UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

RECONNAISSANCE FOR MERCURY OVER GEOTHERMAL AREAS OF THE IMPERIAL VALLEY, CALIFORNIA

By M. E. Hinkle and W. W. Vaughn

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Illustrations

Table

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Abstract

Nine samples of soil gas and gas from drill holes were collected over and near two geothermal anomalies in the Imperial Valley, California, to measure the possible presence of mercury. With the instrumentation used, the smallest quantity of mercury that could be detected was 2 nanograms. No mercury was detected in any sample.

A geochemical reconnaissance was made of two geothermal areas in the Imperial Valley of California during the first week of April 1972. The object was to determine if the soil gas over these geothermal anomalies contains mercury and, if mercury is present, how the concentrations of mercury correlate with temperature gradients previously measured and contoured on maps by U.S. Bureau of Reclamation personnel. The two geothermal anomalies are located in the sandy country between the town of Holtville, Calif., and the Algodones Sand Dunes (fig. 1). The larger anomaly, called the East Mesa anomaly, is centered about 8 miles southeast of Holtville. The smaller anomaly, called the Dunes anomaly, is centered between the Coachella Canal and the Algodones Sand Dunes, about 20 miles east of Holtville. The sample localities are listed in table 1.

Soil-gas samples were collected by use of the apparatus sketched in figure 2. Each vycor sample tube was heated in an induction furnace to remove any mercury contamination of the silver foil prior to the collection of soil gas, and the tubes with cleaned foil were stoppered to exclude air.

The apparatus was placed on the ground with the bottom edge of the plastic hemisphere flush with the ground. The temperature in the plastic hemisphere rose above 50°C for all samples due to solar heating, and after stabilizing at a maximum temperature (3-4 minutes), the exhaust fan was connected to the 12-volt battery and air pulled up through the apparatus for exactly 5 minutes. The exhaust fan moves air through the apparatus at a rate of 0.2 m^3/min. Any mercury pulled through the vycor tube amalgamates on the silver foil. After collection, the vycor tube was removed and stoppered to exclude air.

Gas samples from drill holes were collected by holding the tube directly over the opened pipe while air was pulled through the silver amalgamator for exactly 10 minutes.

The silver foils were analyzed for mercury content by the procedure of Vaughn and McCarthy (1964). The foils were heated in an RF-induction furnace and the evolved mercury measured by the mercury detector, using the 2537A line of mercury.

The mercury detector was calibrated by injecting known quantities of mercury vapor into the detector. The smallest quantity of mercury that could be detected was 2 nanograms.

No mercury was detected in any sample whether on or off a geothermal anomaly. The negative results of this study may not be entirely representative owing to the small number of samples and to the sensitivity of the instrumentation used. However, improving the sensitivity does not assure that the instrument will detect any mercury related to the geothermal sources in the Imperial Valley. Another consideration in evaluating the negative results is a possible seasonal variation in the cycle of the "earth-breathing process."

References

U.S. Bureau of Reclamation, 1972, Geothermal Resource Investigations, Imperial Valley, California, Developmental Concepts, 58 p.

Vaughn, W. W., and McCarthy, J. H., Jr., 1964, An instrumental technique for the determination of submicrogram concentrations of mercury in soils, rocks, and gas, in Geological Survey Research 1964: U.S. Geol. Survey Prof. Paper 501-D, p. D123-D127.

Table 1.--Sample localities (shown in fig. 1)

U.S. Bureau of Reclamation drill hole 115, center of Dunes anomaly (2 samples)
1.1 miles southeast of drill hole 115
1.2 miles southeast of drill hole 115
1.3 miles southeast of drill hole 115
1.4 miles southeast of drill hole 115
Drill hole 2.1 miles southeast of drill hole 115
U.S. Bureau of Reclamation drill hole, center of East Mesa anomaly, about 150 feet from site of 6,000-foot-deep well to be dug in May 1972 (2 samples)

Fig. 1. -- Location of Thermal Anomalies with Temperature Gradients and Sample Localaties (modified from U.S. Bureau of Reclamation, 1972)

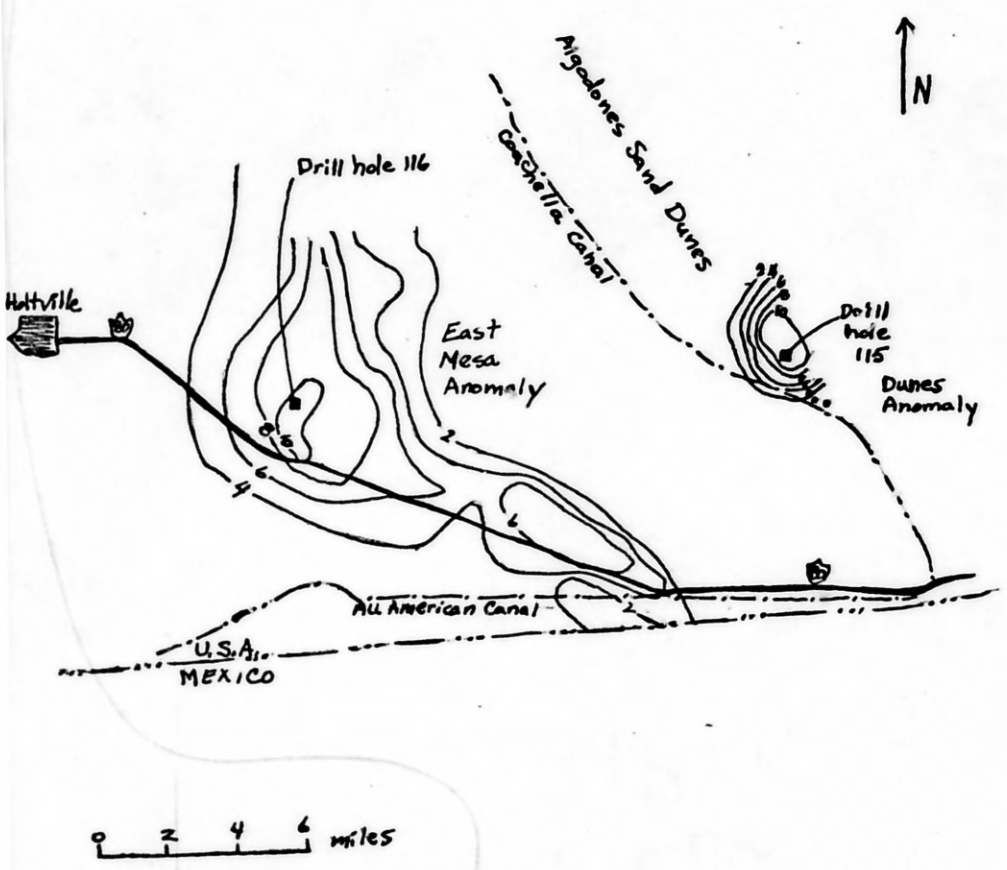
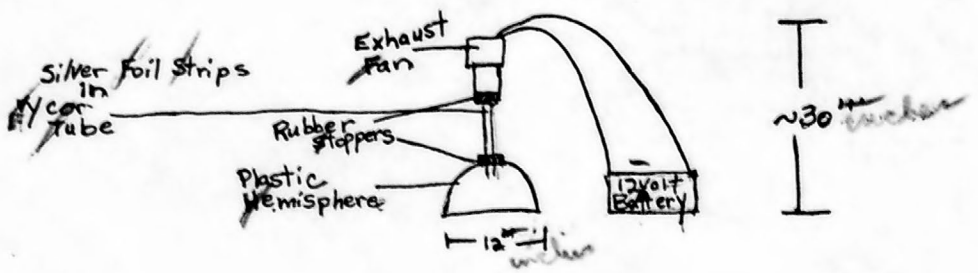


Fig. 2. -- Gas-Collecting Apparatus



I recommend that anomalies be identified as to type.
... any idea of contour interval?

Fig. 1. -- Sample Localities (Geothermal Anomalies contoured by U.S. Bureau of Reclamation)