NA-K...........     92.
            ADIABATIC.....     0.        NA-K-CA(1/3)...    130.
            CHALCEDONY....     0.        NA-K-CA(4/3)...    131.
            CRISTOBALITE..     0.        MG CORRECTED
            AMORPHOUS.....     0.        NA-K-CA(1/3)...     63.
                                     NA-K-CA(4/3)...     63.
```

```
RECORD NO.......       50
NAME OF SOURCE..  75
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...         PH.....   7.7

WATER CHEMISTRY
   SIO2...        0.0
   NA.....      275.00
   K......        4.20
   CA.....       21.00
   MG.....        6.90
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.        NA-K...........     72.
            ADIABATIC.....     0.        NA-K-CA(1/3)...    103.
            CHALCEDONY....     0.        NA-K-CA(4/3)...     80.
            CRISTOBALITE..     0.        MG CORRECTED
            AMORPHOUS.....     0.        NA-K-CA(1/3)...     53.
                                     NA-K-CA(4/3)...     61.
```

```
RECORD NO.......       51
NAME OF SOURCE..  76
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...         PH.....   7.5

WATER CHEMISTRY
   SIO2...        0.0
   NA.....      149.00
   K......        2.00
   CA.....       29.00
   MG.....       14.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.        NA-K...........     66.
            ADIABATIC.....     0.        NA-K-CA(1/3)...     89.
            CHALCEDONY....     0.        NA-K-CA(4/3)...     46.
            CRISTOBALITE..     0.        MG CORRECTED
            AMORPHOUS.....     0.        NA-K-CA(1/3)...     38.
```

```
RECORD NO.......       52
NAME OF SOURCE..  77
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...         PH.....   8.5

WATER CHEMISTRY
   SIO2...        0.0
   NA.....      119.00
   K......        3.10
   CA.....       17.00
   MG.....        6.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.        NA-K...........     96.
            ADIABATIC.....     0.        NA-K-CA(1/3)...    114.
            CHALCEDONY....     0.        NA-K-CA(4/3)...     66.
            CRISTOBALITE..     0.        MG CORRECTED
            AMORPHOUS.....     0.        NA-K-CA(1/3)...     46.
                                     NA-K-CA(4/3)...     63.
```

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

```
RECORD NO.......       53
NAME OF SOURCE..  78
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...            PH.....   8.2

WATER CHEMISTRY
   SIO2...        0.0
   NA.....      256.00
   K......        2.60
   CA.....        5.40
   MG.....        1.20
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.        NA-K...........     55.
            ADIABATIC.....     0.        NA-K-CA(1/3)...     95.
            CHALCEDONY....     0.        NA-K-CA(4/3)...     94.
            CRISTOBALITE..     0.        MG CORRECTED
            AMORPHOUS.....     0.        NA-K-CA(1/3)...     79.
                                   NA-K-CA(4/3)...     80.
```

```
RECORD NO.......       54
NAME OF SOURCE..  81
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...            PH.....   8.1

WATER CHEMISTRY
   SIO2...        0.0
   NA.....      435.00
   K......        0.0
   CA.....       14.00
   MG.....        1.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.        NA-K...........      0.
            ADIABATIC.....     0.        NA-K-CA(1/3)...      0.
            CHALCEDONY....     0.        NA-K-CA(4/3)...      0.
            CRISTOBALITE..     0.        MG CORRECTED
            AMORPHOUS.....     0.        NONE
```

```
RECORD NO.......       55
NAME OF SOURCE..  82
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...            PH.....   7.6

WATER CHEMISTRY
   SIO2...        0.0
   NA.....      131.00
   K......        2.60
   CA.....       29.00
   MG.....       17.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.        NA-K...........     83.
            ADIABATIC.....     0.        NA-K-CA(1/3)...    101.
            CHALCEDONY....     0.        NA-K-CA(4/3)...     52.
            CRISTOBALITE..     0.        MG CORRECTED
            AMORPHOUS.....     0.        NA-K-CA(1/3)...     28.
                                   NA-K-CA(4/3)...     48.
```

```
RECORD NO.......       56
NAME OF SOURCE..  27S/12E-1EA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...            PH.....   7.3

WATER CHEMISTRY
   SIO2...        0.0
   NA.....       32.00
   K......        2.20
   CA.....       58.00
   MG.....       26.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.        NA-K...........    150.
            ADIABATIC.....     0.        NA-K-CA(1/3)...    127.
            CHALCEDONY....     0.        NA-K-CA(4/3)...     24.
            CRISTOBALITE..     0.        MG CORRECTED
            AMORPHOUS.....     0.        NA-K-CA(1/3)...     30.
```

REFERENCE:
RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 57
NAME OF SOURCE.. 27S/12E-2D1
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.2

WATER CHEMISTRY

SIO2...	0.0
NA.....	210.00
K......	0.0
CA.....	10.00
MG.....	5.60

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	0.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	0.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	0.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NONE	

RECORD NO....... 58
NAME OF SOURCE.. 27S/12E-2E1
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.8

WATER CHEMISTRY

SIO2...	0.0
NA.....	35.00
K......	0.0
CA.....	42.00
MG.....	25.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	0.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	0.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	0.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NONE	

RECORD NO....... 59
NAME OF SOURCE.. 27S/12E-2F2
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.5

WATER CHEMISTRY

SIO2...	0.0
NA.....	52.00
K......	0.0
CA.....	44.00
MG.....	34.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	0.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	0.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	0.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NONE	

RECORD NO....... 60
NAME OF SOURCE.. 27S/12E-3P
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.3

WATER CHEMISTRY

SIO2...	0.0
NA.....	71.00
K......	2.10
CA.....	31.00
MG.....	25.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	102.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	108.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	39.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	COOL	

REFERENCE:
RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

```
RECORD NO.......        61
NAME OF SOURCE..  27S/12E-4DX
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...               PH.....    7.9

WATER CHEMISTRY
   SIO2...         0.0
   NA.....        30.00
   K......         2.00
   CA.....        65.00
   MG.....        41.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....    0.      NA-K...........   148.
            ADIABATIC.....    0.      NA-K-CA(1/3)...   124.
            CHALCEDONY....    0.      NA-K-CA(4/3)...    19.
            CRISTOBALITE..    0.      MG CORRECTED
            AMORPHOUS.....    0.      COOL
```

```
RECORD NO.......        62
NAME OF SOURCE..  27S/12E-4EA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...               PH.....    7.8

WATER CHEMISTRY
   SIO2...         0.0
   NA.....        22.00
   K......         1.40
   CA.....        96.00
   MG.....        23.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....    0.      NA-K...........   145.
            ADIABATIC.....    0.      NA-K-CA(1/3)...   116.
            CHALCEDONY....    0.      NA-K-CA(4/3)...     4.
            CRISTOBALITE..    0.      MG CORRECTED
            AMORPHOUS.....    0.      NA-K-CA(1/3)...    61.
```

```
RECORD NO.......        63
NAME OF SOURCE..  27S/12E-4EB
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...               PH.....    7.6

WATER CHEMISTRY
   SIO2...         0.0
   NA.....        52.00
   K......         3.30
   CA.....        98.00
   MG.....        52.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....    0.      NA-K...........   145.
            ADIABATIC.....    0.      NA-K-CA(1/3)...   127.
            CHALCEDONY....    0.      NA-K-CA(4/3)...    29.
            CRISTOBALITE..    0.      MG CORRECTED
            AMORPHOUS.....    0.      NA-K-CA(1/3)...    24.
```

```
RECORD NO.......        64
NAME OF SOURCE..  27S/12E-4NA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...               PH.....    7.8

WATER CHEMISTRY
   SIO2...         0.0
   NA.....        42.00
   K......         2.40
   CA.....       138.00
   MG.....        22.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....    0.      NA-K...........   138.
            ADIABATIC.....    0.      NA-K-CA(1/3)...   118.
            CHALCEDONY....    0.      NA-K-CA(4/3)...    15.
            CRISTOBALITE..    0.      MG CORRECTED
            AMORPHOUS.....    0.      NA-K-CA(1/3)...    81.
```


REFERENCE:
RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE
CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS:
U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 65
NAME OF SOURCE.. 27S/12E-4K2
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.7

WATER CHEMISTRY

SIO2...	0.0
NA.....	127.00
K......	0.0
CA.....	62.00
MG.....	40.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	0.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	0.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	0.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NONE	

RECORD NO....... 66
NAME OF SOURCE.. 27S/12E-4KX
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.7

WATER CHEMISTRY

SIO2...	0.0
NA.....	95.00
K......	2.80
CA.....	149.00
MG.....	62.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	102.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	102.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	23.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	39.

RECORD NO....... 67
NAME OF SOURCE.. 27S/12E-5B
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.8

WATER CHEMISTRY

SIO2...	0.0
NA.....	40.00
K......	5.50
CA.....	70.00
MG.....	44.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	199.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	161.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	45.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	16.

RECORD NO....... 68
NAME OF SOURCE.. 27S/12E-5FA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.2

WATER CHEMISTRY

SIO2...	0.0
NA.....	15.00
K......	2.50
CA.....	48.00
MG.....	31.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	215.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	158.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	24.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	COOL	

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

```
RECORD NO.......       69
NAME OF SOURCE..  27S/12E-5GA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...          PH.....    8.1

WATER CHEMISTRY
   SIO2...        0.0
   NA.....       16.00
   K......        3.00
   CA.....       54.00
   MG.....       34.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....      0.       NA-K...........    226.
            ADIABATIC.....      0.       NA-K-CA(1/3)...    164.
            CHALCEDONY....      0.       NA-K-CA(4/3)...     27.
            CRISTOBALITE..      0.       MG CORRECTED
            AMORPHOUS.....      0.       COOL
```

```
RECORD NO.......       70
NAME OF SOURCE..  27S/12E-5GB
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...          PH.....    8.4

WATER CHEMISTRY
   SIO2...        0.0
   NA.....       20.00
   K......        5.00
   CA.....       77.00
   MG.....       42.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....      0.       NA-K...........    252.
            ADIABATIC.....      0.       NA-K-CA(1/3)...    179.
            CHALCEDONY....      0.       NA-K-CA(4/3)...     35.
            CRISTOBALITE..      0.       MG CORRECTED
            AMORPHOUS.....      0.       NA-K-CA(1/3)...     20.
```

```
RECORD NO.......       71
NAME OF SOURCE..  27S/12E-5HC
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...          PH.....    7.3

WATER CHEMISTRY
   SIO2...        0.0
   NA.....       68.00
   K......       12.00
   CA.....       56.00
   MG.....       32.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....      0.       NA-K...........    220.
            ADIABATIC.....      0.       NA-K-CA(1/3)...    186.
            CHALCEDONY....      0.       NA-K-CA(4/3)...     78.
            CRISTOBALITE..      0.       MG CORRECTED
            AMORPHOUS.....      0.       NA-K-CA(1/3)...     21.
                                   NA-K-CA(4/3)...     39.
```

```
RECORD NO.......       72
NAME OF SOURCE..  27S/12E-5KX
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...          PH..... . 8.1

WATER CHEMISTRY
   SIO2...        0.0
   NA.....       28.00
   K......        4.60
   CA.....       77.00
   MG.....       48.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....      0.       NA-K...........    214.
            ADIABATIC.....      0.       NA-K-CA(1/3)...    163.
            CHALCEDONY....      0.       NA-K-CA(4/3)...     36.
            CRISTOBALITE..      0.       MG CORRECTED
            AMORPHOUS.....      0.       NA-K-CA(1/3)...     16.
```

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 73
NAME OF SOURCE.. 27S/12E-5R
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.8

WATER CHEMISTRY
SIO2... 0.0
NA..... 106.50
K...... 10.20
CA..... 81.00
MG..... 47.00
GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	172.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	158.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	70.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	19.
			NA-K-CA(4/3)...	40.

RECORD NO....... 74
NAME OF SOURCE.. 27S/12E-6HA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.6

WATER CHEMISTRY
SIO2... 0.0
NA..... 170.00
K...... 4.00
CA..... 185.00
MG..... 48.00
GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	91.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	100.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	33.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	61.

RECORD NO....... 75
NAME OF SOURCE.. 27S/12E-6HB
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.9

WATER CHEMISTRY
SIO2... 0.0
NA..... 15.00
K...... 0.90
CA..... 79.00
MG..... 13.00
GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	141.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	110.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	-5.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	81.

RECORD NO....... 76
NAME OF SOURCE.. 27S/12E-9M2
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.8

WATER CHEMISTRY
SIO2... 0.0
NA..... 10.00
K...... 0.0
CA..... 92.00
MG..... 35.00
GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	0.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	0.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	0.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NONE	

REFERENCE:
RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

RECORD NO....... 77
NAME OF SOURCE.. 27S/12E-9N
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.2

WATER CHEMISTRY

SIO2...	0.0
NA.....	260.00
K......	0.0
CA.....	15.00
MG.....	9.20

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	0.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	0.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	0.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NONE	

RECORD NO....... 78
NAME OF SOURCE.. 27S/12E-10AX
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.9

WATER CHEMISTRY

SIO2...	0.0
NA.....	24.00
K......	1.00
CA.....	57.00
MG.....	30.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	120.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	104.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	5.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	29.

RECORD NO....... 79
NAME OF SOURCE.. 27S/12E-10BA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.1

WATER CHEMISTRY

SIO2...	0.0
NA.....	188.00
K......	4.50
CA.....	14.00
MG.....	8.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	92.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	118.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	87.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	28.
			NA-K-CA(4/3)...	37.

RECORD NO....... 80
NAME OF SOURCE.. 27S/12E-10BC
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.1

WATER CHEMISTRY

SIO2...	0.0
NA.....	84.00
K......	3.10
CA.....	44.00
MG.....	27.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	114.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	117.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	45.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	22.

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 81
NAME OF SOURCE.. 27S/12E-10BD
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.9

WATER CHEMISTRY

SIO2...	0.0
NA.....	28.00
K......	1.00
CA.....	57.00
MG.....	32.00

GEOTHERMOMETERS (DEGREES C)

SILICA - CONDUCTIVE....	0.	NA-K...........	112.
ADIABATIC.....	0.	NA-K-CA(1/3)...	100.
CHALCEDONY....	0.	NA-K-CA(4/3)...	6.
CRISTOBALITE..	0.	MG CORRECTED	
AMORPHOUS.....	0.	NA-K-CA(1/3)...	28.

RECORD NO....... 82
NAME OF SOURCE.. 27S/12E-10HA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.2

WATER CHEMISTRY

SIO2...	0.0
NA.....	195.00
K......	4.20
CA.....	18.00
MG.....	11.00

GEOTHERMOMETERS (DEGREES C)

SILICA - CONDUCTIVE....	0.	NA-K...........	87.
ADIABATIC.....	0.	NA-K-CA(1/3)...	113.
CHALCEDONY....	0.	NA-K-CA(4/3)...	80.
CRISTOBALITE..	0.	MG CORRECTED	
AMORPHOUS.....	0.	NA-K-CA(1/3)...	26.
		NA-K-CA(4/3)...	36.

RECORD NO....... 83
NAME OF SOURCE.. 27S/12E-10JA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.5

WATER CHEMISTRY

SIO2...	0.0
NA.....	173.00
K......	4.00
CA.....	79.00
MG.....	26.00

GEOTHERMOMETERS (DEGREES C)

SILICA - CONDUCTIVE....	0.	NA-K...........	90.
ADIABATIC.....	0.	NA-K-CA(1/3)...	104.
CHALCEDONY....	0.	NA-K-CA(4/3)...	48.
CRISTOBALITE..	0.	MG CORRECTED	
AMORPHOUS.....	0.	NA-K-CA(1/3)...	49.

RECORD NO....... 84
NAME OF SOURCE.. 27S/12E=11LA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.2

WATER CHEMISTRY

SIO2...	0.0
NA.....	276.00
K......	2.90
CA.....	5.00
MG.....	1.00

GEOTHERMOMETERS (DEGREES C)

SILICA - CONDUCTIVE....	0.	NA-K...........	56.
ADIABATIC.....	0.	NA-K-CA(1/3)...	98.
CHALCEDONY....	0.	NA-K-CA(4/3)...	101.
CRISTOBALITE..	0.	MG CORRECTED	
AMORPHOUS.....	0.	NA-K-CA(1/3)...	85.
		NA-K-CA(4/3)...	85.

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 85
NAME OF SOURCE.. 27S/12E-12PA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.2

WATER CHEMISTRY
SIO2... 0.0
NA..... 39.00
K...... 1.40
CA..... 45.00
MG..... 29.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	112.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	106.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	19.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	COOL	

RECORD NO....... 86
NAME OF SOURCE.. 27S/12E-14A1S
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.3

WATER CHEMISTRY
SIO2... 99.00
NA..... 260.00
K...... 3.40
CA..... 5.00
MG..... 1.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	137.	NA-K...........	65.
	ADIABATIC.....	132.	NA-K-CA(1/3)...	105.
	CHALCEDONY....	110.	NA-K-CA(4/3)...	106.
	CRISTOBALITE..	86.	MG CORRECTED	
	AMORPHOUS.....	16.	NA-K-CA(1/3)...	86.
			NA-K-CA(4/3)...	86.

RECORD NO....... 87
NAME OF SOURCE.. 27S/12E-14MA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.6

WATER CHEMISTRY
SIO2... 0.0
NA..... 250.00
K...... 10.10
CA..... 38.00
MG..... 14.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	119.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	137.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	96.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	42.
			NA-K-CA(4/3)...	51.

RECORD NO....... 88
NAME OF SOURCE.. 27S/12E-14MB
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.1

WATER CHEMISTRY
SIO2... 0.0
NA..... 33.00
K...... 0.90
CA..... 88.00
MG..... 12.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	98.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	90.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	-1.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NONE	

REFERENCE:
RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 89
NAME OF SOURCE.. 27S/12E-14NA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.0

WATER CHEMISTRY

SIO2...	0.0
NA.....	84.00
K......	2.30
CA.....	74.00
MG.....	16.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	98.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	102.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	28.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	69.

RECORD NO....... 90
NAME OF SOURCE.. 27S/12E-15G1S
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.3

WATER CHEMISTRY

SIO2...	91.00
NA.....	320.00
K......	3.10
CA.....	4.00
MG.....	1.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	132.	NA-K...........	53.
	ADIABATIC.....	128.	NA-K-CA(1/3)...	98.
	CHALCEDONY....	105.	NA-K-CA(4/3)...	111.
	CRISTOBALITE..	81.	MG CORRECTED	
	AMORPHOUS.....	12.	NA-K-CA(1/3)...	78.
			NA-K-CA(4/3)...	76.

RECORD NO....... 91
NAME OF SOURCE.. 27S/12E-15J
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.5

WATER CHEMISTRY

SIO2...	0.0
NA.....	100.00
K......	2.70
CA.....	52.00
MG.....	15.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	98.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	106.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	40.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	55.

RECORD NO....... 92
NAME OF SOURCE.. 27S/12E-20G1
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.0

WATER CHEMISTRY

SIO2...	0.0
NA.....	70.00
K......	70.00
CA.....	27.00
MG.....	33.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	437.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	319.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	171.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	51.
			NA-K-CA(4/3)...	20.

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 93
NAME OF SOURCE.. 27S/12E-20G3
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.6

WATER CHEMISTRY
SIO2... 0.0
NA..... 122.00
K...... 122.00
CA..... 79.00
MG..... 44.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	437.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	320.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	172.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	82.
			NA-K-CA(4/3)...	44.

RECORD NO....... 94
NAME OF SOURCE.. 27S/12E-22K
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.9

WATER CHEMISTRY
SIO2... 0.0
NA..... 137.00
K...... 137.00
CA..... 51.00
MG..... 27.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	437.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	330.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	197.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	112.
			NA-K-CA(4/3)...	66.

RECORD NO....... 95
NAME OF SOURCE.. 27S/12E-22M1
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.1

WATER CHEMISTRY
SIO2... 0.0
NA..... 53.00
K...... 53.00
CA..... 61.00
MG..... 26.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	437.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	299.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	128.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	77.
			NA-K-CA(4/3)...	48.

RECORD NO....... 96
NAME OF SOURCE.. 27S/12E-28A1
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.0

WATER CHEMISTRY
SIO2... 0.0
NA..... 126.00
K...... 5.90
CA..... 75.00
MG..... 13.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	127.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	129.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	56.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	78.

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 97
NAME OF SOURCE.. 27S/12E-28Q1
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.9

WATER CHEMISTRY

SIO2...	0.0
NA.....	34.00
K......	1.80
CA.....	45.00
MG.....	21.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	134.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	119.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	23.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	30.

RECORD NO....... 98
NAME OF SOURCE.. 27S/12E-29P2
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.6

WATER CHEMISTRY

SIO2...	0.0
NA.....	84.50
K......	0.0
CA.....	97.50
MG.....	39.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	0.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	0.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	0.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NONE	

RECORD NO....... 99
NAME OF SOURCE.. 27S/12E-29P4
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.5

WATER CHEMISTRY

SIO2...	0.0
NA.....	32.00
K......	2.40
CA.....	63.00
MG.....	41.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	156.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	131.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	24.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	COOL	

RECORD NO....... 100
NAME OF SOURCE.. 27S/12E-29P6
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.7

WATER CHEMISTRY

SIO2...	0.0
NA.....	76.00
K......	0.01
CA.....	38.80
MG.....	73.40

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	-56.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	-26.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	-58.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	COOL	

REFERENCE:
RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 101
NAME OF SOURCE.. 27S/12E-31DA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.1

WATER CHEMISTRY

SIO2...	0.0
NA.....	28.00
K......	28.00
CA.....	118.00
MG.....	53.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	437.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	272.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	80.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	48.
			NA-K-CA(4/3)...	48.

RECORD NO....... 102
NAME OF SOURCE.. 27S/12E-31KA
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.3

WATER CHEMISTRY

SIO2...	0.0
NA.....	220.00
K......	0.0
CA.....	96.00
MG.....	32.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	0.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	0.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	0.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NONE	

RECORD NO....... 103
NAME OF SOURCE.. 27S/12E-33G1
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.6

WATER CHEMISTRY

SIO2...	0.0
NA.....	14.00
K......	0.70
CA.....	57.00
MG.....	20.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	131.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	104.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	-6.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	45.

RECORD NO....... 104
NAME OF SOURCE.. 25S/12E-26D1
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.7

WATER CHEMISTRY

SIO2...	0.0
NA.....	39.00
K......	2.00
CA.....	47.00
MG.....	38.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	132.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	119.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	26.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	COOL	

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

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GEOTHERMOMETRY

RECORD NO....... 105
NAME OF SOURCE.. 25S/12E-26K1
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.8

WATER CHEMISTRY

SIO2...	0.0
NA.....	48.00
K......	1.00
CA.....	31.00
MG.....	21.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	85.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	91.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	18.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	COOL	

RECORD NO....... 106
NAME OF SOURCE.. 25S/12E-26L1
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.1

WATER CHEMISTRY

SIO2...	0.0
NA.....	39.00
K......	2.00
CA.....	36.00
MG.....	56.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	132.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	121.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	31.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	COOL	

RECORD NO....... 107
NAME OF SOURCE.. 25S/12E-26N1
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.3

WATER CHEMISTRY

SIO2...	0.0
NA.....	99.00
K......	2.00
CA.....	20.00
MG.....	20.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	84.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	101.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	49.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	COOL	

RECORD NO....... 108
NAME OF SOURCE.. 25S/12E-27F3
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.0

WATER CHEMISTRY

SIO2...	0.0
NA.....	73.00
K......	2.00
CA.....	46.00
MG.....	50.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	98.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	103.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	32.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	COOL	

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

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GEOTHERMOMETRY

RECORD NO....... 109
NAME OF SOURCE.. 25S/12E-28B1
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.9

WATER CHEMISTRY

SIO2...	47.00
NA.....	145.00
K......	5.00
CA.....	52.00
MG.....	76.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	99.	NA-K...........	110.
	ADIABATIC.....	100.	NA-K-CA(1/3)...	120.
	CHALCEDONY....	69.	NA-K-CA(4/3)...	60.
	CRISTOBALITE..	49.	MG CORRECTED	
	AMORPHOUS.....	-16.	COOL	

RECORD NO....... 110
NAME OF SOURCE.. 25S/13E-35D1
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.9

WATER CHEMISTRY

SIO2...	0.0
NA.....	64.00
K......	2.00
CA.....	27.00
MG.....	40.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	105.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	110.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	39.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	COOL	

RECORD NO....... 111
NAME OF SOURCE.. 25S/13E-35E1
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.9

WATER CHEMISTRY

SIO2...	0.0
NA.....	63.00
K......	3.00
CA.....	48.00
MG.....	28.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	128.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	123.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	40.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	22.

RECORD NO....... 112
NAME OF SOURCE.. 26S/12E-3K3
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.2

WATER CHEMISTRY

SIO2...	0.0
NA.....	39.00
K......	9.00
CA.....	39.00
MG.....	22.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	245.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	194.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	70.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	23.
			NA-K-CA(4/3)...	43.

REFERENCE:
RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE
CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS:
U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 113
NAME OF SOURCE.. 26S/12E-14G1
STATE.......... CALIF
COUNTY......... SLO

WATER TEMPERATURE... PH..... 8.0

WATER CHEMISTRY

SIO2...	0.0
NA.....	182.00
K......	1.20
CA.....	29.00
MG.....	12.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	39.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	68.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	34.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	53.

RECORD NO....... 114
NAME OF SOURCE.. 26S/12E-16N1S
STATE.......... CALIF
COUNTY......... SLO

WATER TEMPERATURE... PH..... 8.0

WATER CHEMISTRY

SIO2...	68.00
NA.....	500.00
K......	4.00
CA.....	6.00
MG.....	0.0

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	117.	NA-K...........	46.
	ADIABATIC.....	115.	NA-K-CA(1/3)...	94.
	CHALCEDONY....	88.	NA-K-CA(4/3)...	116.
	CRISTOBALITE..	66.	MG CORRECTED	
	AMORPHOUS.....	-1.	NONE	

RECORD NO....... 115
NAME OF SOURCE.. 26S/12E-21L1
STATE.......... CALIF
COUNTY......... SLO

WATER TEMPERATURE... PH..... 7.4

WATER CHEMISTRY

SIO2...	7.40
NA.....	330.00
K......	6.00
CA.....	85.00
MG.....	27.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	30.	NA-K...........	79.
	ADIABATIC.....	39.	NA-K-CA(1/3)...	103.
	CHALCEDONY....	-3.	NA-K-CA(4/3)...	64.
	CRISTOBALITE..	-17.	MG CORRECTED	
	AMORPHOUS.....	-73.	NA-K-CA(1/3)...	51.

RECORD NO....... 116
NAME OF SOURCE.. 26S/12E-22P2
STATE.......... CALIF
COUNTY......... SLO

WATER TEMPERATURE... PH..... 7.8

WATER CHEMISTRY

SIO2...	38.00
NA.....	85.00
K......	2.00
CA.....	33.00
MG.....	23.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	89.	NA-K...........	91.
	ADIABATIC.....	92.	NA-K-CA(1/3)...	102.
	CHALCEDONY....	59.	NA-K-CA(4/3)...	38.
	CRISTOBALITE..	39.	MG CORRECTED	
	AMORPHOUS.....	-25.	COOL	

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

```
RECORD NO.......     117
NAME OF SOURCE..  26S/13E-4K1
STATE.......... CALIF
COUNTY......... SLO

WATER TEMPERATURE...          PH.....   8.0

WATER CHEMISTRY
   SIO2...       0.0
   NA.....     191.00
   K......       3.00
   CA.....      82.00
   MG.....      61.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....      0.       NA-K...........      73.
            ADIABATIC.....      0.       NA-K-CA(1/3)...      91.
            CHALCEDONY....      0.       NA-K-CA(4/3)...      40.
            CRISTOBALITE..      0.       MG CORRECTED
            AMORPHOUS.....      0.       COOL
```

```
RECORD NO.......     118
NAME OF SOURCE..  26S/13E-10D1
STATE.......... CALIF
COUNTY......... SLO

WATER TEMPERATURE...          PH.....   8.1

WATER CHEMISTRY
   SIO2...       0.0
   NA.....     138.00
   K......       8.00
   CA.....      20.00
   MG.....      12.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....      0.       NA-K...........     139.
            ADIABATIC.....      0.       NA-K-CA(1/3)...     149.
            CHALCEDONY....      0.       NA-K-CA(4/3)...      95.
            CRISTOBALITE..      0.       MG CORRECTED
            AMORPHOUS.....      0.       NA-K-CA(1/3)...      23.
                                     NA-K-CA(4/3)...      33.
```

```
RECORD NO.......     119
NAME OF SOURCE..  26S/13E-11L1
STATE.......... CALIF
COUNTY......... SLO

WATER TEMPERATURE...          PH.....   8.0

WATER CHEMISTRY
   SIO2...       0.0
   NA.....     208.00
   K......       1.90
   CA.....      11.00
   MG.....      10.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....      0.       NA-K...........      51.
            ADIABATIC.....      0.       NA-K-CA(1/3)...      85.
            CHALCEDONY....      0.       NA-K-CA(4/3)...      66.
            CRISTOBALITE..      0.       MG CORRECTED
            AMORPHOUS.....      0.       COOL
```

```
RECORD NO.......     120
NAME OF SOURCE..  26S/13E-28J1
STATE.......... CALIF
COUNTY......... SLO

WATER TEMPERATURE...          PH.....   7.4

WATER CHEMISTRY
   SIO2...      28.00
   NA.....      49.00
   K......       2.00
   CA.....      34.00
   MG.....      26.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     77.       NA-K...........     119.
            ADIABATIC.....     81.       NA-K-CA(1/3)...     115.
            CHALCEDONY....     45.       NA-K-CA(4/3)...      33.
            CRISTOBALITE..     27.       MG CORRECTED
            AMORPHOUS.....    -35.       COOL
```

REFERENCE:
RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE
CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS:
U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

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RECORD NO.......      121
NAME OF SOURCE..  26S/13E-28L2
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...          PH.....    8.0

WATER CHEMISTRY
   SIO2...        0.0
   NA.....       47.00
   K......        2.00
   CA.....       36.00
   MG.....       25.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.       NA-K...........     121.
            ADIABATIC.....     0.       NA-K-CA(1/3)...     116.
            CHALCEDONY....     0.       NA-K-CA(4/3)...      32.
            CRISTOBALITE..     0.       MG CORRECTED
            AMORPHOUS.....     0.       COOL
```

```
RECORD NO.......      122
NAME OF SOURCE..  27S/12E-04B1
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...          PH.....    7.5

WATER CHEMISTRY
   SIO2...        0.0
   NA.....      148.00
   K......        2.00
   CA.....       41.00
   MG.....       14.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.       NA-K...........      67.
            ADIABATIC.....     0.       NA-K-CA(1/3)...      87.
            CHALCEDONY....     0.       NA-K-CA(4/3)...      39.
            CRISTOBALITE..     0.       MG CORRECTED
            AMORPHOUS.....     0.       NA-K-CA(1/3)...      53.
```

```
RECORD NO.......      123
NAME OF SOURCE..  27S/12E-04K5
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...          PH.....    7.6

WATER CHEMISTRY
   SIO2...        0.0
   NA.....       48.00
   K......        2.00
   CA.....       86.00
   MG.....       48.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.       NA-K...........     120.
            ADIABATIC.....     0.       NA-K-CA(1/3)...     110.
            CHALCEDONY....     0.       NA-K-CA(4/3)...      19.
            CRISTOBALITE..     0.       MG CORRECTED
            AMORPHOUS.....     0.       NA-K-CA(1/3)...      26.
```

```
RECORD NO.......      124
NAME OF SOURCE..  27S/12E-34P1
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...          PH.....    7.9

WATER CHEMISTRY
   SIO2...        0.0
   NA.....       52.00
   K......        2.00
   CA.....       82.00
   MG.....       30.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.       NA-K...........     116.
            ADIABATIC.....     0.       NA-K-CA(1/3)...     108.
            CHALCEDONY....     0.       NA-K-CA(4/3)...      20.
            CRISTOBALITE..     0.       MG CORRECTED
            AMORPHOUS.....     0.       NA-K-CA(1/3)...      43.
```

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 125
NAME OF SOURCE.. 27S/13E-9K1
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.2

WATER CHEMISTRY

SIO2...	0.0
NA.....	198.00
K......	2.00
CA.....	8.60
MG.....	2.80

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	55.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	89.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	72.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	58.
			NA-K-CA(4/3)...	65.

RECORD NO....... 126
NAME OF SOURCE.. 25S/12E-21L01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.9

WATER CHEMISTRY

SIO2...	0.0
NA.....	267.00
K......	7.00
CA.....	162.00
MG.....	114.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	96.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	110.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	54.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	COOL	

RECORD NO....... 127
NAME OF SOURCE.. 25S/12E-28N01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.0

WATER CHEMISTRY

SIO2...	0.0
NA.....	134.00
K......	5.00
CA.....	67.00
MG.....	58.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	114.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	121.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	55.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	COOL	

RECORD NO....... 128
NAME OF SOURCE.. 25S/12E-28N04
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.0

WATER CHEMISTRY

SIO2...	0.0
NA.....	163.00
K......	2.50
CA.....	163.00
MG.....	87.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	72.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	85.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	23.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	35.

REFERENCE:
RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE
CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS:
U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

```
RECORD NO.......     129
NAME OF SOURCE..  25S/12E-32A01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...          PH.....   7.9

WATER CHEMISTRY
   SIO2...      0.0
   NA.....    108.00
   K......      2.00
   CA.....     54.00
   MG.....     15.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....    0.      NA-K...........     80.
            ADIABATIC.....    0.      NA-K-CA(1/3)...     93.
            CHALCEDONY....    0.      NA-K-CA(4/3)...     32.
            CRISTOBALITE..    0.      MG CORRECTED
            AMORPHOUS.....    0.      NA-K-CA(1/3)...     60.
```

```
RECORD NO.......     130
NAME OF SOURCE..  25S/12E-32K01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...          PH.....   8.1

WATER CHEMISTRY
   SIO2...      0.0
   NA.....     74.00
   K......      2.00
   CA.....     57.00
   MG.....     32.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....    0.      NA-K...........     98.
            ADIABATIC.....    0.      NA-K-CA(1/3)...    102.
            CHALCEDONY....    0.      NA-K-CA(4/3)...     28.
            CRISTOBALITE..    0.      MG CORRECTED
            AMORPHOUS.....    0.      NA-K-CA(1/3)...     28.
```

```
RECORD NO.......     131
NAME OF SOURCE..  25S/12E-33Q02
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...          PH.....   8.1

WATER CHEMISTRY
   SIO2...      0.0
   NA.....    188.00
   K......      2.00
   CA.....    153.00
   MG.....     73.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....    0.      NA-K...........     57.
            ADIABATIC.....    0.      NA-K-CA(1/3)...     75.
            CHALCEDONY....    0.      NA-K-CA(4/3)...     20.
            CRISTOBALITE..    0.      MG CORRECTED
            AMORPHOUS.....    0.      NA-K-CA(1/3)...     43.
```

```
RECORD NO.......     132
NAME OF SOURCE..  25S/12E-35C01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...          PH.....   8.2

WATER CHEMISTRY
   SIO2...      0.0
   NA.....   3000.00
   K......      6.00
   CA.....     92.00
   MG.....     59.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....    0.      NA-K...........      3.
            ADIABATIC.....    0.      NA-K-CA(1/3)...     55.
            CHALCEDONY....    0.      NA-K-CA(4/3)...     86.
            CRISTOBALITE..    0.      MG CORRECTED
            AMORPHOUS.....    0.      COOL
```

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 133
NAME OF SOURCE.. 25S/13E-19R01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.3

WATER CHEMISTRY

SIO2...	0.0
NA.....	35.00
K......	1.80
CA.....	33.00
MG.....	28.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	132.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	120.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	29.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	COOL	

RECORD NO....... 134
NAME OF SOURCE.. 27S/13E-13Q1
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 10.

WATER CHEMISTRY

SIO2...	0.0
NA.....	71.00
K......	3.00
CA.....	4.00
MG.....	1.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	121.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	137.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	91.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	73.
			NA-K-CA(4/3)...	80.

RECORD NO....... 135
NAME OF SOURCE.. 26S/13E-30B01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.2

WATER CHEMISTRY

SIO2...	0.0
NA.....	110.00
K......	0.80
CA.....	22.00
MG.....	11.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	43.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	67.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	25.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	45.

RECORD NO....... 136
NAME OF SOURCE.. 27S/13E-17Q01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.7

WATER CHEMISTRY

SIO2...	0.0
NA.....	53.00
K......	2.00
CA.....	50.00
MG.....	27.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	115.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	111.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	28.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	27.

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 137
NAME OF SOURCE.. 27S/13E-20R01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.7

WATER CHEMISTRY

SIO2...	0.0
NA.....	31.00
K......	2.00
CA.....	49.00
MG.....	28.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	146.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	125.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	24.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	22.

RECORD NO....... 138
NAME OF SOURCE.. 27S/13E-26Q01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.1

WATER CHEMISTRY

SIO2...	0.0
NA.....	29.00
K......	2.00
CA.....	53.00
MG.....	21.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	150.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	127.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	22.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	36.

RECORD NO....... 139
NAME OF SOURCE.. 28S/12E-10A03
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.9

WATER CHEMISTRY

SIO2...	0.0
NA.....	28.00
K......	1.50
CA.....	60.00
MG.....	31.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	135.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	115.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	14.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	27.

RECORD NO....... 140
NAME OF SOURCE.. 28S/13E-4K02
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.9

WATER CHEMISTRY

SIO2...	0.0
NA.....	30.00
K......	1.00
CA.....	60.00
MG.....	27.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	108.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	98.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	6.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	37.

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

```
RECORD NO.......      141
NAME OF SOURCE..  28S/13E-4K03
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...           PH.....   8.0

WATER CHEMISTRY
   SIO2...        0.0
   NA.....       49.00
   K......        2.00
   CA.....       51.00
   MG.....       30.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.       NA-K...........    119.
            ADIABATIC.....     0.       NA-K-CA(1/3)...    113.
            CHALCEDONY....     0.       NA-K-CA(4/3)...     27.
            CRISTOBALITE..     0.       MG CORRECTED
            AMORPHOUS.....     0.       NA-K-CA(1/3)...     24.
```

```
RECORD NO.......      142
NAME OF SOURCE..  26S/12E-09F03
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...           PH.....   7.6

WATER CHEMISTRY
   SIO2...        0.0
   NA.....       43.00
   K......        2.00
   CA.....       65.00
   MG.....       27.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.       NA-K...........    126.
            ADIABATIC.....     0.       NA-K-CA(1/3)...    115.
            CHALCEDONY....     0.       NA-K-CA(4/3)...     22.
            CRISTOBALITE..     0.       MG CORRECTED
            AMORPHOUS.....     0.       NA-K-CA(1/3)...     36.
```

```
RECORD NO.......      143
NAME OF SOURCE..  26S/12E-09L01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...           PH.....   7.5

WATER CHEMISTRY
   SIO2...        0.0
   NA.....       98.00
   K......        2.00
   CA.....       66.00
   MG.....       28.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.       NA-K...........     84.
            ADIABATIC.....     0.       NA-K-CA(1/3)...     94.
            CHALCEDONY....     0.       NA-K-CA(4/3)...     28.
            CRISTOBALITE..     0.       MG CORRECTED
            AMORPHOUS.....     0.       NA-K-CA(1/3)...     41.
```

```
RECORD NO.......      144
NAME OF SOURCE..  25S/12E-19B01M
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...           PH.....   8.3

WATER CHEMISTRY
   SIO2...        0.0
   NA.....       35.00
   K......        0.40
   CA.....       64.00
   MG.....       39.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.       NA-K...........     60.
            ADIABATIC.....     0.       NA-K-CA(1/3)...     64.
            CHALCEDONY....     0.       NA-K-CA(4/3)...    -12.
            CRISTOBALITE..     0.       MG CORRECTED
            AMORPHOUS.....     0.       COOL
```

REFERENCE:
RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

```
RECORD NO.......      145
NAME OF SOURCE..  25S/12E-35E01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...            PH.....   7.8

WATER CHEMISTRY
   SIO2...       0.0
   NA.....     390.00
   K......       4.00
   CA.....      98.00
   MG.....      69.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.      NA-K...........     56.
            ADIABATIC.....     0.      NA-K-CA(1/3)...     84.
            CHALCEDONY....     0.      NA-K-CA(4/3)...     51.
            CRISTOBALITE..     0.      MG CORRECTED
            AMORPHOUS.....     0.      COOL
```

```
RECORD NO.......      146
NAME OF SOURCE..  26S/12E-03L01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...            PH.....   8.1

WATER CHEMISTRY
   SIO2...       0.0
   NA.....     170.00
   K......      19.00
   CA.....      91.00
   MG.....      48.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.      NA-K...........    183.
            ADIABATIC.....     0.      NA-K-CA(1/3)...    173.
            CHALCEDONY....     0.      NA-K-CA(4/3)...     93.
            CRISTOBALITE..     0.      MG CORRECTED
            AMORPHOUS.....     0.      NA-K-CA(1/3)...     24.
                                   NA-K-CA(4/3)...     36.
```

```
RECORD NO.......      147
NAME OF SOURCE..  26S/12E--05A02
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...            PH.....   8.2

WATER CHEMISTRY
   SIO2...       0.0
   NA.....      42.00
   K......       2.00
   CA.....      88.00
   MG.....      28.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.      NA-K...........    128.
            ADIABATIC.....     0.      NA-K-CA(1/3)...    113.
            CHALCEDONY....     0.      NA-K-CA(4/3)...     17.
            CRISTOBALITE..     0.      MG CORRECTED
            AMORPHOUS.....     0.      NA-K-CA(1/3)...     48.
```

```
RECORD NO.......      149
NAME OF SOURCE..  26S/12E-09R01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...            PH.....   7.6

WATER CHEMISTRY
   SIO2...       0.0
   NA.....     147.00
   K......       2.00
   CA.....     103.00
   MG.....      47.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.      NA-K...........     67.
            ADIABATIC.....     0.      NA-K-CA(1/3)...     82.
            CHALCEDONY....     0.      NA-K-CA(4/3)...     24.
            CRISTOBALITE..     0.      MG CORRECTED
            AMORPHOUS.....     0.      NA-K-CA(1/3)...     42.
```


REFERENCE:
RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE
CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS:
U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 150
NAME OF SOURCE.. 26S/12E-14G02
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.3

WATER CHEMISTRY

SIO2...	0.0
NA.....	120.00
K......	1.70
CA.....	20.00
MG.....	12.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	68.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	90.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	46.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	30.

RECORD NO....... 151
NAME OF SOURCE.. 26S/12E-16C01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.5

WATER CHEMISTRY

SIO2...	38.00
NA.....	102.00
K......	2.00
CA.....	97.00
MG.....	43.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	89.	NA-K...........	83.
	ADIABATIC.....	92.	NA-K-CA(1/3)...	91.
	CHALCEDONY....	59.	NA-K-CA(4/3)...	22.
	CRISTOBALITE..	39.	MG CORRECTED	
	AMORPHOUS.....	-25.	NA-K-CA(1/3)...	40.

RECORD NO....... 152
NAME OF SOURCE.. 26S/12E-16C02
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.6

WATER CHEMISTRY

SIO2...	39.00
NA.....	368.00
K......	4.00
CA.....	46.00
MG.....	15.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	91.	NA-K...........	58.
	ADIABATIC.....	93.	NA-K-CA(1/3)...	89.
	CHALCEDONY....	60.	NA-K-CA(4/3)...	65.
	CRISTOBALITE..	40.	MG CORRECTED	
	AMORPHOUS.....	-24.	NA-K-CA(1/3)...	55.

RECORD NO....... 153
NAME OF SOURCE.. 26S/12E-16C04
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.1

WATER CHEMISTRY

SIO2...	43.00
NA.....	94.00
K......	2.00
CA.....	174.00
MG.....	61.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	95.	NA-K...........	86.
	ADIABATIC.....	97.	NA-K-CA(1/3)...	89.
	CHALCEDONY....	64.	NA-K-CA(4/3)...	13.
	CRISTOBALITE..	45.	MG CORRECTED	
	AMORPHOUS.....	-20.	NA-K-CA(1/3)...	50.

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

```
RECORD NO.......     154
NAME OF SOURCE..  26S/12E-16F01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...           PH.....   7.4

WATER CHEMISTRY
   SIO2...       43.00
   NA.....       61.00
   K......        2.00
   CA.....       98.00
   MG.....       34.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....    95.      NA-K...........    107.
            ADIABATIC.....    97.      NA-K-CA(1/3)...    103.
            CHALCEDONY....    64.      NA-K-CA(4/3)...     18.
            CRISTOBALITE..    45.      MG CORRECTED
            AMORPHOUS.....   -20.      NA-K-CA(1/3)...     46.
```

```
RECORD NO.......     155
NAME OF SOURCE..  26S/12E-20A01S
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...           PH.....   7.3

WATER CHEMISTRY
   SIO2...        0.0
   NA.....      680.00
   K......        9.00
   CA.....      108.00
   MG.....        2.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.      NA-K...........     66.
            ADIABATIC.....     0.      NA-K-CA(1/3)...     99.
            CHALCEDONY....     0.      NA-K-CA(4/3)...     79.
            CRISTOBALITE..     0.      MG CORRECTED
            AMORPHOUS.....     0.      NONE
```

```
RECORD NO.......     156
NAME OF SOURCE..  26S/12E-20A012S
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...           PH.....   7.1

WATER CHEMISTRY
   SIO2...       85.00
   NA.....      720.00
   K......       11.00
   CA.....      116.00
   MG.....        1.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....   128.      NA-K...........     72.
            ADIABATIC.....   125.      NA-K-CA(1/3)...    104.
            CHALCEDONY....   101.      NA-K-CA(4/3)...     85.
            CRISTOBALITE..    78.      MG CORRECTED
            AMORPHOUS.....     9.      NONE
```

```
RECORD NO.......     157
NAME OF SOURCE..  26S/12E-21D01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...           PH.....   8.5

WATER CHEMISTRY
   SIO2...        0.0
   NA.....      320.00
   K......        4.50
   CA.....       34.00
   MG.....       16.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     0.      NA-K...........     68.
            ADIABATIC.....     0.      NA-K-CA(1/3)...     99.
            CHALCEDONY....     0.      NA-K-CA(4/3)...     74.
            CRISTOBALITE..     0.      MG CORRECTED
            AMORPHOUS.....     0.      NA-K-CA(1/3)...     37.
                                    NA-K-CA(4/3)...     47.
```

REFERENCE:
RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE
CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS:
U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 158
NAME OF SOURCE.. 26S/12E-21D02
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.0

WATER CHEMISTRY
SIO2... 0.0
NA..... 306.00
K...... 6.00
CA..... 88.00
MG..... 42.00
GEOTHERMOMETERS (DEGREES C)
SILICA - CONDUCTIVE.... 0. NA-K........... 83.
ADIABATIC..... 0. NA-K-CA(1/3)... 105.
CHALCEDONY.... 0. NA-K-CA(4/3)... 63.
CRISTOBALITE.. 0. MG CORRECTED
AMORPHOUS..... 0. NA-K-CA(1/3)... 34.
NA-K-CA(4/3)... 50.

RECORD NO....... 159
NAME OF SOURCE.. 26S/12E-21L025
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.7

WATER CHEMISTRY
SIO2... 79.00
NA..... 465.00
K...... 5.00
CA..... 5.00
MG..... 1.00
GEOTHERMOMETERS (DEGREES C)
SILICA - CONDUCTIVE.... 124. NA-K........... 57.
ADIABATIC..... 122. NA-K-CA(1/3)... 105.
CHALCEDONY.... 96. NA-K-CA(4/3)... 129.
CRISTOBALITE.. 74. MG CORRECTED
AMORPHOUS..... 6. NA-K-CA(1/3)... 91.
NA-K-CA(4/3)... 90.

RECORD NO....... 160
NAME OF SOURCE.. 26S/12E-21L99
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.4

WATER CHEMISTRY
SIO2... 0.0
NA..... 170.00
K...... 3.00
CA..... 39.00
MG..... 17.00
GEOTHERMOMETERS (DEGREES C)
SILICA - CONDUCTIVE.... 0. NA-K........... 78.
ADIABATIC..... 0. NA-K-CA(1/3)... 98.
CHALCEDONY.... 0. NA-K-CA(4/3)... 53.
CRISTOBALITE.. 0. MG CORRECTED
AMORPHOUS..... 0. NA-K-CA(1/3)... 39.

RECORD NO....... 161
NAME OF SOURCE.. 26S/12E-22P01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.9

WATER CHEMISTRY
SIO2... 0.0
NA..... 82.00
K...... 1.90
CA..... 32.00
MG..... 24.00
GEOTHERMOMETERS (DEGREES C)
SILICA - CONDUCTIVE.... 0. NA-K........... 90.
ADIABATIC..... 0. NA-K-CA(1/3)... 101.
CHALCEDONY.... 0. NA-K-CA(4/3)... 37.
CRISTOBALITE.. 0. MG CORRECTED
AMORPHOUS..... 0. COOL

REFERENCE:
RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 162
NAME OF SOURCE.. 28S/12E-10H03
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.2

WATER CHEMISTRY

SIO2...	0.0
NA.....	39.00
K......	1.00
CA.....	32.00
MG.....	74.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	95.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	95.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	16.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	COOL	

RECORD NO....... 163
NAME OF SOURCE.. 28S/12E-10R02
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.9

WATER CHEMISTRY

SIO2...	27.00
NA.....	40.00
K......	1.00
CA.....	79.00
MG.....	49.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	75.	NA-K...........	94.
	ADIABATIC.....	79.	NA-K-CA(1/3)...	90.
	CHALCEDONY....	44.	NA-K-CA(4/3)...	4.
	CRISTOBALITE..	25.	MG CORRECTED	
	AMORPHOUS.....	-36.	COOL	

RECORD NO....... 164
NAME OF SOURCE.. 26S/12E-33Q01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.3

WATER CHEMISTRY

SIO2...	0.0
NA.....	142.00
K......	2.70
CA.....	108.00
MG.....	48.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	81.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	93.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	31.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	39.

RECORD NO....... 165
NAME OF SOURCE.. 26S/12E-33Q02
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.8

WATER CHEMISTRY

SIO2...	0.0
NA.....	25.00
K......	1.00
CA.....	75.00
MG.....	28.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	118.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	101.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	1.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	43.

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

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GEOTHERMOMETRY

RECORD NO....... 166
NAME OF SOURCE.. 26S/13E-04F01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.0

WATER CHEMISTRY

SIO2...	0.0
NA.....	115.00
K......	2.00
CA.....	45.00
MG.....	17.00

GEOTHERMOMETERS (DEGREES C)

SILICA - CONDUCTIVE....	0.	NA-K...........	77.
ADIABATIC.....	0.	NA-K-CA(1/3)...	92.
CHALCEDONY....	0.	NA-K-CA(4/3)...	36.
CRISTOBALITE..	0.	MG CORRECTED	
AMORPHOUS.....	0.	NA-K-CA(1/3)...	46.

RECORD NO....... 167
NAME OF SOURCE.. 26S/13E-04J01S
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.1

WATER CHEMISTRY

SIO2...	50.00
NA.....	165.00
K......	4.00
CA.....	111.00
MG.....	33.00

GEOTHERMOMETERS (DEGREES C)

SILICA - CONDUCTIVE....	102.	NA-K...........	92.
ADIABATIC.....	103.	NA-K-CA(1/3)...	103.
CHALCEDONY....	72.	NA-K-CA(4/3)...	41.
CRISTOBALITE..	51.	MG CORRECTED	
AMORPHOUS.....	-14.	NA-K-CA(1/3)...	54.

RECORD NO....... 168
NAME OF SOURCE.. 26S/13E-10D02
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.0

WATER CHEMISTRY

SIO2...	29.00
NA.....	60.00
K......	3.00
CA.....	112.00
MG.....	68.00

GEOTHERMOMETERS (DEGREES C)

SILICA - CONDUCTIVE....	78.	NA-K...........	131.
ADIABATIC.....	82.	NA-K-CA(1/3)...	118.
CHALCEDONY....	47.	NA-K-CA(4/3)...	26.
CRISTOBALITE..	28.	MG CORRECTED	
AMORPHOUS.....	-34.	NA-K-CA(1/3)...	21.

RECORD NO....... 169
NAME OF SOURCE.. 26S/13E-11C01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.7

WATER CHEMISTRY

SIO2...	0.0
NA.....	202.00
K......	6.00
CA.....	112.00
MG.....	73.00

GEOTHERMOMETERS (DEGREES C)

SILICA - CONDUCTIVE....	0.	NA-K...........	102.
ADIABATIC.....	0.	NA-K-CA(1/3)...	114.
CHALCEDONY....	0.	NA-K-CA(4/3)...	54.
CRISTOBALITE..	0.	MG CORRECTED	
AMORPHOUS.....	0.	COOL	

REFERENCE:
RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

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GEOTHERMOMETRY

RECORD NO....... 170
NAME OF SOURCE.. 26S/13E-11F01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.5

WATER CHEMISTRY

SIO2...	0.0
NA.....	212.00
K......	2.00
CA.....	12.00
MG.....	9.50

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	52.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	86.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	66.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	COOL	

RECORD NO....... 171
NAME OF SOURCE.. 26S/13E-11F02
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.5

WATER CHEMISTRY

SIO2...	0.0
NA.....	145.00
K......	3.00
CA.....	95.00
MG.....	60.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	85.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	97.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	35.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	COOL	

RECORD NO....... 172
NAME OF SOURCE.. 26S/14E-18J01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.6

WATER CHEMISTRY

SIO2...	0.0
NA.....	110.00
K......	3.00
CA.....	25.00
MG.....	15.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	98.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	112.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	57.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	24.
			NA-K-CA(4/3)...	45.

RECORD NO....... 173
NAME OF SOURCE.. 26S/14E-18G01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.5

WATER CHEMISTRY

SIO2...	0.0
NA.....	104.50
K......	3.00
CA.....	30.00
MG.....	9.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	101.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	112.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	53.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	53.

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 174
NAME OF SOURCE.. 27S/12E-03C01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.0

WATER CHEMISTRY

SIO2...	0.0
NA.....	59.00
K......	2.00
CA.....	114.00
MG.....	62.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	109.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	103.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	16.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	28.

RECORD NO....... 175
NAME OF SOURCE.. 27S/12E-03C02
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.9

WATER CHEMISTRY

SIO2...	48.00
NA.....	42.00
K......	2.00
CA.....	58.00
MG.....	38.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	100.	NA-K...........	128.
	ADIABATIC.....	101.	NA-K-CA(1/3)...	116.
	CHALCEDONY....	70.	NA-K-CA(4/3)...	24.
	CRISTOBALITE..	50.	MG CORRECTED	
	AMORPHOUS.....	-16.	COOL	

RECORD NO....... 176
NAME OF SOURCE.. 27S/12E-04F01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.3

WATER CHEMISTRY

SIO2...	22.00
NA.....	108.00
K......	0.0
CA.....	90.00
MG.....	38.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	67.	NA-K...........	0.
	ADIABATIC.....	72.	NA-K-CA(1/3)...	0.
	CHALCEDONY....	35.	NA-K-CA(4/3)...	0.
	CRISTOBALITE..	18.	MG CORRECTED	
	AMORPHOUS.....	-43.	NONE	

RECORD NO....... 177
NAME OF SOURCE.. 27S/12E-04F04
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.8

WATER CHEMISTRY

SIO2...	0.0
NA.....	145.00
K......	2.30
CA.....	58.00
MG.....	33.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	73.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	90.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	37.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	31.

REFERENCE:
RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 178
NAME OF SOURCE.. 27S/12E-04P02
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.0

WATER CHEMISTRY

SIO2...	0.0
NA.....	125.00
K......	2.00
CA.....	54.00
MG.....	22.00

GEOTHERMOMETERS (DEGREES C)

SILICA - CONDUCTIVE....	0.	NA-K...........	74.
ADIABATIC.....	0.	NA-K-CA(1/3)...	89.
CHALCEDONY....	0.	NA-K-CA(4/3)...	33.
CRISTOBALITE..	0.	MG CORRECTED	
AMORPHOUS.....	0.	NA-K-CA(1/3)...	44.

RECORD NO....... 179
NAME OF SOURCE.. 28S/12E-11N0?
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.7

WATER CHEMISTRY

SIO2...	0.0
NA.....	43.00
K......	2.00
CA.....	79.00
MG.....	44.00

GEOTHERMOMETERS (DEGREES C)

SILICA - CONDUCTIVE....	0.	NA-K...........	126.
ADIABATIC.....	0.	NA-K-CA(1/3)...	113.
CHALCEDONY....	0.	NA-K-CA(4/3)...	19.
CRISTOBALITE..	0.	MG CORRECTED	
AMORPHOUS.....	0.	NA-K-CA(1/3)...	25.

RECORD NO....... 181
NAME OF SOURCE.. 27S/12E-21B01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.7

WATER CHEMISTRY

SIO2...	0.0
NA.....	48.00
K......	3.00
CA.....	149.00
MG.....	58.00

GEOTHERMOMETERS (DEGREES C)

SILICA - CONDUCTIVE....	0.	NA-K...........	144.
ADIABATIC.....	0.	NA-K-CA(1/3)...	123.
CHALCEDONY....	0.	NA-K-CA(4/3)...	19.
CRISTOBALITE..	0.	MG CORRECTED	
AMORPHOUS.....	0.	NA-K-CA(1/3)...	37.

RECORD NO....... 182
NAME OF SOURCE.. 27S/12E-21G01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.7

WATER CHEMISTRY

SIO2...	0.0
NA.....	125.00
K......	3.00
CA.....	94.00
MG.....	77.00

GEOTHERMOMETERS (DEGREES C)

SILICA - CONDUCTIVE....	0.	NA-K...........	92.
ADIABATIC.....	0.	NA-K-CA(1/3)...	101.
CHALCEDONY....	0.	NA-K-CA(4/3)...	34.
CRISTOBALITE..	0.	MG CORRECTED	
AMORPHOUS.....	0.	COOL	

REFERENCE:
RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 183
NAME OF SOURCE.. 27S/12E-21N01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.1

WATER CHEMISTRY

SIO2...	0.0
NA.....	45.00
K......	1.00
CA.....	129.00
MG.....	50.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	88.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	84.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	-2.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	48.

RECORD NO....... 184
NAME OF SOURCE.. 27S/12E-21N04
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.4

WATER CHEMISTRY

SIO2...	0.0
NA.....	41.00
K......	2.00
CA.....	113.00
MG.....	47.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	129.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	112.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	13.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	36.

RECORD NO....... 186
NAME OF SOURCE.. 27S/12E-29P02
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.0

WATER CHEMISTRY

SIO2...	0.0
NA.....	40.00
K......	1.50
CA.....	126.00
MG.....	41.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	115.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	101.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	6.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	49.

RECORD NO....... 187
NAME OF SOURCE.. 27S/12E-29P03
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.6

WATER CHEMISTRY

SIO2...	0.0
NA.....	42.00
K......	2.00
CA.....	102.00
MG.....	64.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	128.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	112.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	15.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	COOL	

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 188
NAME OF SOURCE.. 27S/12E-29P04
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.5

WATER CHEMISTRY

SIO2...	18.00
NA.....	32.00
K......	2.00
CA.....	87.00
MG.....	37.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	60.	NA-K...........	144.
	ADIABATIC.....	65.	NA-K-CA(1/3)...	121.
	CHALCEDONY....	27.	NA-K-CA(4/3)...	15.
	CRISTOBALITE..	11.	MG CORRECTED	
	AMORPHOUS.....	-49.	NA-K-CA(1/3)...	33.

RECORD NO....... 189
NAME OF SOURCE.. 27S/12E-32C03
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.4

WATER CHEMISTRY

SIO2...	23.00
NA.....	37.00
K......	1.00
CA.....	113.00
MG.....	38.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	69.	NA-K...........	98.
	ADIABATIC.....	74.	NA-K-CA(1/3)...	89.
	CHALCEDONY....	37.	NA-K-CA(4/3)...	-1.
	CRISTOBALITE..	19.	MG CORRECTED	
	AMORPHOUS.....	-42.	NA-K-CA(1/3)...	52.

RECORD NO....... 190
NAME OF SOURCE.. 27S/12E-32C04
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.6

WATER CHEMISTRY

SIO2...	21.00
NA.....	46.00
K......	2.00
CA.....	131.00
MG.....	79.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	65.	NA-K...........	123.
	ADIABATIC.....	71.	NA-K-CA(1/3)...	108.
	CHALCEDONY....	33.	NA-K-CA(4/3)...	12.
	CRISTOBALITE..	16.	MG CORRECTED	
	AMORPHOUS.....	-45.	NA-K-CA(1/3)...	24.

RECORD NO....... 191
NAME OF SOURCE.. 27S/12E-32E01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 0.0

WATER CHEMISTRY

SIO2...	32.00
NA.....	47.00
K......	1.00
CA.....	194.00
MG.....	66.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	82.	NA-K...........	86.
	ADIABATIC.....	85.	NA-K-CA(1/3)...	81.
	CHALCEDONY....	51.	NA-K-CA(4/3)...	-7.
	CRISTOBALITE..	32.	MG CORRECTED	
	AMORPHOUS.....	-31.	NA-K-CA(1/3)...	54.

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

```
RECORD NO.......      192
NAME OF SOURCE..  27S/12E-32F02
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...            PH.....   7.5

WATER CHEMISTRY
   SIO2...       0.0
   NA.....      41.00
   K......       1.00
   CA.....      85.00
   MG.....      61.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....      0.        NA-K...........       93.
            ADIABATIC.....      0.        NA-K-CA(1/3)...       89.
            CHALCEDONY....      0.        NA-K-CA(4/3)...        3.
            CRISTOBALITE..      0.        MG CORRECTED
            AMORPHOUS.....      0.        COOL
```

```
RECORD NO.......      193
NAME OF SOURCE..  27S/12E-32Q01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...            PH.....   8.0

WATER CHEMISTRY
   SIO2...      19.00
   NA.....      35.00
   K......       1.00
   CA.....      69.00
   MG.....      49.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....     62.        NA-K...........      100.
            ADIABATIC.....     67.        NA-K-CA(1/3)...       93.
            CHALCEDONY....     29.        NA-K-CA(4/3)...        5.
            CRISTOBALITE..     12.        MG CORRECTED
            AMORPHOUS.....    -48.        COOL
```

```
RECORD NO.......      194
NAME OF SOURCE..  27S/12E-32Q03
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...            PH.....   7.6

WATER CHEMISTRY
   SIO2...       0.0
   NA.....      35.00
   K......       1.00
   CA.....      64.00
   MG.....      50.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....      0.        NA-K...........      100.
            ADIABATIC.....      0.        NA-K-CA(1/3)...       94.
            CHALCEDONY....      0.        NA-K-CA(4/3)...        6.
            CRISTOBALITE..      0.        MG CORRECTED
            AMORPHOUS.....      0.        COOL
```

```
RECORD NO.......      195
NAME OF SOURCE..  27S/12E-33N01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE...            PH.....   7.7

WATER CHEMISTRY
   SIO2...       0.0
   NA.....      59.00
   K......       3.00
   CA.....     106.00
   MG.....      75.00
GEOTHERMOMETERS (DEGREES C)
   SILICA - CONDUCTIVE....      0.        NA-K...........      132.
            ADIABATIC.....      0.        NA-K-CA(1/3)...      119.
            CHALCEDONY....      0.        NA-K-CA(4/3)...       26.
            CRISTOBALITE..      0.        MG CORRECTED
            AMORPHOUS.....      0.        COOL
```

REFERENCE:
RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 196
NAME OF SOURCE.. 27S/13E-09P01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 8.2

WATER CHEMISTRY

SIO2...	45.00
NA.....	130.00
K......	3.00
CA.....	13.00
MG.....	9.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	97.	NA-K...........	90.
	ADIABATIC.....	98.	NA-K-CA(1/3)...	112.
	CHALCEDONY....	67.	NA-K-CA(4/3)...	72.
	CRISTOBALITE..	47.	MG CORRECTED	
	AMORPHOUS.....	-18.	COOL	

RECORD NO....... 197
NAME OF SOURCE.. 27S/13E-24N01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.9

WATER CHEMISTRY

SIO2...	0.0
NA.....	32.00
K......	2.00
CA.....	53.00
MG.....	17.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	144.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	124.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	23.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	46.

RECORD NO....... 198
NAME OF SOURCE.. 27S/13E-36R01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.4

WATER CHEMISTRY

SIO2...	60.00
NA.....	40.00
K......	2.60
CA.....	105.00
MG.....	17.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	111.	NA-K...........	146.
	ADIABATIC.....	110.	NA-K-CA(1/3)...	124.
	CHALCEDONY....	81.	NA-K-CA(4/3)...	20.
	CRISTOBALITE..	60.	MG CORRECTED	
	AMORPHOUS.....	-7.	NA-K-CA(1/3)...	80.

RECORD NO....... 199
NAME OF SOURCE.. 28S/12E-04G01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.4

WATER CHEMISTRY

SIO2...	0.0
NA.....	32.00
K......	1.00
CA.....	61.00
MG.....	38.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	105.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	96.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	6.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	COOL	

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMOMETRY

RECORD NO....... 200
NAME OF SOURCE.. 28S/12E-04J02
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.7

WATER CHEMISTRY

SIO2...	22.00
NA.....	25.00
K......	1.00
CA.....	106.00
MG.....	34.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	67.	NA-K...........	118.
	ADIABATIC.....	72.	NA-K-CA(1/3)...	99.
	CHALCEDONY....	35.	NA-K-CA(4/3)...	-3.
	CRISTOBALITE..	18.	MG CORRECTED	
	AMORPHOUS.....	-43.	NA-K-CA(1/3)...	51.

RECORD NO....... 201
NAME OF SOURCE.. 28S/12E-10G01
STATE........... CALIF
COUNTY.......... SLO

WATER TEMPERATURE... PH..... 7.5

WATER CHEMISTRY

SIO2...	0.0
NA.....	30.00
K......	1.00
CA.....	59.00
MG.....	29.00

GEOTHERMOMETERS (DEGREES C)

SILICA -	CONDUCTIVE....	0.	NA-K...........	108.
	ADIABATIC.....	0.	NA-K-CA(1/3)...	98.
	CHALCEDONY....	0.	NA-K-CA(4/3)...	6.
	CRISTOBALITE..	0.	MG CORRECTED	
	AMORPHOUS.....	0.	NA-K-CA(1/3)...	33.

REFERENCE:

RAPPORT, A., 1982, FORTRAN PROGRAM TO COMPUTE CHEMICAL GEOTHERMOMETERS FOR GEOTHERMAL FLUIDS: U. S. GEOLOGICAL SURVEY, OPEN-FILE REPORT 82-308, 25 P.

CALIFORNIA DIVISION OF MINES AND GEOLOGY

GEOTHERMAL PUBLICATIONS

Generated in response to the U.S. Department of Energy
California State-Coupled Program for Reservoir Assessment and Confirmation.

1978 - 1982

Campion, L.F., Chapman, R.H., and Chase, G.W., Youngs, L.G., Publication in 1982, Resource investigation of low - and moderate-temperature geothermal areas in Paso Robles, California - Part of the fourth year report, 1981-1982, of the U.S. Department of Energy - California State-Coupled Program for reservoir assessment and confirmation: California Division of Mines and Geology, Open-File Report___, Report for U.S. Department of Energy, Contract No. DE-FG03-81SF10855, ___p.

"The report presents the data and results of a detailed scientific geothermal resource investigation of the Paso Robles area, California. Geothermal historical development, geology, geochemistry, hydrology, geophysical surveys, temperature measurements, and geothermal reservoir characteristics are addressed in the report".

Chapman, R.H., Chase, G.W., and Youngs, L.G., 1980, Geophysical survey, Paso Robles Geothermal Area, California - Part of the resource assessment of low- and moderate-temperature geothermal resource areas in California - Part of the second year report, 1979-80 of the U.S. Department of Energy - California State-Coupled Program for reservoir assessment and confirmation: California Division of Mines and Geology, 43 p.

"The report details an aeromagnetic, ground magnetic, and gravity survey conducted at the Paso Robles goethermal area. Interpretations of data are presented. A general overview of the Paso Robles geothermal area, including geology, history, hydrology, geochemistry, and geothermal activity, is included in the report".

Higgins, C.T., Chapman, R.H., and Chase, G.W., Publication in 1982, Geothermal resource of the Bridgeport-Bodie Hills region, California - Part of the fourth year, 1981-1982, of the U.S. Department of Energy - California State-Coupled Program for reservoir assessment and confirmation: California Division of Mines and Geology, Open-File Report_____, Report for U.S. Department of Energy, Contract No. DE-FG03-81SF10855, ___p.

"The report summarizes detailed geological, geochemical, and geophysical investigations of the area immediately southeast of Bridgeport as well as a regional evaluation of the Bodie Hills. The results of the investigations are used to speculate on the source of the thermal water and the nature of the area's source of heat".

Higgins, C.T., 1980, Geothermal resources of California: California Division of Mines and Geology, Geologic Data Map Series, Map no. 4, scale 1:750,000. A 4 1/2 by 5 foot, 5-color map of California with more than 600 geothermal wells and springs located. In addition to high-temperature geothermal resources that can be used to generate electricity, the map shows geothermal resources from which energy in the form of low- and moderate-temperature (70° - 150°F) groundwater may be tapped for direct heat applications".

"A 4 1/2 by 5 foot, 5-color map of California with more than 600 geothermal wells and springs located. In addition to high-temperature geothermal resources that can be used to generate electricity, the map shows geothermal resources from which energy in the form of low- and moderate-temperature (70°-150°F) ground water may be tapped for direct heat applications."

Leivas, E. and Bacon, C.F., Publication in 1982, Reconnaissance geothermal resource assessment of another 40 sites in California - Part of the fourth year, 1981-1982, of the U.S. Department of Energy - California State-Coupled Program for reservoir assessment and confirmation: California Division of Mines and Geology, Open-File Report______, Report for U.S. Department of Energy, Contract No. DE-FG03-81SF10855, ___p.

"The report presents geological, geochemical, and historical data for another 40 low-temperature geothermal sites located throughout California".

Leivas, E., Martin, R.C., Higgins, C.T., and Bezore, S.P., 1981, Reconnaissance geothermal resource assessment of 40 sites in California - Part of the third year report, 1980-81, of the U.S. Department of Energy - California State-Coupled Program for reservoir assessment and confirmation: California Division of Mines and Geology, Open-File Report 82-4SAC, Report for U.S. Department of Energy, Contract No. DE-FG03-80SF10855, 237 p.

"The report presents geological, geochemical, and historical data for low- and moderate-temperature geothemal sites located throughout California".

Majmundar, H.H., Publication in 1982, Technical Map of the Geothermal Resources of California: California Division of Mines and Geology, Geologic Data Map Series, map no. 5, scale 1:750,000.

"A 4 1/2 by 5 foot, 7-color map of California with more than 600 geothermal wells and springs annotated. In addition to temperature data, the map presents information on water chemistry including some mineral concentrations and water chemical type. An accompanying explanatory text contains many tables and maps".

Martin, R.C., Higgins, C.T., and Olmstead, D., 1980, Resource assessment of low- and moderate-temperature geothermal waters in California - Report of the first year, 1978-79 of the U.S. Department of Energy - California State-Coupled Progdram for reservoir assessment and confirmation: California Division of Mines and Geology, Report for U.S. Department of Energy Contract No. EW-78-S-07-1739, 188 p.

"The report is a compilation of California state wide low- and moderate-temperature geothermal resource data. The geothermal resources of Mono Basin, the South Bay Area of San Diego County, Paso Robles and the Southern Coast Ranges, and Bridgeport-Western Bodie Hill Region are presented in detail".

Taylor, G.C., Bacon, C.F., Chapman, R.H., Chase, G.W., and Majmundar, H.H., 1981, Drilling Addendum to resource assessment of low-and moderate-temperature geothermal waters in Calistoga, Napa County, California - Report of the second year, 1979-80, of the U.S. Department of Energy - California State-Coupled Program for reservoir assessment and confirmation: California Division of Mines and Geology, Addendum to Open-File Report 81-13SAC, Report for U.S. Department of Energy, Contract No. DE-FG03-79ET27035, 73 p.

APPENDIX C

GEOTHERMOMETRY

"The addendum presents the result and conclusions of the CDMG exploratory drilling program at Calistoga, California. The report includes geologic drill logs, geochemistry data, cross-sections, correlations of various investigative techniques, and geologic and hydrologic interpretations".

Youngs, L.G., Bacon, C.F., Chapman, R.H., Chase, G.W., Higgins, C.T., Majmundar, H.H., and Taylor, G.C., 1980, Resource assessment of low- and moderate-temperature geothermal waters in Calistoga, Napa County, California - Report of the second year, 1979-80 of the U.S. Department of Energy - California State-Coupled Program for reservoir assessment and confirmation: California Division of Mines and Geology, Open-File Report 81-13SAC, Report for U.S. Department of Energy, Contract No. DE-FG03-79ET26035, 168 p.

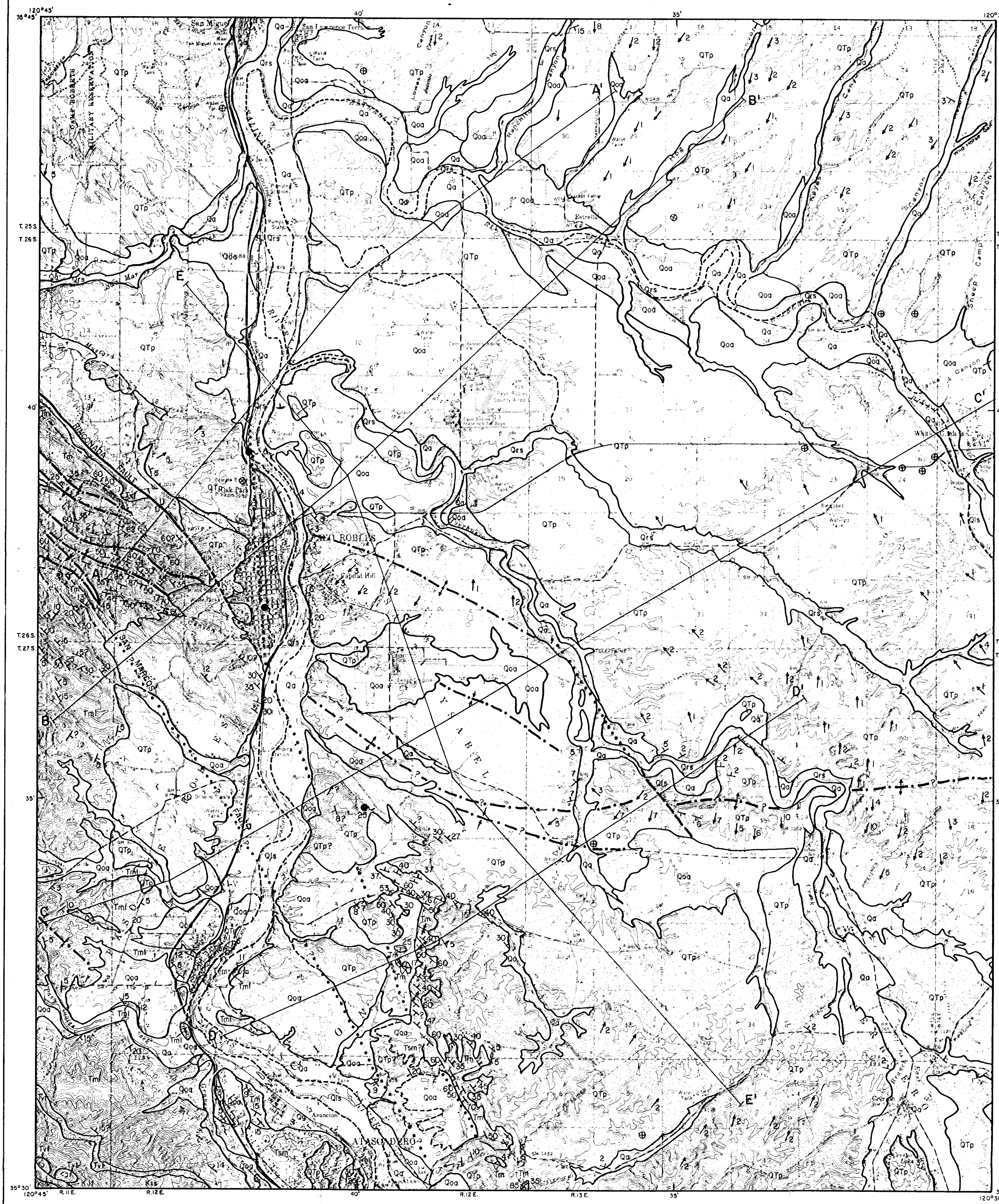
"The report presents the data and results of a detailed scientific geothermal reservoir investigation of the Calistoga, California area. Methodology, history, geology, geophysical investigations, shallow and moderately deep hole temperature surveys, hydrology, geochemistry, seismicity, exploratory drilling, and reservoir evaluation are addressed in the report".

Youngs, L.G., Bezore, S.P., Chapman, R.H., and Chase, G.W., 1981, Resource investigation of low- and moderate-temperature geothermal areas in San Bernardino, California - Part of the third year report, 1980-81, of the U.S. Department of Energy - California State-Coupled Program for reservoir assessment and confirmation: California Division of Mines and Geology, Open-File Report 82-11SAC, Report for U.S. Department of Energy, Contract No. DE-FG03-80SF10855, 242 p.

"The report presents the data and results of a detailed scientific geothermal reservoir investigation of the San Bernardino, California area. Geothermal historical development, geology, geochemistry, geophysical investigations, temperature surveys, hydrology, seismicity, and geothermal reservoir evaluation are addressed in the report".

Youngs, L.G., Chapman, R.H., Bezore, S.P., Chase, G.W., and Majmundar, H.H., publication in 1982, Low-temperature geothermal resource investigation for the Sonoma Valley area, California - Part of the fourth year report, 1981-82, of the U.S. Department of Energy - California State-Coupled Program for reservoir assessment and confirmation: California Division of Mines and Geology, Open-File Report _____, Report for U.S. Department of Energy, Contract No. DE-FG03-80SF10855, __p.

"The report presents the data and results of a detailed scientific geothermal reservoir investigation of the Sonoma Valley area, California. Historical geothermal development, geology, geochemistry, geophysical, surveys, temperature surveys, hydrology, and geothermal reservoir characteristics are discussed in the report."



Topographic Base Map by U.S.G.S.

EXPLANATION

QUATERNARY

Holocene

Qrs — River sand

Qa — Alluvium

Qls — Landslide rubble

Pleistocene

Qoa — Older or dissected alluvium

Plio?

QTp — Paso Robles Formation

TERTIARY

Miocene

Tsm — Santa Margarita Formation

Tm / Tml — Monterey shale Tm, cherty siliceous shale, Upper Miocene (Mohnian) Tml, semi-siliceous shale

Tvt — Vaqueros Formation

MESOZOIC

CRETACEOUS

Kss — Unnamed Formation

KJf — Franciscan Complex

gr — Quartz diorite or granodiorite

SYMBOLS

Spring >30°C

CONTACT
(Dashed where gradational or approximately located)

U / D
FAULT
(Dashed where doubtful, Dotted where concealed)
U, Upthrown side
D, Downthrown side
Arrows indicate horizontal movement

Anticline — Syncline
(Axis of fold showing direction of plunge)

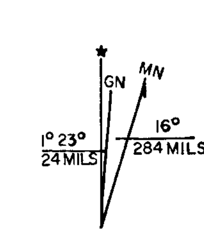
Horizontal

30 2
Inclined
Strike and dip

2 trend and plunge of lineation

C — C'
Cross Section

GEOLOGIC MAP OF PASO ROBLES 15 MINUTE QUADRANGLE



UTM GRID AND 1961 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

compiled by
L. F. Campion

SCALE 1:62,500
1 .5 0 1 2 3 4 MILES
3000 0 3000 6000 9000 12000 15000 18000 21000 FEET
1 .5 0 1 2 3 4 5 KILOMETERS

Quadrangle Location

Geologic References

The geologic map was compiled from the following maps with appropriate modifications.

Dibblee, T. W., Jr., 1971, Geologic maps of seventeen 15-minute quadrangles along the San Andreas fault in the vicinity of King City, Coalinga, Panoche Valley, and Paso Robles, California: U.S. Geological Survey Open-File Maps.

Olmstead, Dennis, Youngs, Les G., 1979, Geologic map of the Paso Robles 15-minute quadrangle, scale 1:62,500: California Division of Mines and Geology, Unpublished.

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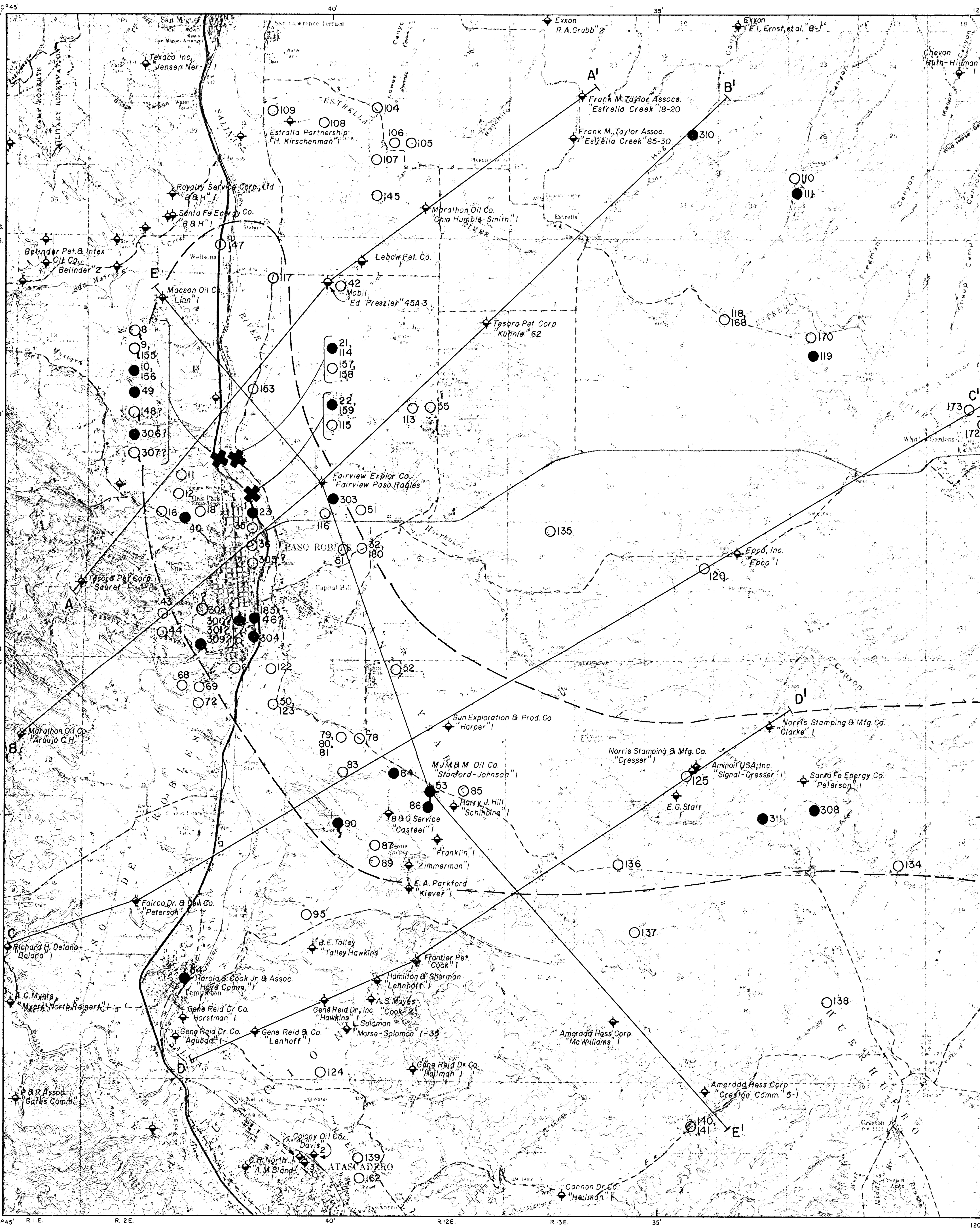


LOCATION OF WARM WATER WELLS, WARM SPRINGS, AND OIL WELLS IN THE PASO ROBLES QUADRANGLE

compiled by
L. F. Campion

SCALE 1:62,500
1 0 1 2 3 4 MILES
3000 0 3000 6000 9000 12000 15000 18000 21000 FEET
1 0 1 2 3 4 5 KILOMETERS

SYMBOLS

- ○ Water Well < 30° C
- ● Water Well > 30° C
- Spring < 30° C
- Spring > 30° C
- ? Historical
- Oil Well, Abd-dry hole
- Abd-oil converted to water well
- C —— Cross Section —— C'
- — — — Area of geothermal potential
- ✖ Multiple Wells

GN MN 1°23' 24MILS 16° 284MILS
UTM GRID AND 1961 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

WELL NO.	TWN-RNG	NAMES IN LITERATURE	REFERENCES*	DATE SAMPLED	SURFACE TEMPERATURE °C	°F	TOTAL DEPTH FEET	FLOW RATE (gpm)	REMARKS
8	26S/12E - 20A0XS	(Bubbling Spring, Fish Pond)	1,6	01-24-80	21.1	70	Spring	Small (Artesian)	
9	26S/12E - 20A01S		1	01-24-80	27.2	81	Spring	(Artesian)	Same as No. 155, issues from under building
10	26S/12E - 20A02S	Paso Robles Hot Springs Main Well	1,6	01-24-80	43	109.3***	55		Same as No. 156, Temperature Log in Appendix B
11	26S/12E - 20F01		1	11-04-80	23.3	74	424	8	
12	26S/12E - 20L		1	11-05-80	21.1	70	240		
16	26S/12E - 20N0B		1	03-27-80	20	68	---		
18	26S/12E - 20Q0A		1	11-05-80	23.3	74	---		H_2S odor
21	26S/12E - 21D01S	Kleck Well	1	01-24-80	38.8	102	300	30 (Artesian)	H_2S odor, same as No. 114
22	26S/12E - 21L02S	Paso Robles Sewer Treatment Plant Well	1	11-16-78	36.1	97	---	48 (Artesian)	H_2S odor
23	26S/12E - 21P01S	Cal-Trans Well	1	11-16-78	40.5	105	---	40 (Artesian)	H_2S odor, well buried under freeway, flow diverted to bathhouse then East to Salines River
31	26S/12E - 27G0A		1	08-20-80	27.7	82	---		H_2S odor
32	26S/12E - 27H0A		1	08-20-80	22.2	72	---		
35	26S/12E - 28C01S	Bianchi Well	1	11-16-78	25.5	78	55+	2 (Artesian)	H_2S odor
36	26S/12E - 28F01S	Fairgrounds (NE of track) well	1,6	11-17-78	26.1	79	---	6 (Artesian)	H_2S odor, drilled before 1930
37	26S/12E - 28L01S	Pioneer Museum Well	1	11-17-78	27.2	81	---	9 (Artesian)	H_2S odor, when value is open well No. 36 flow decreases
40	26S/12E - 29C0B		1,6	01-30-81	32.8	91**	650		Temperature Log in Appendix B
43	26S/12E - 32E		1	11-05-80	22.2	72	---		Slight H_2S odor
44	26S/12E - 32M		1	11-05-80	21.1	70	---		Strong H_2S odor
46	26S/12E - 33F0B	Sulphur Bath House Co., Well, Municipal Bath, Alley Physical Therapy Spa, Mikels Health Spa (Clark Building)	7,8,11	09-20-62	42.5	108.6	427	264 (Artesian)	Historical
49	26S/12E - 20A	Paso Robles Hot Springs Stand-by well	3,6	01-07-81	41.6	107**		95	Temperature Log in Appendix B
50	27S/12E - 04K	"Borcherdt" 5 well	3,6,7	05-07-75	27.3	81.1**	400	445	Water level at 46' draws to 136' when pumped then draws in sulphur water, Temperature Log in Appendix B
51	26S/12E - 22R	"Butterfield" 12 well	3,7	06-06-77	28.3	83	1004		
52	27S/12E - 02C	"Sherwood" 6 well	3	07-17-?	26	78.8	800	733	
53	27S/12E - 11R01	"Stanford and Johnson" 1 well	3,4,6	08-12-71	36.7	98	756	3000 (Artesian)	Mud log Temperature 52.7°C (127°F) when flowing wide open well No. 84 flow decreases from full 6" pipe to trickle. Well head pressure has decreased from 43 psi to 20 psi in last 15 years.
54	27S/12E - 14H	"Hove Community" 1 well	4	07-26-62	38.9	102**	886	500 to 1000 (Artesian)	
55	26S/12E - 14H	"Youth Authority" 4 well	3	10-29-76	20	68	1220		
61	27S/12E - 04D0X		1,6	11-06-80	21.1	70	350		Temperature taken from tank
68	27S/12E - 05F0A		1	11-05-80	21.1	70	350		
69	27S/12E - 05G0A		1	08-20-80	26.1	79	---		
72	27S/12E - 05K0X		1	03-27-80	21.1	70	Perforated to 235		Temperature taken from tank
74	27S/12E - 10A0X		1,6	08-21-80	24.4	76	220	40	Temperature taken from tank
79	27S/12E - 10B0A		1,6	11-06-80	28.3	83	---	15	Slight sulphur
80	27S/12E - 10B0C		1	11-06-80	23.3	74	350		
81	27S/12E - 10B0D		1	11-06-80	21.1	70	300		
[illegible]	27S/12E - 10J0A		1	11-06-80	20.5	69	---		
[illegible]	27S/12E - 11L0A	Riechel Well	1,6	11-06-80	34.4	94	1120	(Artesian)	Flow fills 6" pipe except when well No. 53 is open wide then flow is a trickle
85	27S/12E - 12P0A		1	11-06-80	23.3	74	275		
86	27S/12E - 14A01S	Franklin Well	1	01-24-80	37.2	99	840	(Artesian)	Sulphur odor
87	27S/12E - 14M0A		1	11-07-80	21.1	71	200		
89	27S/12E - 14N0A		1	11-07-80	20	68	92		
90	27S/12E - 15G01S	Santa Ysabel Spring	1,6	01-23-80	34.4	94	Spring	15 (Artesian)	Flows into concrete lined pool, gas bubbling from bottom of pool
95	27S/12E - 22M01		1	04-11-78	20	68	500		
[illegible]	25S/12E - 26D01		2	06-08-67	21	69	280		
105	25S/12E - 26K01		2	05-31-54	21	70	250		
106	25S/12E - 26L01		2	05-05-66	21	70	Perforated 200-400		
107	25S/12E - 26N01		2	10-20-64	21	70	---		
108	25S/12E - 27F03		2	06-08-67	22	72	---		
109	25S/12E - 28B01		2	05-04-65	22	72	---		
110	25S/13E - 35D01		2	08-29-68	24	75	380		
111	25S/13E - 35E01		2	07-22-54	30	86	380		
112	26S/12E - 03K03		2	04-26-65	21	70	210		
113	26S/12E - 14G01		2	10-20-75	28.9	84	---		
114	26S/12E - 21L02S	Kleck Well	2	01-09-68	48	118	---	30 (Artesian)	Same as No. 21, H_2S odor
115	26S/12E - 21L0L		2	08-03-64	21	70	---		
116	26S/12E - 22P02		2	10-15-76	23.3	74	300		
117	26S/13E - 04K01		2	09-02-53	21	70	320		
118	26S/13E - 10D01		2	08-28-57	24	75	1012		
119	26S/13E - 11L01		2	11-10-71	32	90	---		
120	26S/13E - 28J01		2	09-22-68	23	74	440		
122	27S/12E - 04B01		2	08-19-53	20	68	---		
123	27S/12E - 04K05		2	06-08-67	24	76	---		
124	27S/12E - 34P01		2	06-07-67	22	72	---		
125	[illegible]		2	[illegible]	[illegible]	[illegible]	[illegible]		
[illegible]	[illegible]		2	[illegible]	[illegible]	[illegible]	[illegible]		
153	[illegible]	Soda Spring	[illegible]	[illegible]	25	77	Spring	4 (Artesian)	Historical
[illegible]	26S/12E - 16C04		2	06-26-67	20	68	138		
155	26S/12E - 20A01S		2	06-26-67	43	110	Spring		Same as No. 9, issues from under building
156	26S/12E - 20A02S	Paso Robles Hot Springs Main Well	2,6	09-20-62	42	108	55		Same as No. 10, Temperature Log in Appendix B
157	[illegible]		2	[illegible]	22	71			
158	[illegible]		2	11-09-71	20	68			
159	26S/12E - 21L01S		2	09-19-62	42	108			
162	[illegible]		2	07-15-64	20	68	96		
163	[illegible]		2	[illegible]	20	68	---		
168	[illegible]		2	11-05-73	26.6	80	690		
170	[illegible]		2	10-06-66	24	75			
172	[illegible]		2	10-06-66	25	77			
173	[illegible]		2	[illegible]	20	68	400		
180	26S/12E - 33F10	Heaton Well	5,8	03-65	40.5	105	230	247 (Artesian)	Abandoned, 1965
300	26S/12E - 33P	Main Sulphur Spring Well	1	---	42	107.6	640	1389 (Artesian)	Historical, abandoned, was the well for the Hotel El Paso de Robles
301	[illegible]	Grand Central Sulphur Spring (under City Hall) well	1	---	[illegible]	[illegible]	510	Strong (Artesian)	Historical, abandoned, located under City Hall
302	[illegible]	[illegible] Mineral well	1		?	?	170	Small	Historical, no mention of temperature in literature
303	[illegible]	Burkey Well	6	03-10-82	36.7 / 500	98 / 500	600	379	Temperature Log in Appendix B
304	[illegible]	Ernest Well	6	03-09-82	37.6	99		40 (Artesian)	Well head is buried. Issues into storm drain on Riverside Street
305	[illegible]	Fairgrounds (SW of track) well	1	11-03-77	26	79	---	30	Historical, sulphur odor abandoned
306	[illegible]	Lithium Spring well	9	---	47.8	118	140	8 (Artesian)	Historical
307	[illegible]	Sand Spring	12	---	26.1	79	Spring		Historical
308	[illegible]	Cal-Rosa well	4	---		113***	1032	1320	Cascading use, fish aquaculture, polyculture, hydroponics, and irrigation
309	[illegible]	Mud Bath Spring	12	---			Spring	100	Historical, temperature reported between [illegible]
310	[illegible]	Hog Canyon well	10	---	30's	90's	570	50	
311	[illegible]	McAdams well	9	---	45	113***	690	100 (Artesian)	

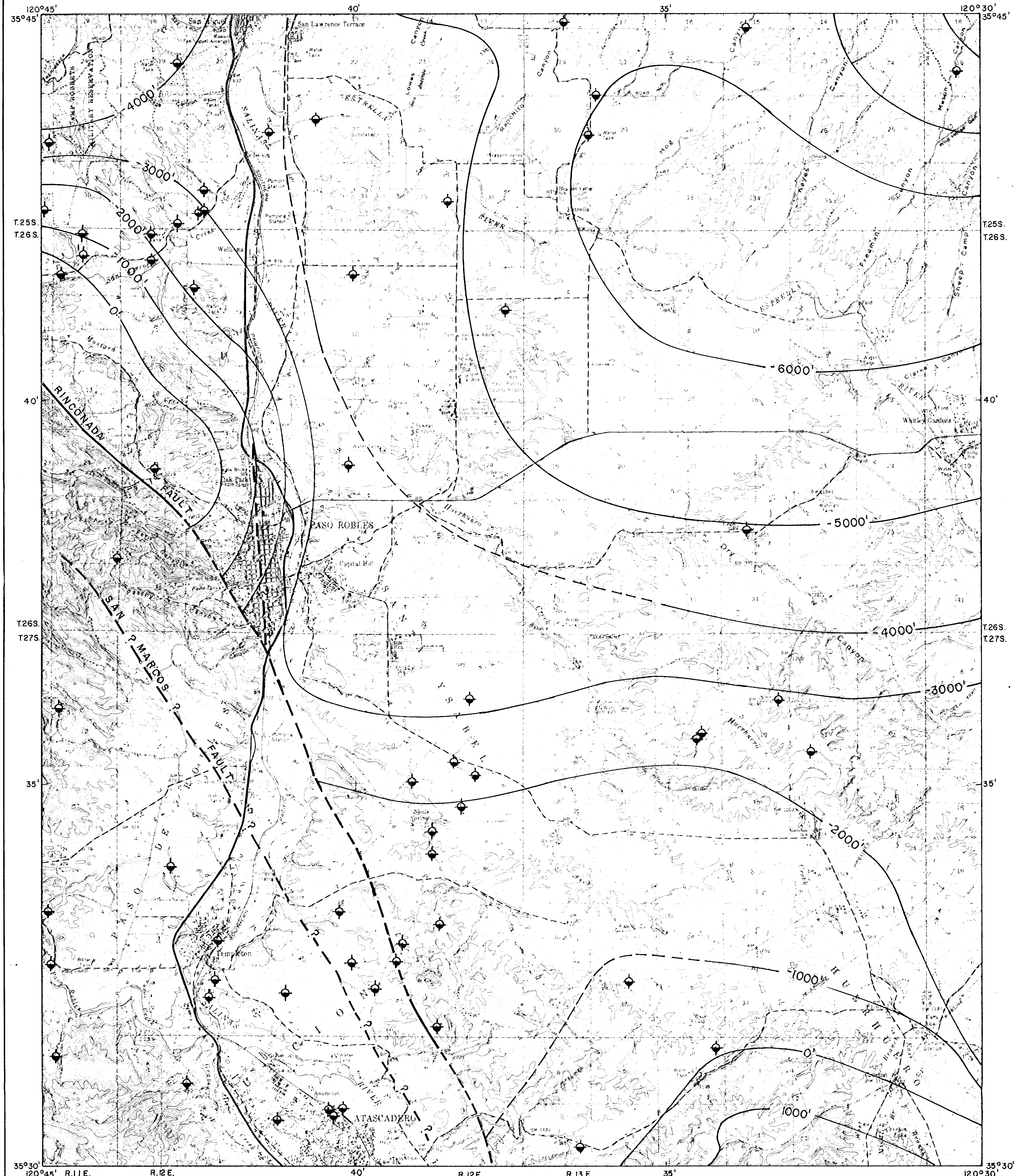
FOOTNOTES:

*REFERENCES:

1. California Department of Water Resources, 1981, Water quality in the Paso Robles Area: Memorandum Report, 116 p.
2. California Department of Water Resources, 1979, Ground water in the Paso Robles Basin: District Report, 88 p.
3. Thorpe Labs, 1981, Personal communication, Paso Robles, California.
4. California Division of Oil and Gas, Open Well Records.
5. [illegible] Labs Inc., 1930, Personal communication, Bakersfield, California.
6. California Division of Mines and Geology, 1982, Field investigation.
7. City of Paso Robles, Water Department, 1982, Personal communication.
8. Laizure, 1925, San Luis Obispo County, California, State Mining Bureau, 21st Annual Report of the State Mineralogist, p. 526-527.
9. Mr. McAdams, 1982, Personal communication.
10. Mr. [illegible], 1982, Personal communication.
11. Logan, C.A., 1917, San Luis Obispo County, in California State Mining Bureau, 15th Annual Report of the State Mineralogist, p. 680-697.
12. Anderson, Winslow M.D., 1892 Mineral Springs and Health Resorts of California, Annual Prize of the Medical Society of the State of California, p. 384.

** Bottom-hole Temperature

*** 300 Series of Numbers has no Geochemistry



BASE BY U.S.GEOLOGICAL SURVEY

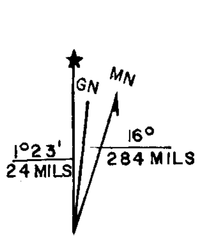
CONTOUR MAP SHOWING TOP OF BASEMENT, OIL WELLS AND MAJOR FAULTS

Paso Robles 15 Minute Quadrangle, California

MODIFIED FROM DURHAM, 1974 AND DIBBLEE, 1976

by

L. G. Youngs, L. F. Campion



UTM GRID AND 1961 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:62,500

1 ½ 0 1 2 3 4 MILES

3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

1 .5 0 1 2 3 4 5 KILOMETERS

(DATUM: SEA LEVEL)

EXPLANATION

- ABANDONED, DRY HOLE
- FAULT
- POSSIBLE FAULT

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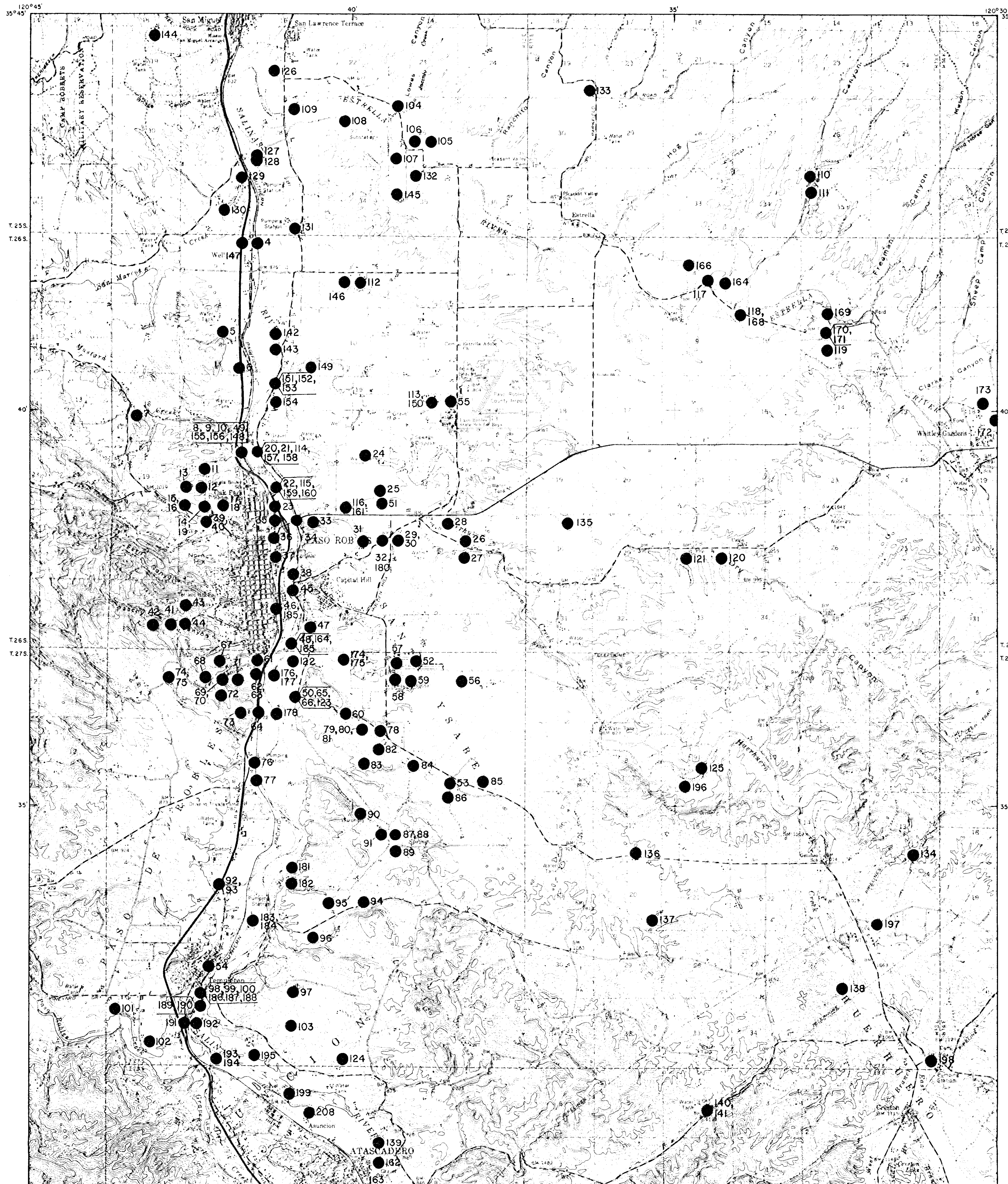


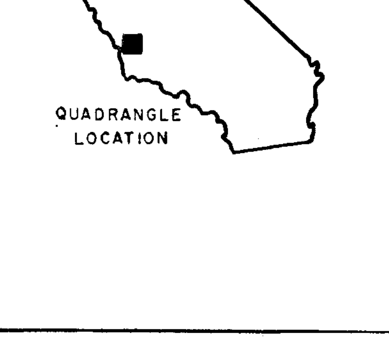
Topographic Base Map by U.S.G.S.

MAP OF GEOCHEMICAL SAMPLE LOCATIONS

(DATA AND REFERENCES IN APPENDIX A)

compiled by
L. F. Campion

UTM GRID AND 1961 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET



SCALE 1:62,500

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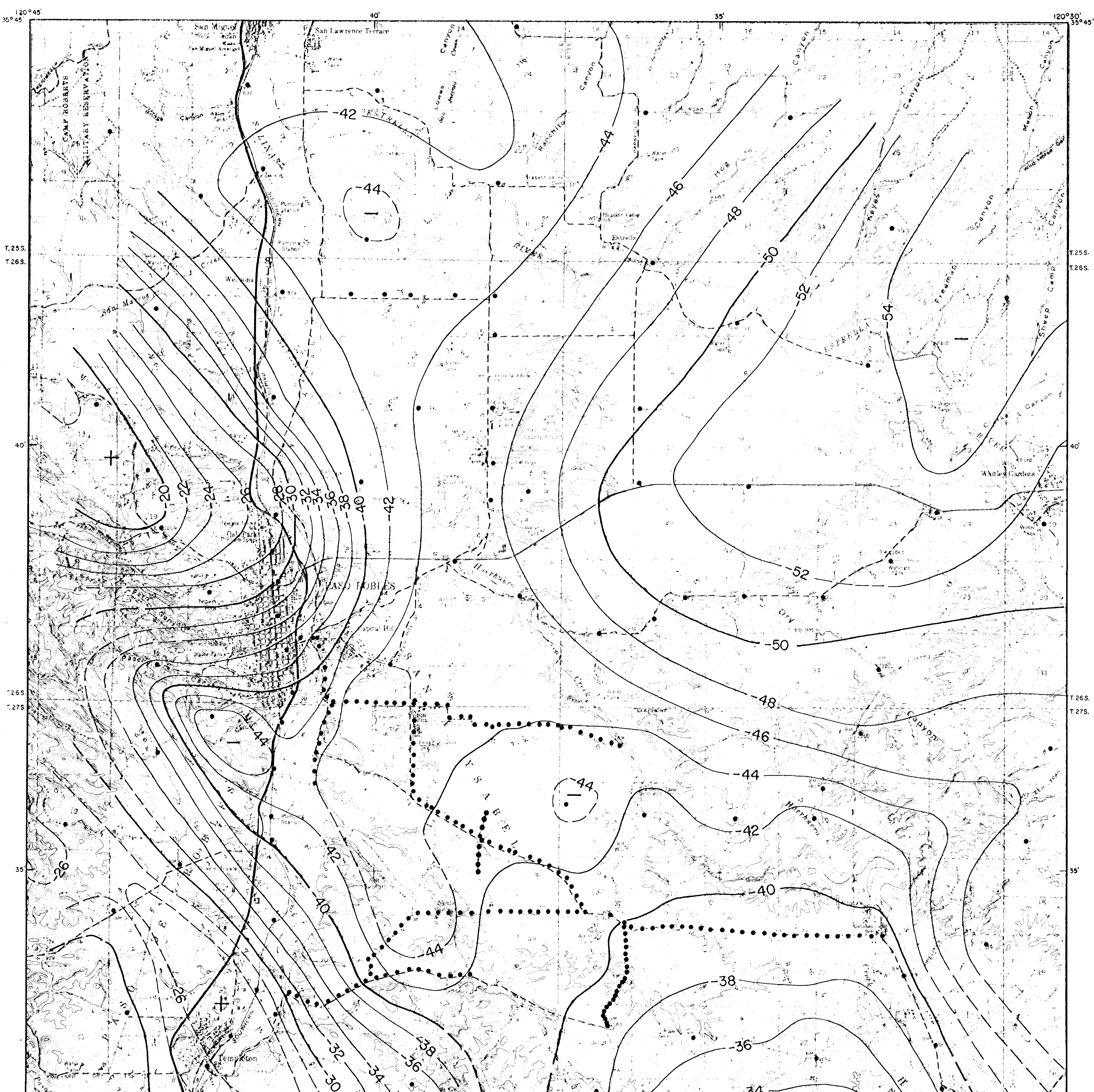
3000 0 3000 6000 9000 12000 15000 18000 21000 FEET
0 1 2 3 4 5 KILOMETERS



Topographic Base Map by U.S.G.S.

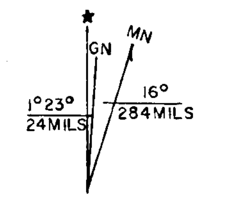
COMPLETE BOUGUER GRAVITY MAP
PASO ROBLES, CALIFORNIA
15 MINUTE QUADRANGLE

Some Data From BURCH et al, (1979)
Other Data By L. G. YOUNGS

EXPLANATION

Reduction Density = 2.67 g/cm^3
Contour Interval = 2 mgal
Gravity Stations •

SCALE 1:62,500
1 .5 0 1 2 3 4 MILES
3000 0 3000 6000 9000 12000 15000 18000 21000 FEET
1 .5 0 1 2 3 4 5 KILOMETERS



UTM GRID AND 1961 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

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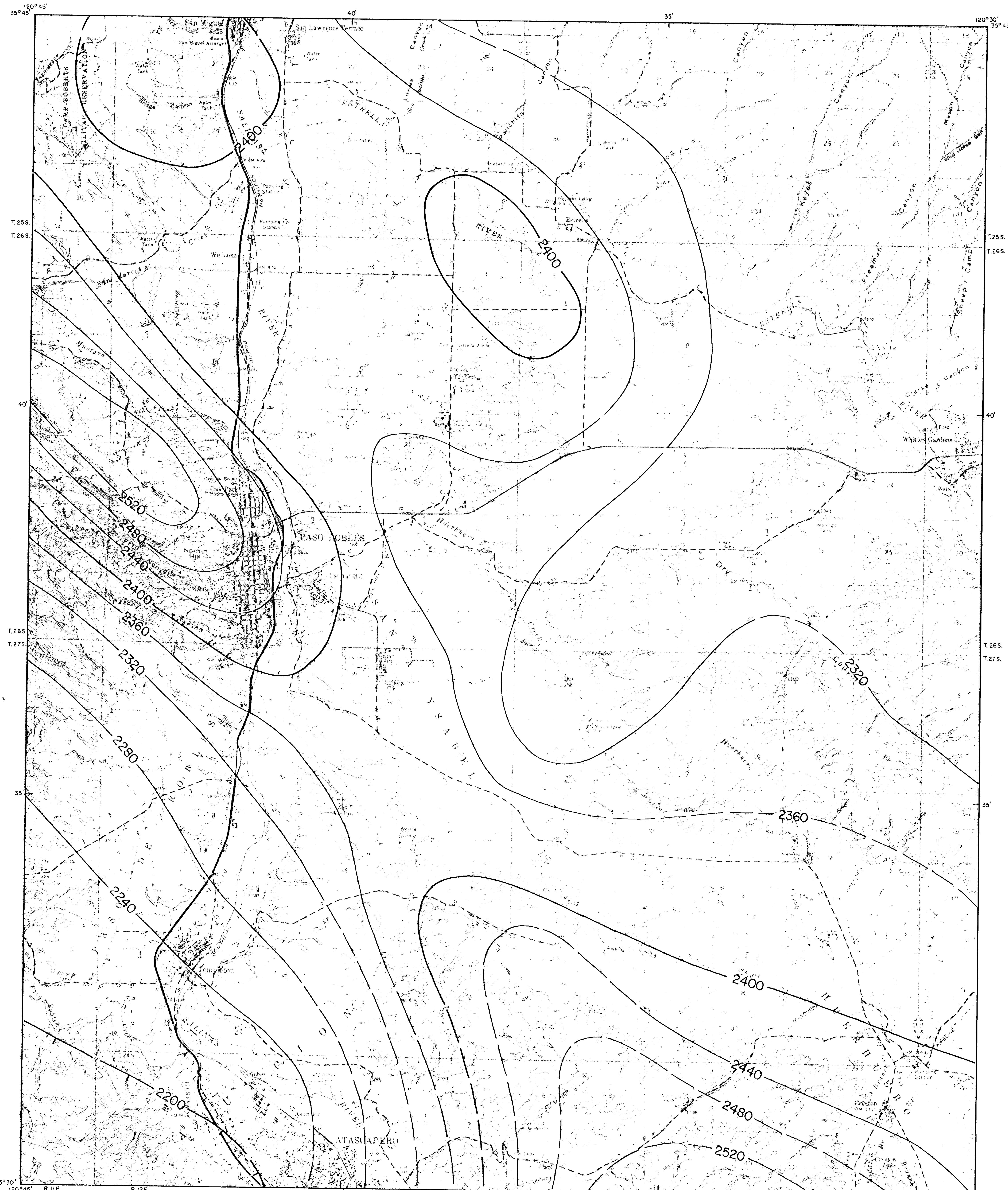


Topographic Base Map by U.S.G.S.

AEROMAGNETIC MAP OF PASO ROBLES, CALIFORNIA
15 MINUTE QUADRANGLE
(AFTER HANNA, 1970)

QUADRANGLE LOCATION

SCALE 1:62,500

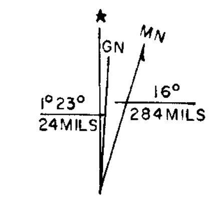
1 .5 0 1 2 3 4 MILES

3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

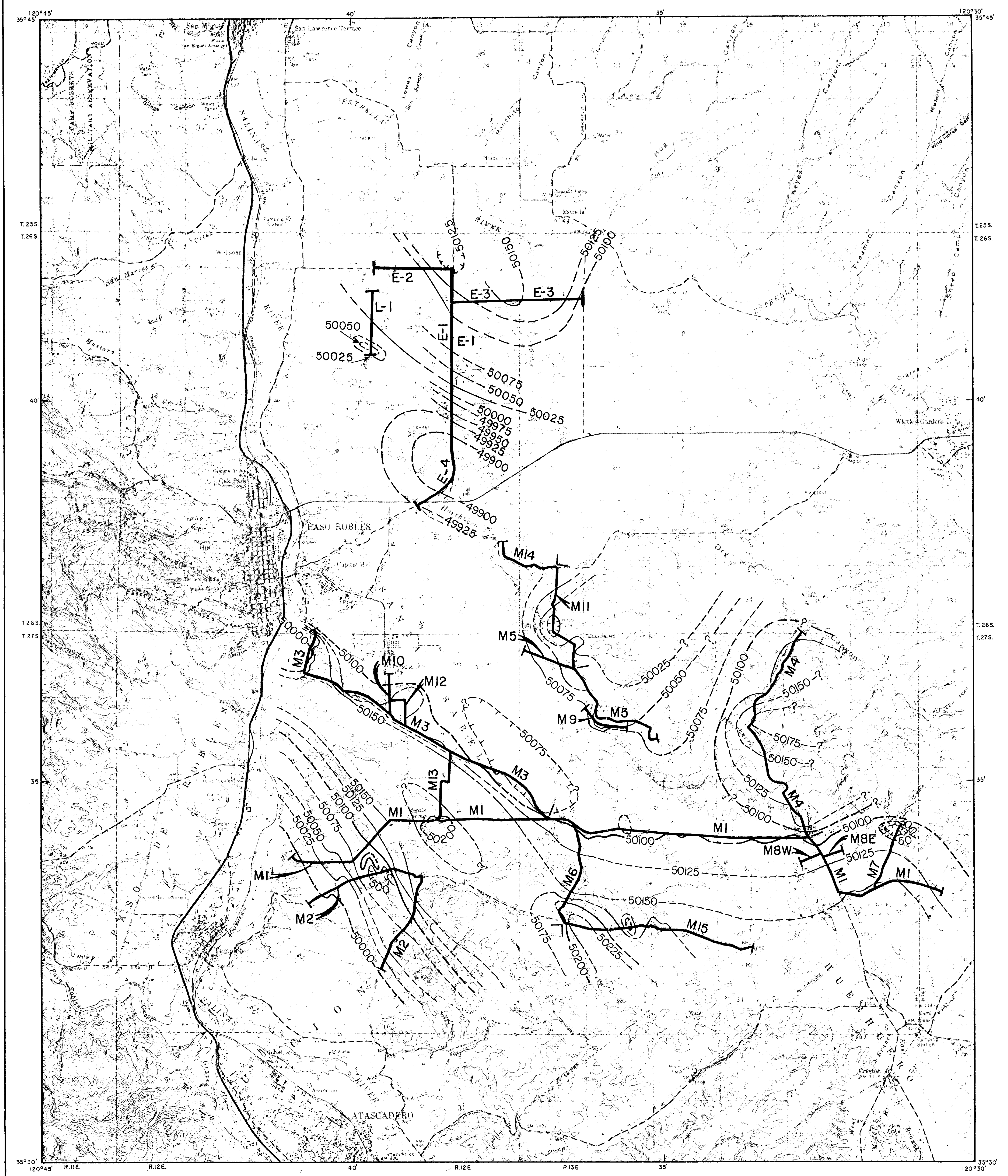
1 .5 0 1 2 3 4 5 KILOMETERS

EXPLANATION

Contour interval = 40 gammas.



UTM GRID AND 1961 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

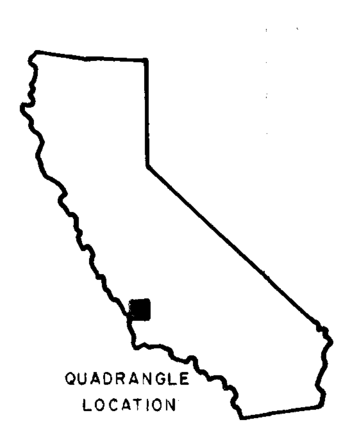


Topographic Base Map by U.S.G.S.

GROUND MAGNETIC MAP OF A PART OF THE PASO ROBLES GEOTHERMAL AREA

compiled by

L.G. Youngs, G.W. Chase, R.H. Chapman



SCALE 1:62,500

1 .5 0 1 2 3 4 MILES

3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

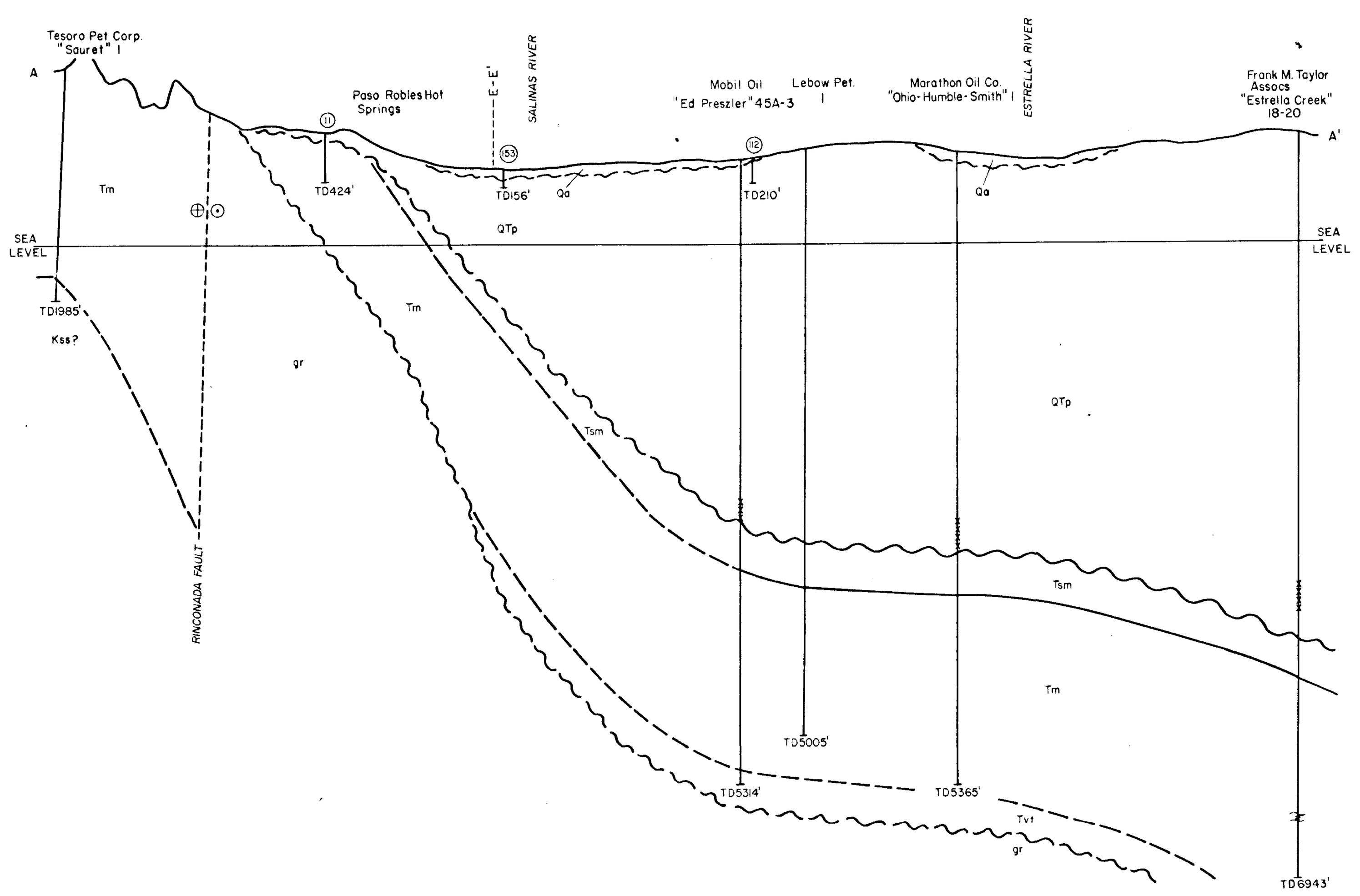
1 .5 0 1 2 3 4 5 KILOMETERS

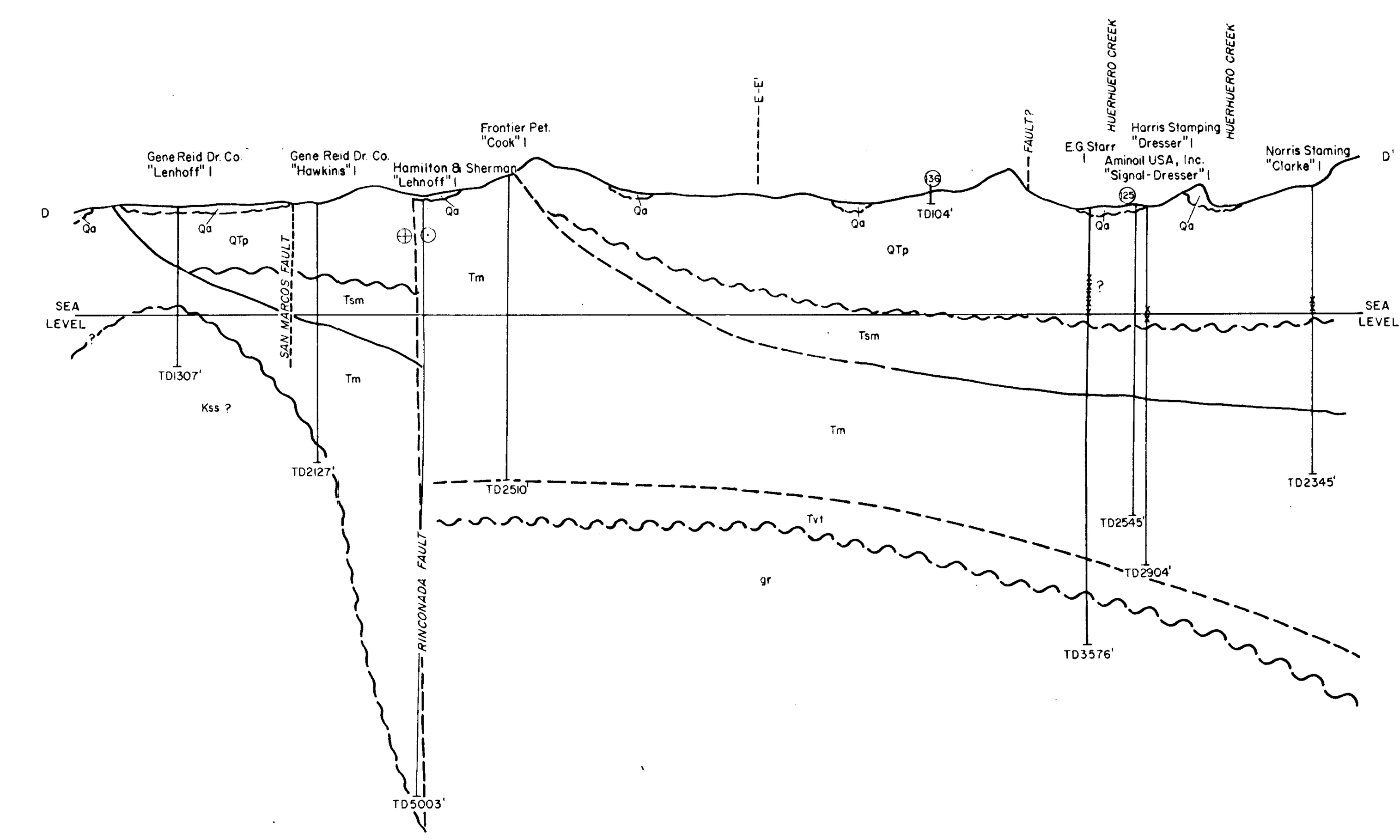
UTM GRID AND 1961 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

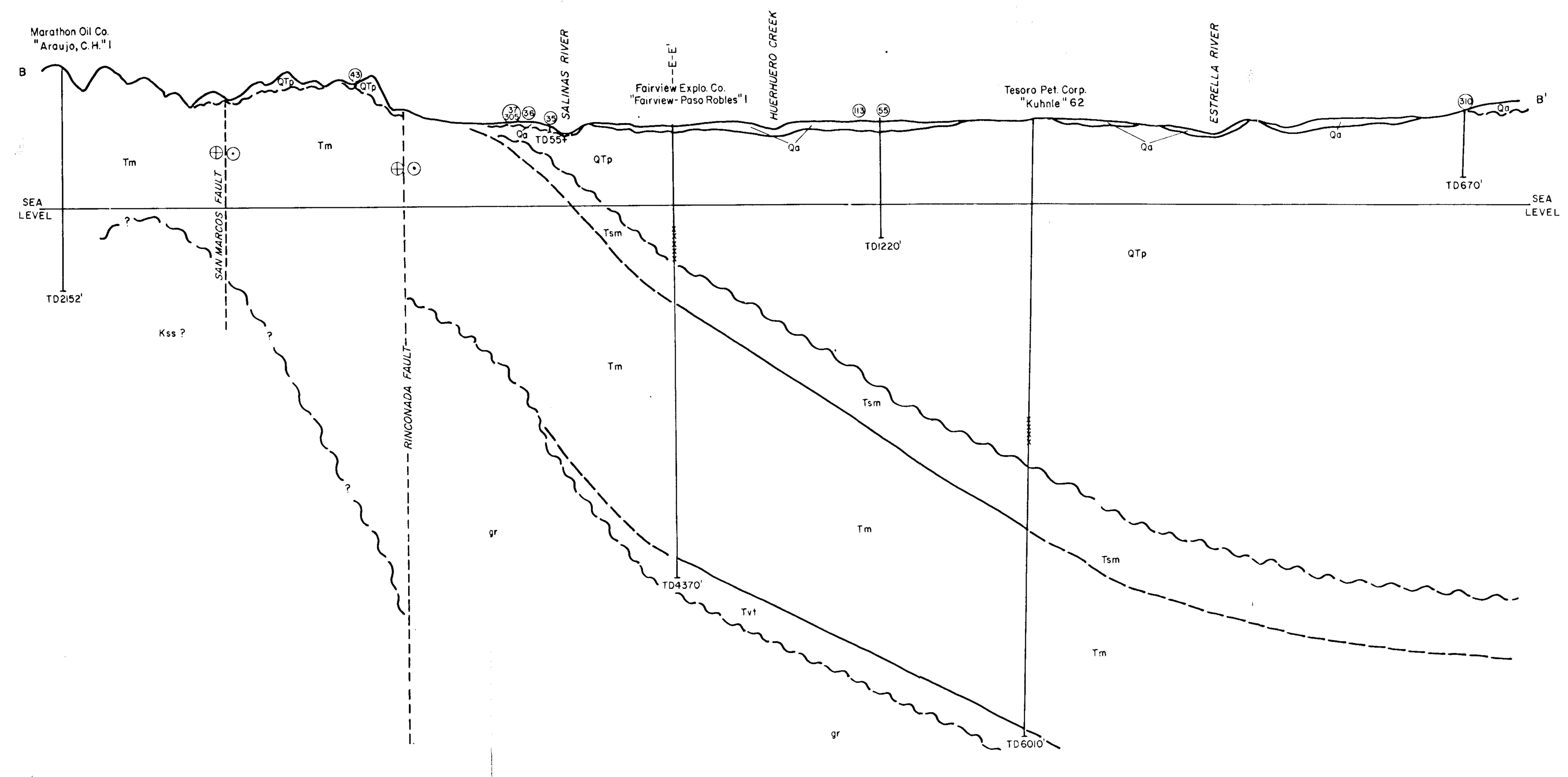
EXPLANATION

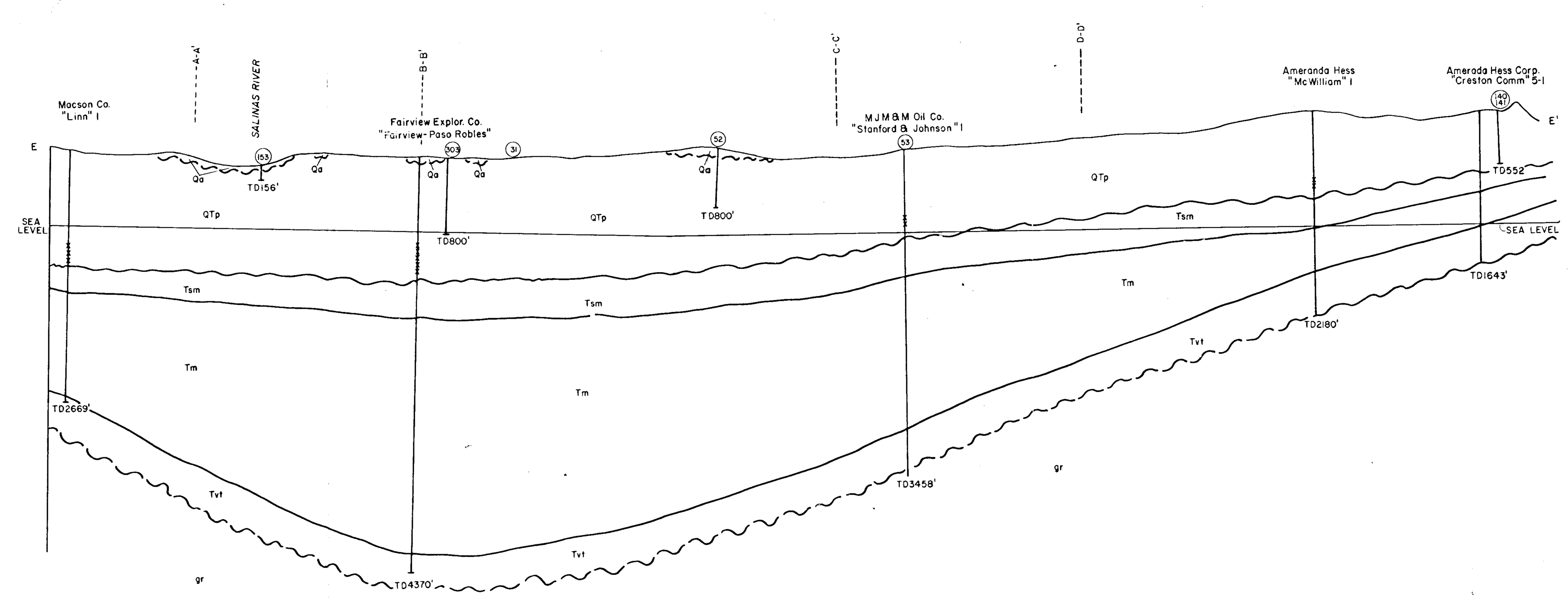
Contour Interval 25 Gammas

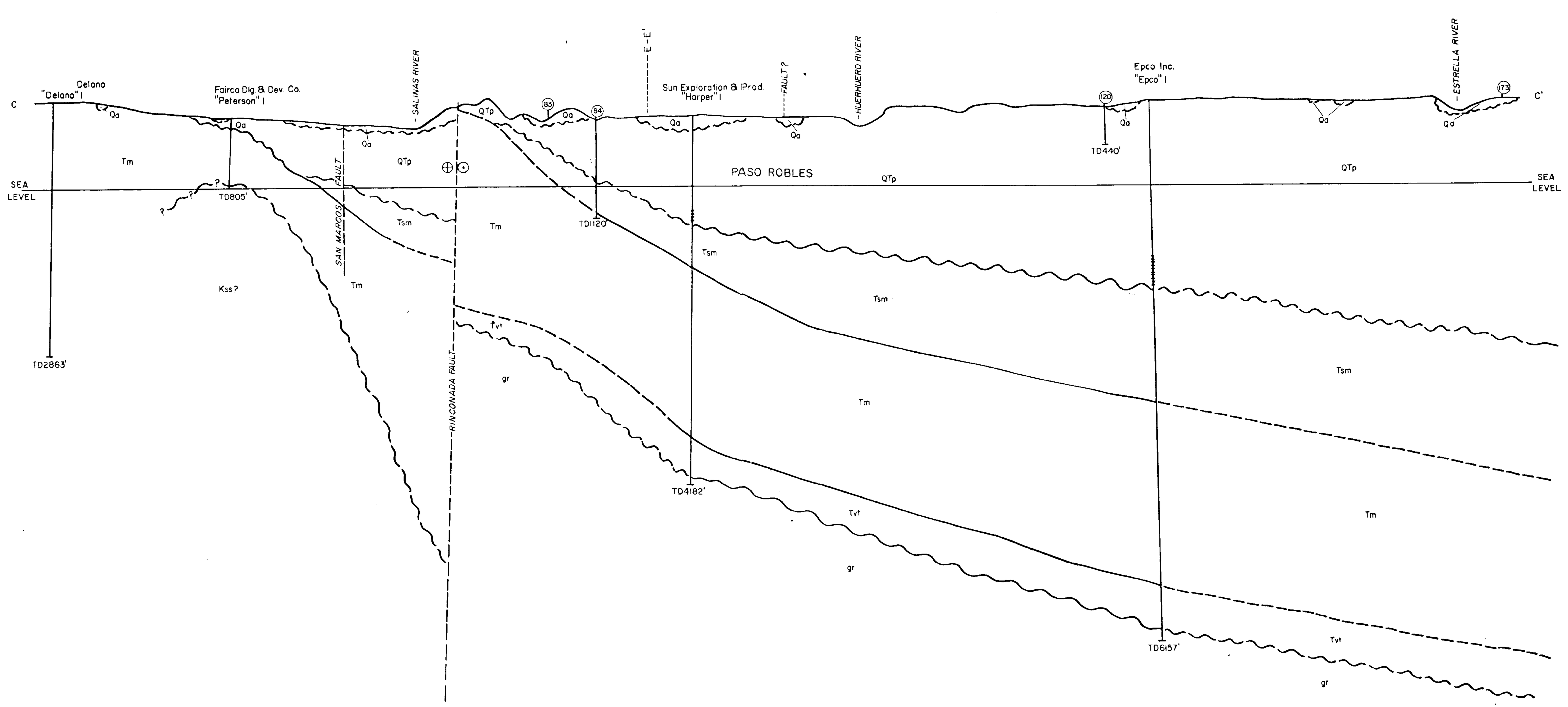
M2 Magnetometer Traverse











EXPLANATION

QA — Alluvium

QTp — Paso Robles Formation

Tsm — Santa Margarita Sandstone

Tm — Monterey Formation

Tvt — Vaqueros Formation

Kss — Unnamed Formation

gr — Quartz diorite or granodiorite

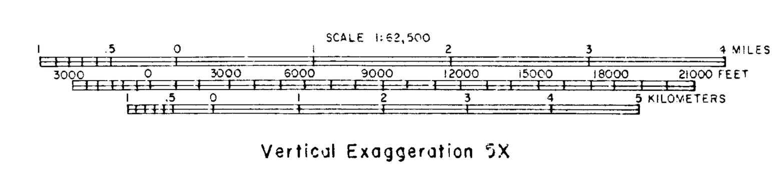
(13) Warm Wells

X X Sand Unit

GEOLOGIC CROSS SECTIONS OF THE PASO ROBLES 15 MINUTE QUADRANGLE

compiled by

L. F. Campion



Vertical Exaggeration 5X