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A SUMMARY OF THE GEOLOGY AND GEOPHYSICS OF THE SAN EMIDIO KGRA, WASHOE COUNTY, NEVADA

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ABSTRACT

Geologic mapping, thermal gradient drilling, electrical resistivity surveys, and gravity data interpretation define a north-trending Basin and Range fault which acts as the principle conduit for hydrothermal fluids at San Emidio. There is a possibility that this principle conduit has not been intersected in the drilling to date. The maximum temperature recorded to date is 262°F. The low apparent reservoir temperatures have reduced interest in exploration for an electrical power quality resource. An economic evaluation for using the hydrothermal fluids in industrial processing is now underway.

GEOLOGIC SETTING

The San Emidio geothermal area is adjacent to the northern end of the Lake Range, approximately 15 miles south of Gerlach, Nevada (Figure 1). The geology is dominated by a thick sequence of Tertiary lava flows, ash-flow tuffs, and volcaniclastic sedimentary rocks accumulated on a surface cut into Mesozoic phyllites (Moore, 1979). The Tertiary rocks are covered by a layer of lake beds, in the San Emidio Desert.

North- and east-trending faults, related to Basin and Range tectonics, have rotated rocks of the Lake Range eastward. The trend of the north-striking faults which bound the desert on the east are marked by a discontinuous line of hydrothermally altered rocks. Along the northern portions of this zone intense silicification and calcium carbonate deposition have occurred. In the southern part, fumaroles occur along the trend of the main range front fault with intense acid leaching and minor native sulphur deposition.

EXPLORATION

A 2,000-foot dipole-dipole resistivity survey was undertaken on the San Emidio geothermal prospect during the fall of 1973 (Chevron, 1979). This survey consisted of one east-west and four north-south lines. These data were supplemented in the spring of 1976 by five east-west profiles using 500-foot dipole spacings.

Anomalous low resistivity zones are shown on Figure 2. These zones were identified by modeling of the field data utilizing a finite-element, two-dimensional computer program developed at ESL/UURI. An interactive modeling process resulted in an excellent match between observed and computed resistivity values on the various lines. Good agreement is noted between mapped geologic structures and the modeled resistivity contrasts which infer structural breaks.

A gravity survey consisting of 1056 stations was completed in November 1975 (Chevron, 1979). These data (Figure 3) show a Bouguer gravity anomaly typical of Basin and Range intermountain basins. Pronounced faulting is evident along the eastern side of the valley.

Stratigraphic considerations from recent geologic mapping (Moore, 1979) suggest a vertical displacement of more than 8,000 feet for the valley block based on units outcropping in the Lake Range and intersected in a deep drill hole (Kosmos 1-9). Figure 4 is a computed gravity profile utilizing a 2 1/2-dimensional interactive modeling program modified at ESL/UURI. This profile is in excellent agreement with geologic inferences. The maximum Quaternary-Tertiary sediment thickness shown by the profile is about 4600 feet.

The ultimate exploration goal of any geothermal prospect is the delineation of a high-temperature steam and/or hot-water reservoir. The most direct evaluation requires a drilling program in which hot fluids are encountered, thus enabling direct measurements of the temperature and fluid properties of the system. At San Emidio, exploration progressed to the deep exploratory drilling stage following drilling of seventy-two shallow holes (≤500 feet). Two deep exploration holes, Kosmos 1-8 (4011 feet) and Kosmos 1-9 (5365 feet), were drilled and logged. The maximum observed temperatures in the deep holes are 228°F (Kosmos 1-8) and 262°F (Kosmos 1-9) at depths of 3924 feet and 5292 feet, respectively. Because these temperatures are insufficient for electric power generation, continued exploration interest has been greatly reduced.

Displayed on Figure 5 are the contoured temperatures (°F) measured in the drill holes at a depth of 100 feet. This depth was selected to minimize variations in temperature caused by surface fluctuations and to use the large number of drill holes which penetrated to this depth. Anomalous (>200°F) temperatures are observed in holes located in Sections 4, 9, and 16, T29N, R23E. A strong correlation exists between the anomalous temperatures and mapped Basin and Range structures, suggesting this break is the conduit through which the hot waters reach the surface. This fault has associated hydrogen sulfide seeps, acid alteration, and hot water wells (Garside, 1979). The data suggest that the thermal fluids rise along this fault zone and flow valleyward, the principle flow directions being west and southwest along permeable zones beneath lake beds. Figure 6 is an east-west profile across the thermal anomaly showing temperature logs of five drill holes.

ACKNOWLEDGEMENTS

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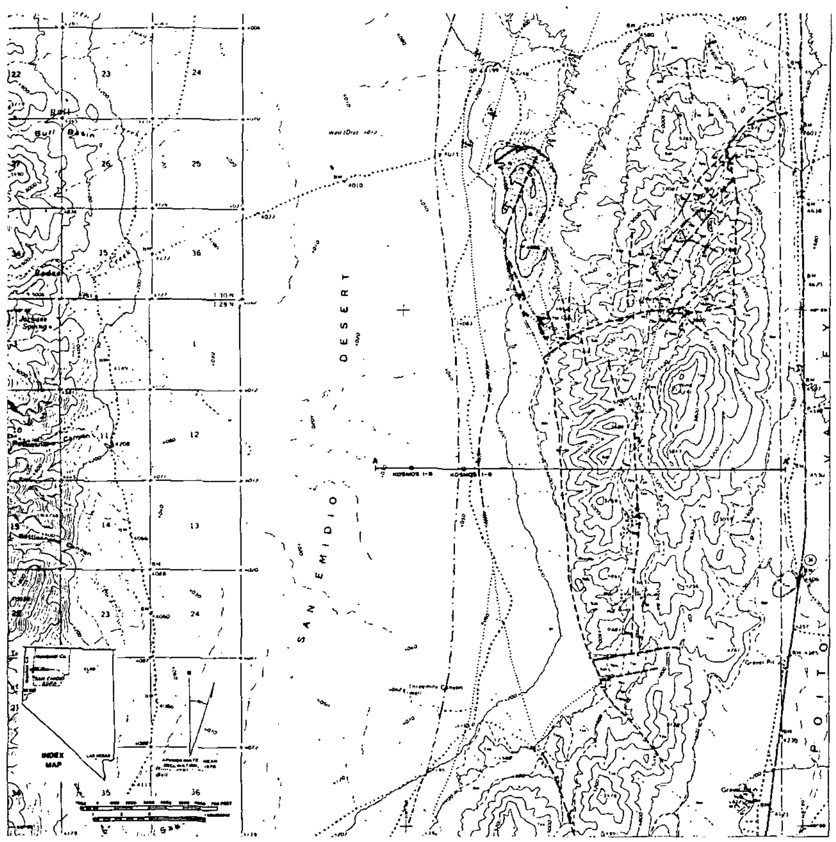

FIGURE 1 GEOLOGY MAP
SAN EMIDIO GEOTHERMAL AREA
WASHOE AND PERSHING COUNTIES, NEVADA

FIGURE 2 INTERPRETED ELECTRICAL RESISTIVITY
DEPTH INTERVAL 1000 - 1500 FEET

FIGURE 3 BOUGUER GRAVITY MAP

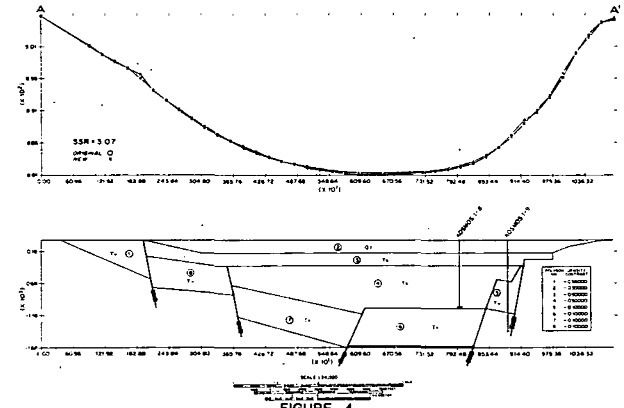

FIGURE 4
GRAVITY PROFILE A-A'

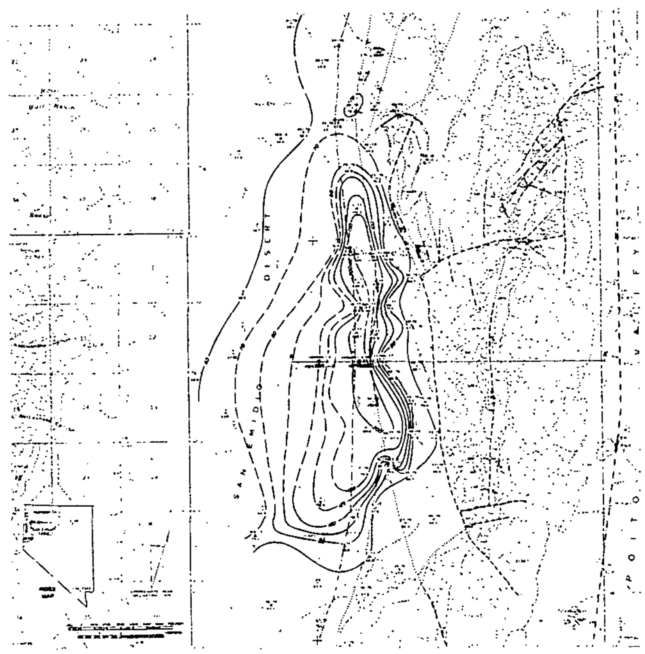

FIGURE 5 TEMPERATURE (°F) AT 100 FT. DEPTH

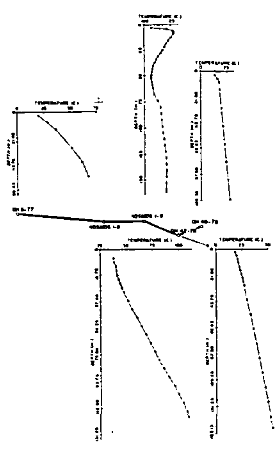

FIGURE 6 TEMPERATURE PROFILE