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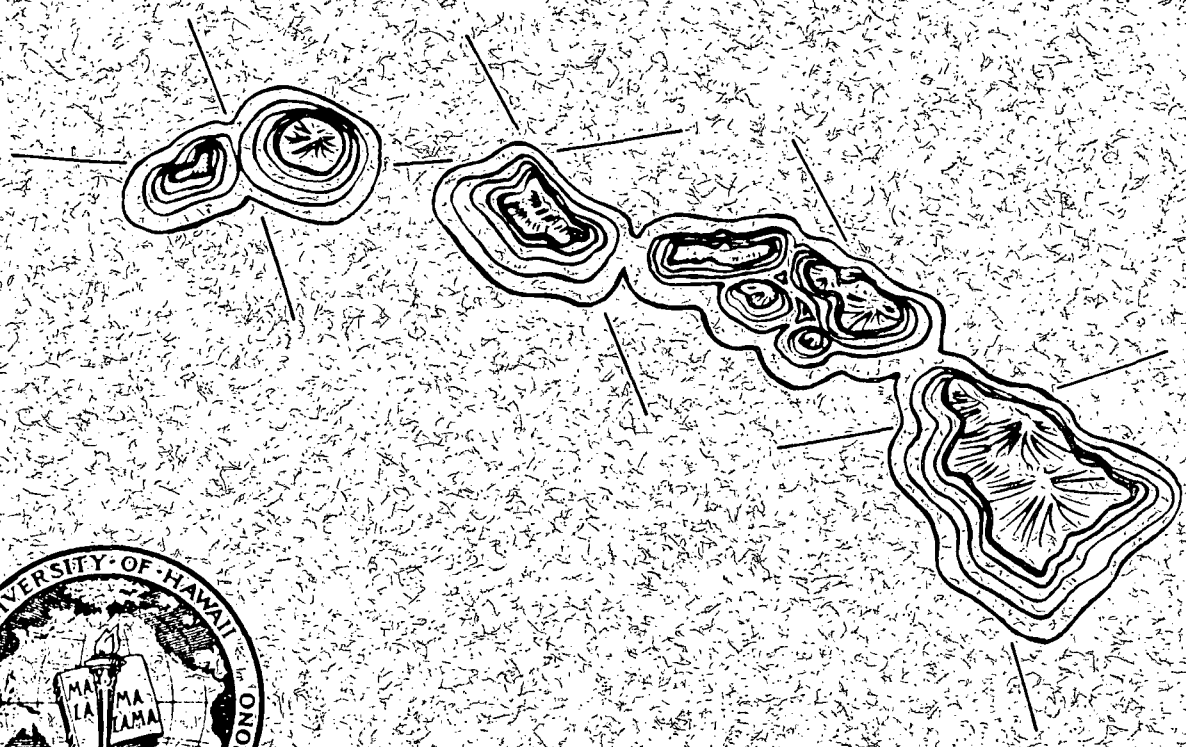
HAWAII GEOTHERMAL RESOURCE ASSESSMENT PROGRAM

DIRECT HEAT RESOURCE ASSESSMENT; PHASE II

YEAR I

FINAL REPORT

FEBRUARY 1, 1979 TO JANUARY 31, 1980



Hawaii Institute of Geophysics

DOE/ID/27023-4

DIRECT HEAT RESOURCE ASSESSMENT; PHASE II

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FINAL REPORT

FEBRUARY 1, 1979 TO JANUARY 31, 1980

Donald M. Thomas
Malcolm E. Cox
James P. Kauahikaua*
Mark D. Mattice

*U.S. Geological Survey

FEBRUARY 1980

WORK PERFORMED UNDER CONTRACT

DE-AS03-ET7927023

HAWAII INSTITUTE OF GEOPHYSICS

2525 Correa Road
Honolulu, Hawaii 96822

Abstract

During 1979 reconnaissance field surveys were conducted on the islands of Hawaii, Maui, and Oahu with the objective of confirming groundwater chemical data and geophysical data compiled during the preliminary regional assessment of Phase I of the Direct Heat Resource Assessment Program.

The exploration techniques applied include (1) groundwater chemistry, (2) mercury-radon surveys, (3) isotopic composition of groundwaters, (4) time domain electromagnetics, and (5) Schlumberger resistivity surveys. The results of these surveys can be classified as follows: (1) Hawaii: Kailua-Kona, strong geochemical anomalies; Kawaihae, strong geophysical anomalies, moderate to strong geochemical anomalies; Hualalai northwest rift, weak geqchemical and moderate geophysical anomalies; South Point, moderate to weak geophysical anomalies; Hualalai southeast rift, weak geophysical anomalies; Keaau, weak geophysical and geochemical anomalies; (2) Maui: Haiku-Paia, strong geochemical anomalies; Olowalu-Ukamehame canyons, moderate to strong geochemical and geophysical anomalies; Lahaina, weak geochemical and geophysical anomlies; (3) Oahu: Lualualei, moderate to strong geochemical and geophysical anomlies; Waimanalo-Maunawili, insufficient data.

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I. INTRODUCTION

The Geothermal Resource Assessment Program at the Hawaii Institute of Geophysics is presently conducting a geothermal reconnaissance study throughout the State of Hawaii. The objectives of this exploration program, carried out under the sponsorship of the U.S. Department of Energy Western States Cooperative Direct Heat Resources Assessment Program, is to identify areas within the State which may have sufficient geothermal potential to justify their development as a source of direct or industrial process heat.

The initial phase of the assessment program was oriented toward the compilation of existing geological, geochemical and geophysical data on the major islands in the Hawaiian chain. Upon completion of the data gathering work, twenty separate areas in Hawaii were identified as having potential for the existence of a geothermal resource (Thomas et al., 1979).

The areas identified are presented in Table 1 and their locations in Figure 1. Each area was given a rating according to a preliminary assessment of its geothermal potential and to the likelihood of its being developed. The former assessment was made on the basis of the magnitude and areal extent of the various geochemical and geophysical anomalies identified as well as the age of most recent volcanism; the assessment of the potential for development was made on the basis of an area's proximity to population centers and industrial users as well as the probability for favorable or adverse zoning regulations.

Subsequent to the initial regional assessment, the current investigation has been directed toward verification of the preliminary data set compiled during Phase I and toward area-specific field exploration of several of the more promising of the identified potential geothermal sites. The targets of

Table 1

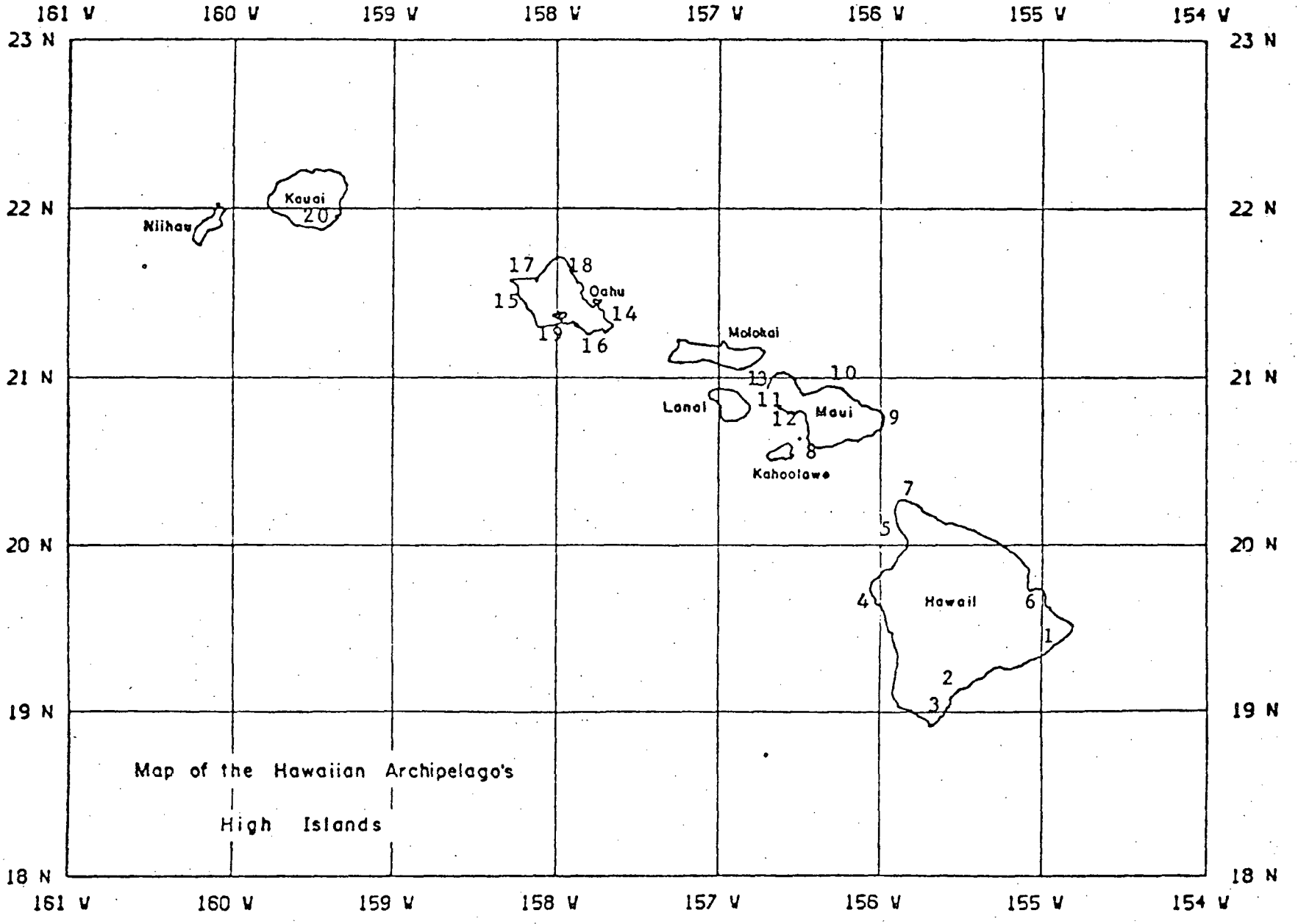
Summary of Potential of Survey Areas†

Location	High Temp. Resource*	Low Temp. Resource*	Probability for Development*
Hawaii			
1. Puna (S.E. Rift, Kilauea)	1	1	3
2. Ka'u (S.W. Rift, Kilauea)	2	1	7
3. South Point	3	2	3
4. Hualalai-North Kona	5	3	1
5. Kawaihae	5	3	1
6. Keaau	6	4	1
7. Kohala	7	5	8
Maui			
8. Haleakala-Southwest Rift	2	2	5
9. Haleakala-East Rift	3	2	6
10. Haiku-Paia	3	2	3
11. Lahaina-Kaanapali	4	2	1
12. Olowalu-Ukumehame	3	1	2
13. Honokawai	5	4	2
Oahu			
14. Waimanalo	7	6	1
15. Lualualei	8	4	1
16. Honolulu Volcanic Series	8	7	2
17. Haleiwa	9	7	3
18. Laie	9	7	3
19. Pearl Harbor	10	9	1
Kauai			
20. Post erosional volcanic series	10	8	5

†This summary is based on data available up to January, 1980.
*1 = highest potential; 10 = lowest potential

Figure 1

Location of Areas With Geothermal Potential Based on the Phase I Regional Assessment



this phase of work were chosen on the basis of the potential for the existence of a resource and potential for near term development; the areas selected for immediate exploration are located on Hawaii, where the highest potential for thermal resources exists, as well as on Maui and Oahu, where there is currently a greater potential market for geothermal energy.

The field exploration program has attempted to apply a coordinated set of geophysical, geological, and geochemical exploration techniques to each of the chosen survey areas. In addition to confirming the initial Phase I data set, Phase II efforts are also directed toward developing a more complete understanding of the survey areas with which to interpret the identifed geochemical and geophysical anomalies. The techniques found to be most useful in our exploration efforts have been as follows: groundwater geochemistry, soil mercury and radon surveys, isotopic analysis of groundwaters and rainfall, Schlumberger resistivity soundings, and time domain electromagnetic surveys. The areas in which field surveys have been conducted are as follows:

on Oahu: Lualualei Valley, Waimanalo-Maunawili;

on Maui: Lahaina, Olomalu-Ukumehame, Haiku-Paia;

on Hawaii: Kawaihae, Hualalai northwest rift, Kailua-Kona, Keaau, Puna.

The locations of the survey areas are presented in Figures 2, 3, and 4. The area specific exploration work in Lualualei Valley has been completed and is described in Cox et al. (1979). The present interim report details the preliminary geophysical and geochemical surveys which have been completed to January, 1980 on each of the chosen study areas. Further surveys, both in more detail and utilizing other exploration techniques, are currently underway on the most prospective of the above areas.

Figure 2

Location of 1979 Survey Areas: Island of Hawaii

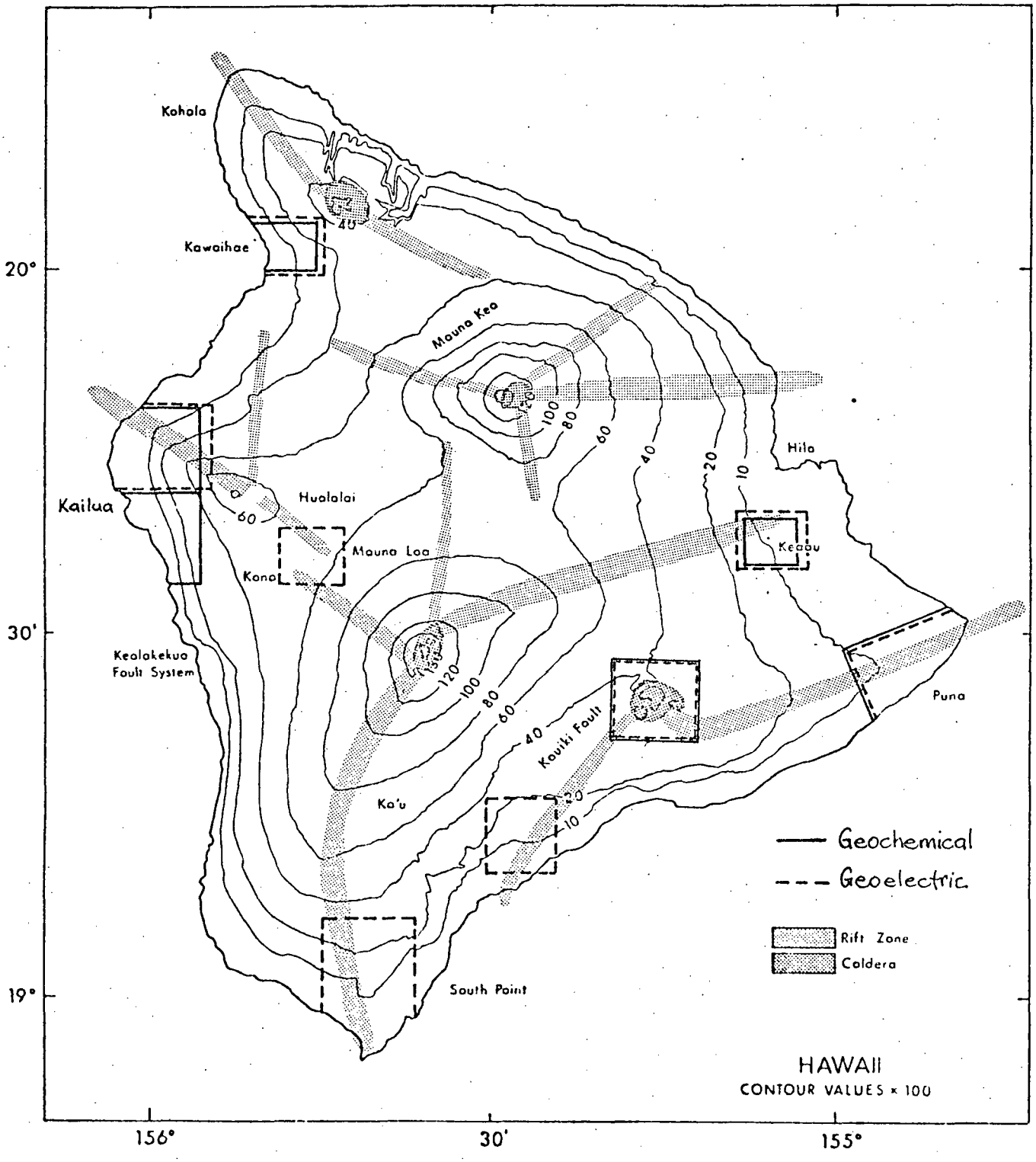


Figure 3

Location of 1979 Survey Areas: Island of Maui

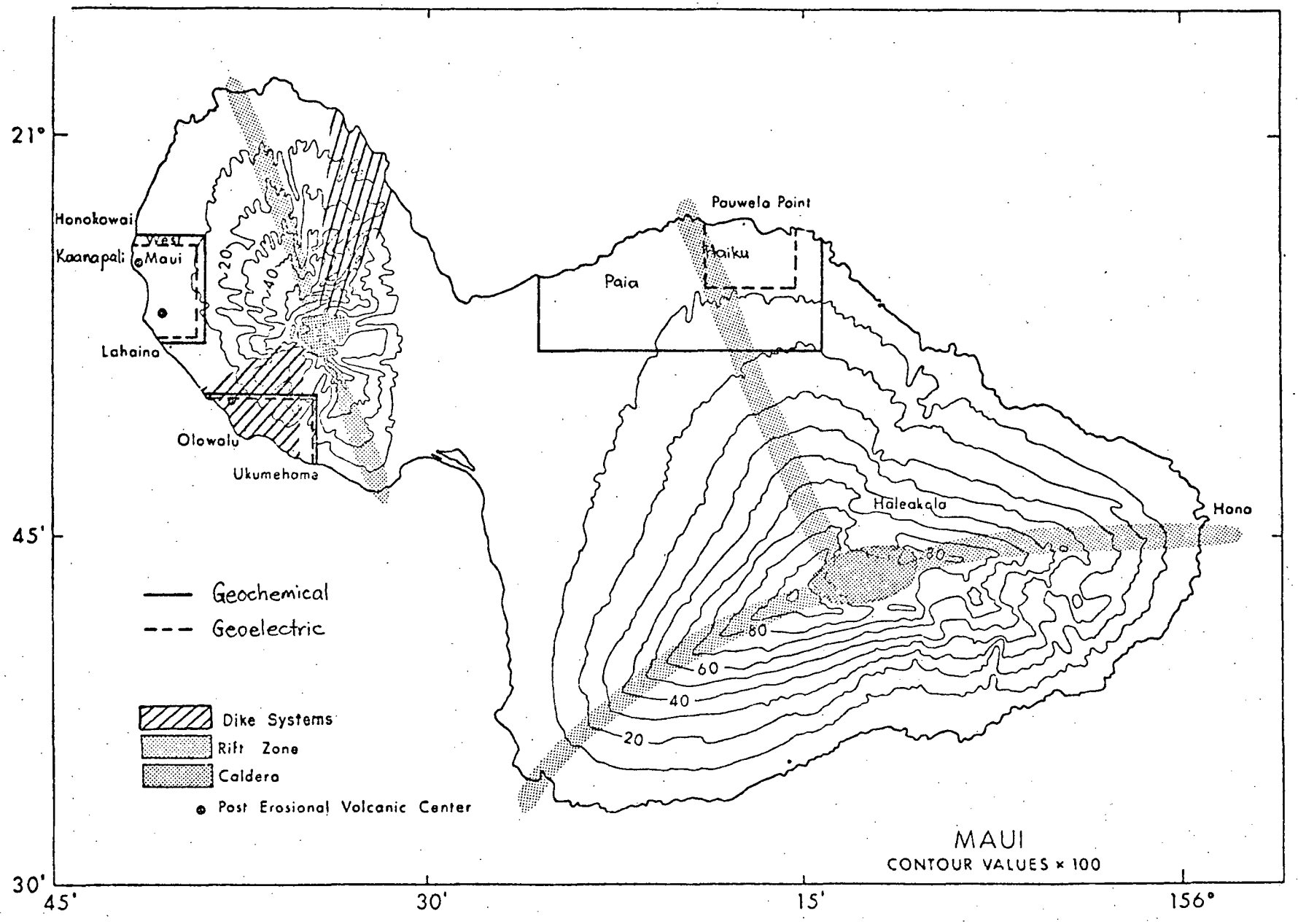
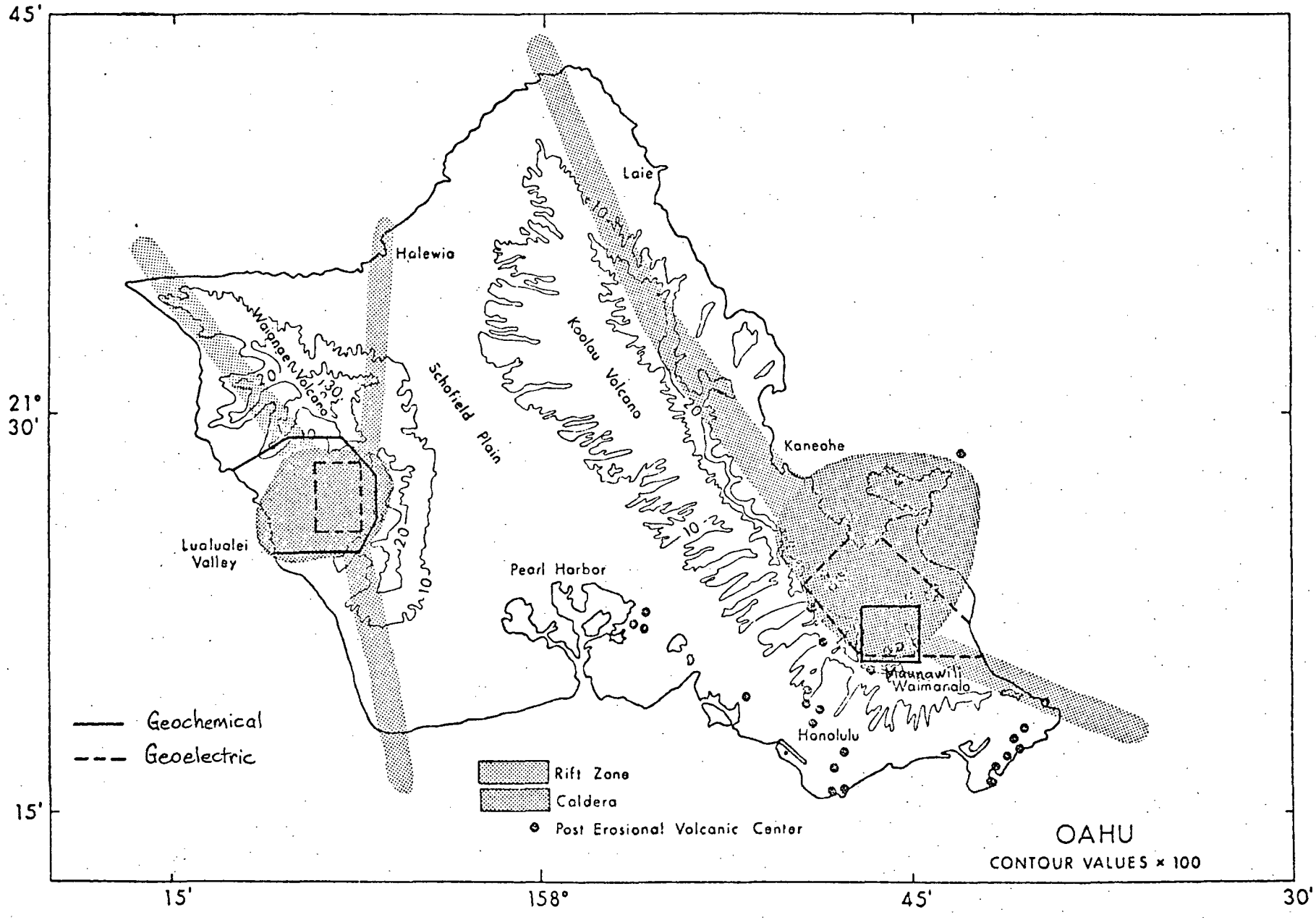


Figure 4

Location of 1979 Survey Areas: Island of Oahu



II. GEOCHEMICAL EXPLORATION PROGRAM

The techniques employed in the geochemical exploration program consist of resampling and analysis of surface groundwater supplies, reconnaissance soil mercury and radon surveys, and isotopic analysis of rainfall and groundwaters. A brief discussion of the application of each of these techniques and a discussion of the data acquired for each location is presented. An assessment of the probability for the existence of a geothermal reservoir for each study area is also presented, however, it should be noted that, at this point, our interpretations are preliminary in nature and are subject to revision as continuing exploration work provides more complete data sets for each of the areas under study.

Groundwater Chemistry

Chemical analysis of groundwater from drilled wells and coastal springs has played an important role in the current geothermal investigations. The interpretation of groundwater data in terms of geothermal potential utilizes both the absolute ion concentrations (e.g. SiO_2) as well as ratios of ions (e.g. Cl/Mg) (Cox and Thomas, 1979). In addition to providing information on geothermal potential, groundwater chemistry can provide considerable insight into the hydrogeology of each of the study areas.

Phase I of the assessment program relied heavily upon existing groundwater chemistry data; during the present stage of the survey, we have resampled many of the wells in each area of interest as well as other water sources for which no data previously existed.

The results of the chemical analyses of groundwaters which have been completed to date are presented in Appendices 1, 2, and 3. Although we do

not yet have sufficient data to draw up a detailed geochemical model of the study areas, we have been using Cl/Mg ion ratios as a qualitative indicator of areas in which geothermal fluids may be entering the near surface environment. Ratios of 15 or greater are considered to be a strong indication of thermally altered groundwater in Hawaii whereas ratios of 12-15 are classed as low order geothermal anomalies. (Unaltered groundwaters have ratios typically of the order of 3-8.) The wells for which these ratios are available are plotted for each area studied and will be discussed in more detail below.

Radon Surveys

Radon is a radioactive daughter product of naturally occurring uranium in rock and soil. Radon concentrations in ground gases were measured using alpha sensitive films buried to a depth of 30 to 40 centimeters in inverted plastic cups. It is believed that radon outgassing rates are significantly affected by thermally induced convection systems and by ground permeability. In Hawaii these are often associated with structures of volcanic origin. As variations in radon outgassing occur as a result of different uranium concentrations in local rock and soil cover, the radon count rates in each survey area are corrected for radon emanation from each soil type. Count rates are reported in units of T (tracks) x $10^{-2}/cm^2$ (film)/hr (exposure time).

Soil Mercury Surveys

Mercury is an element that has often been found to be associated with volcanic and geothermal fluids. In its elemental form, mercury is highly

volatile and tends to concentrate in surface soils above and around geothermal reservoirs. Soil surveys for mercury have been found to be a useful geothermal exploration technique in Hawaii (Cox et al, 1979), however, variations in mercury concentrations are also found to be associated with changes in soil type thus, the results of soil mercury surveys are most useful when interpreted in conjunction with soil radon surveys.

Isotopic Investigations

The hydrogen and oxygen isotopic composition of local groundwaters can contribute to the understanding of the hydrogeology of a study area as well as assist in the identification of areas in which geothermal fluids are entering shallow groundwater aquifers. Under favorable conditions, mixing models of local recharge with deeper geothermal fluids can provide information on reservoir temperatures and leakage rates.

Sampling of local rainfall and groundwaters in several of the study areas is presently underway. We have begun the isotopic analysis of the groundwater and rainfall samples, however, we have not yet obtained sufficient data to determine whether such surveys will be applicable as an exploration technique in the Hawaiian environment.

Geochemical Surveys on Hawaii

Kawaihae

This area is located on the dry leeward side of the Big Island and is in the contact zone between the lava flows of Mauna Kea and Kohala volcanoes. Initial interest in this area arose from the higher than expected groundwater

temperatures measured in some of the water supply wells (e.g. 6147-01; 32° to 36°C, Fig. 5). Subsequent resampling of the local wells confirmed the relatively warm temperatures and water chemistry analyses yielded anomalous Cl/Mg ratios in the area (Fig. 6). The highest Cl/Mg ratio observed is 18.1 in well number 6048-01.

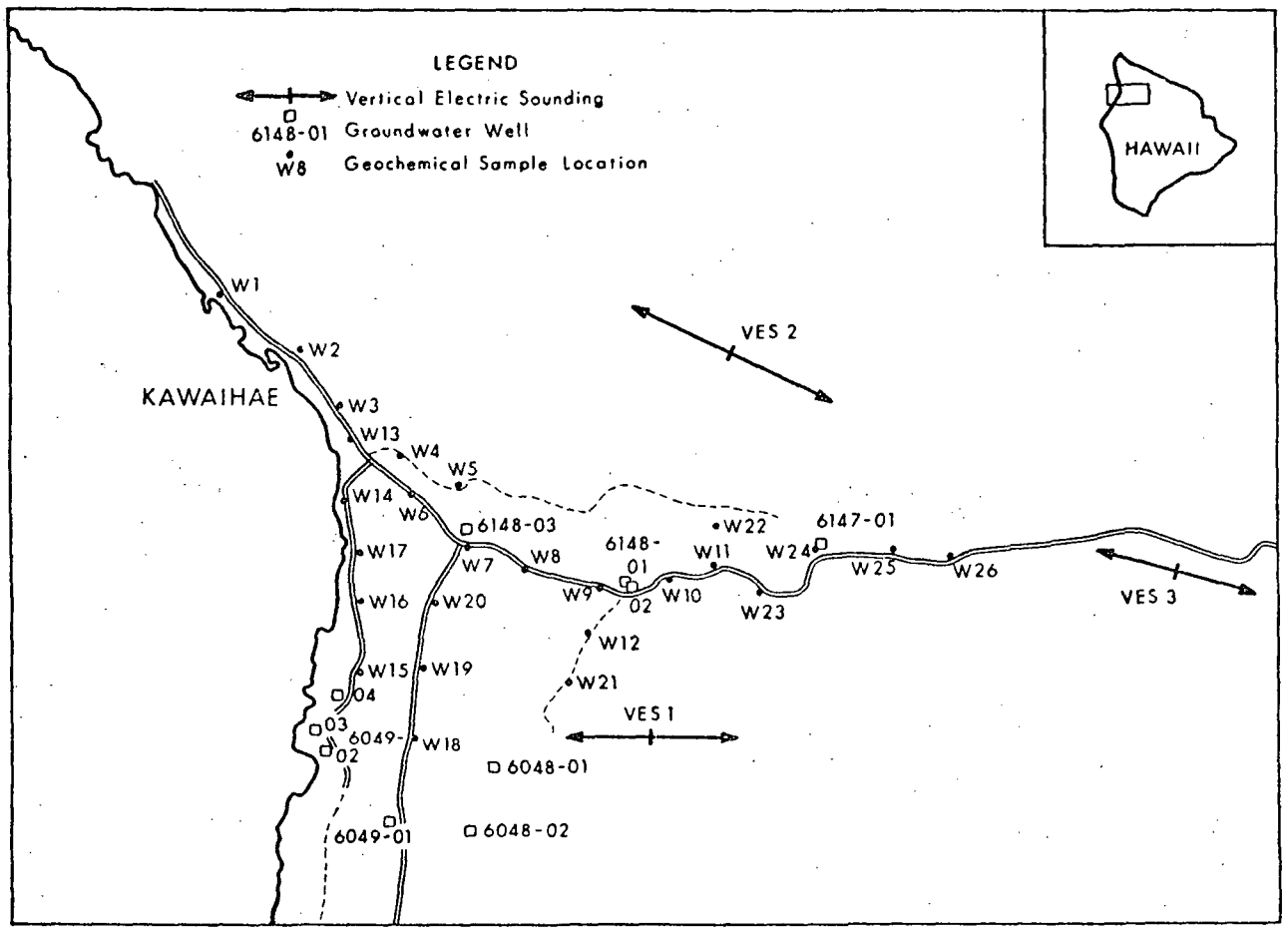
Radon surveys indicate an east-west high ground gas emanation zone peaking at a value of more than 10 units above background (Fig. 7). The highest radon emanation rate in the survey area (73 units) occurs near the warm water well (6147-01) and appears to extend to the north. The central part of the anomaly is bordered by negative values which may be attributable to downward circulation of ground gas at the borders of what is possibly a ground gas convective cell. A second, lower order, radon anomaly (40 units) occurs in the center of the area surveyed. Our interpretation of these results is preliminary as the details of the radon emanation from the soil in this area requires further substantiation as it is highly variable.

Soil mercury surveys have also delineated an elongate high (Fig. 8) (80 ppb Hg) generally parallel to and somewhat north of the radon anomaly, and open to the east. It is possible that an E-W permeable structure (perhaps a zone of fracturing) is responsible for the topographic low in which the main road is constructed and with which the anomalous zone may be associated.

Our preliminary assessment of this area is that a low level thermal anomaly may be present and that further study of this area is warranted.

Figure 5

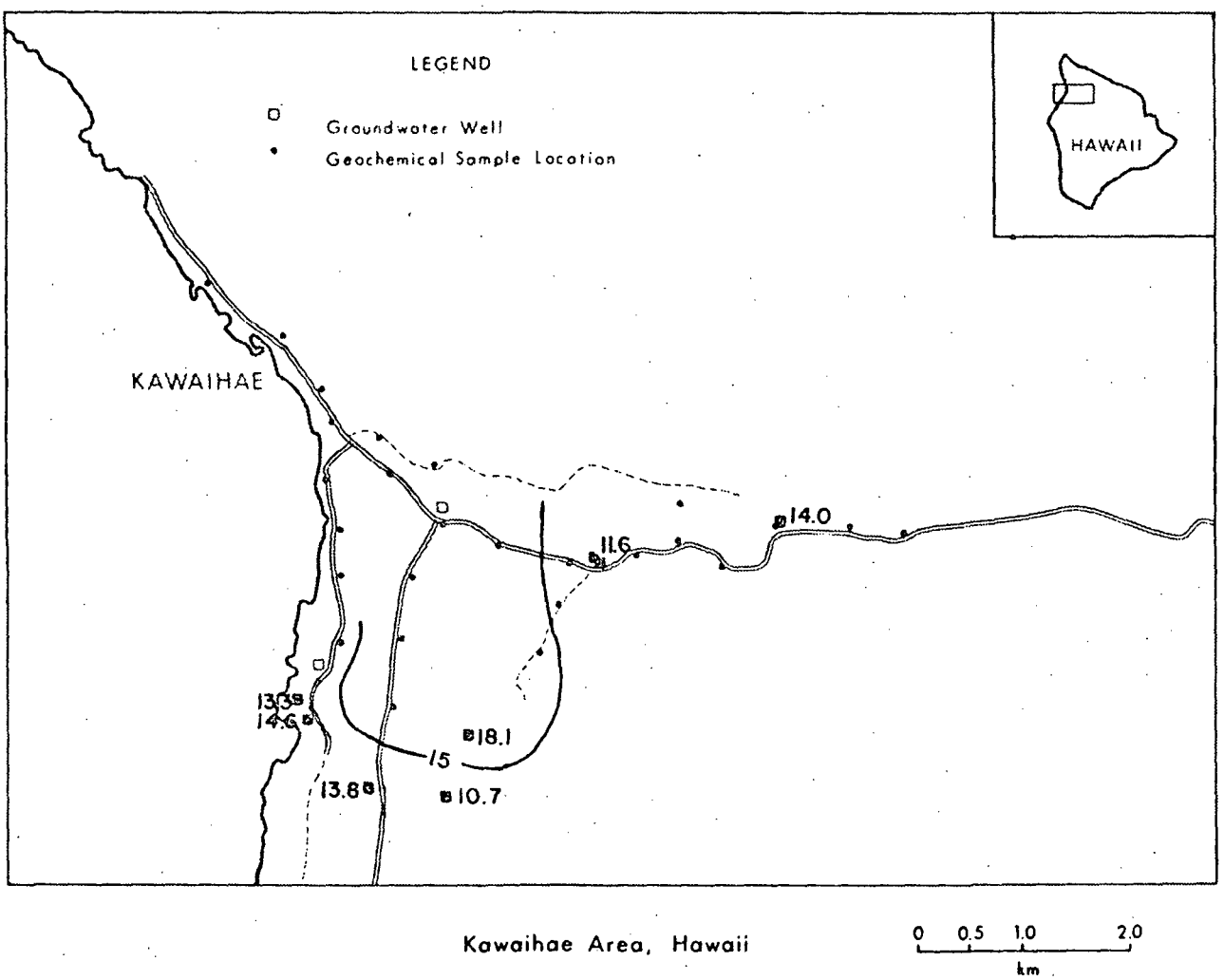
Base map Kawaihae



Kawaihae Area, Hawaii

Figure 6

Cl/Mg ratio of groundwater

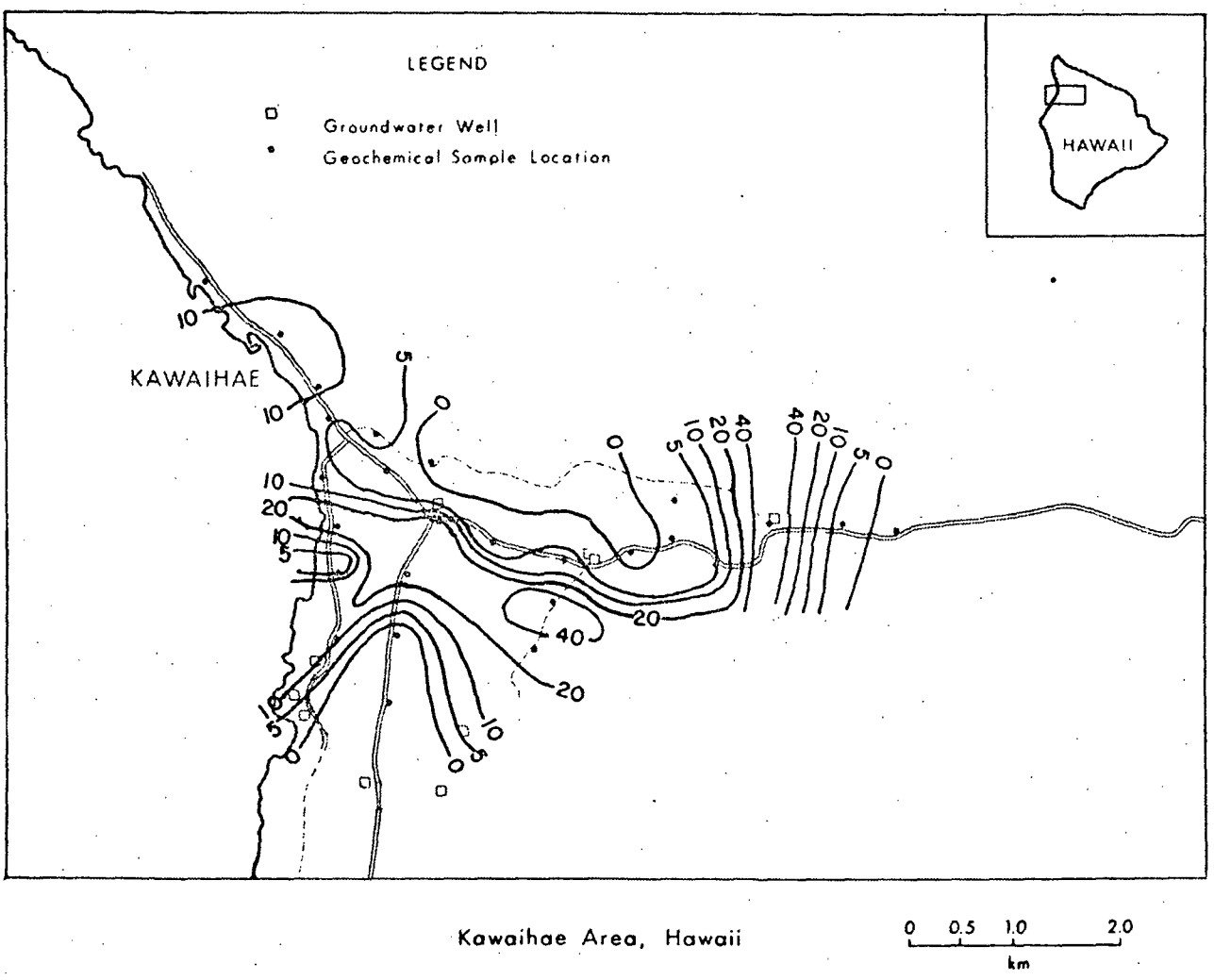


Kawaihae Area, Hawaii

Closed squares indicate wells with chemical analyses.

Figure 7

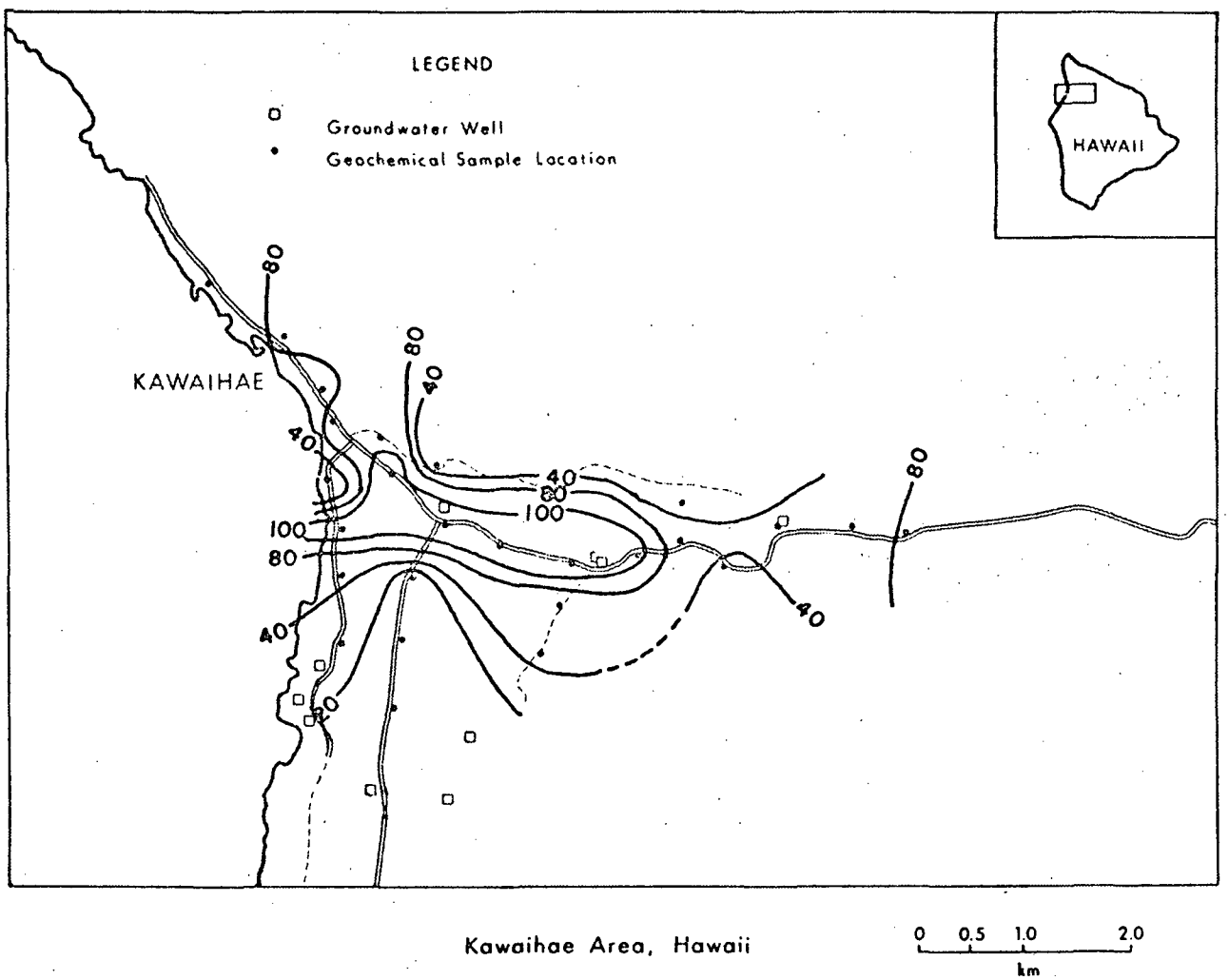
Ground Radon emanation



Closed circles show measurement locations. Contours are logarithmic at 0, 5, 10, 20, 40 units.

Figure 8

Soil mercury survey



Mercury concentration is in ppb. and contoured logarithmically.

Hualalai Northwest Rift

Studies were conducted along the northwest rift system of Hualalai volcano from sea level to an altitude of approximately 2000 meters (Fig. 9). The rift is well defined by ash and cinder cones near the summit of the volcano, however, along the lower elevations the rift zone becomes more diffuse possibly bifurcating near an altitude of 400 m. This rift zone was last active in approximately 1801 and has produced at least six major eruptions in the last 500 years (R.B. Moore, abstract, Pac. Northwest AGU, Bend, Oregon, 1979). Soil cover is variable, being virtually nonexistent on recent flows in the drier lowlands. Soil thickness increases rapidly to 10's of centimeters in the higher rainfall upper elevations.

Groundwater chemical analyses exist for only two groups of wells both of which are located on the coastal plain (Fig. 10). The observed Cl/Mg ratios for the northern group is 5.4 whereas to the south of the rift zone, the ratio is 16.1. There are, unfortunately, few other groundwater wells in this area and as a result, no firm conclusions can yet be made concerning the hydrology of this area.

Radon measurements are unusually low in the study region, most values being in the range of 0 to 5 units and several apparently broad areas of negative values occur. There are three localized areas of low positive values, two along the rift zone (Fig. 11), however, no significant trends are obvious from the presently available data.

Mercury concentrations (Fig. 12) are very low over the little weathered flows of the coastal plain although some localized highs were observed which appear to be associated with the observed radon trends. On the higher elevations of the Hualalai flanks, mercury tends to be locally elevated along

Figure 9

Northwest Hualalai base map

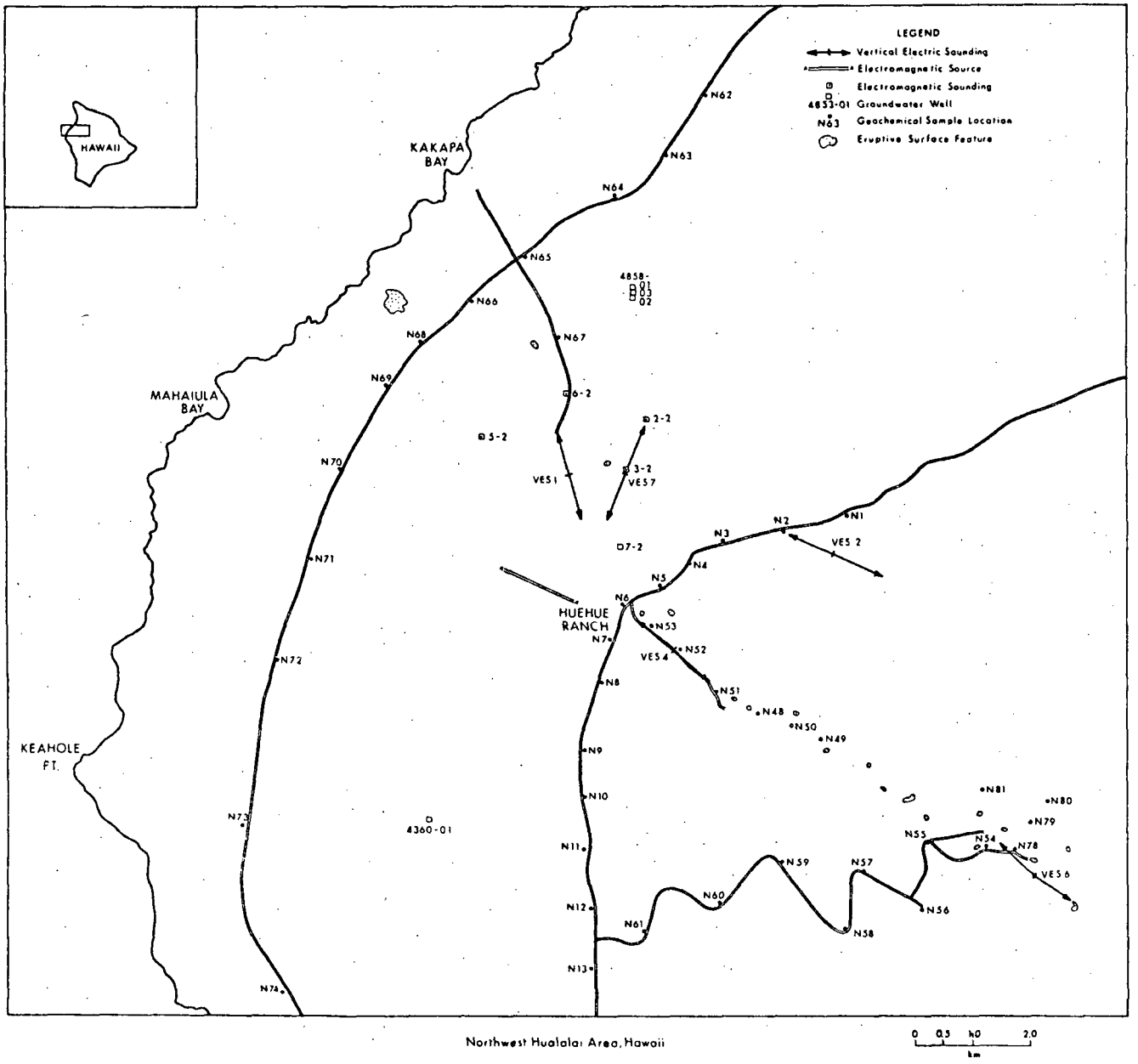
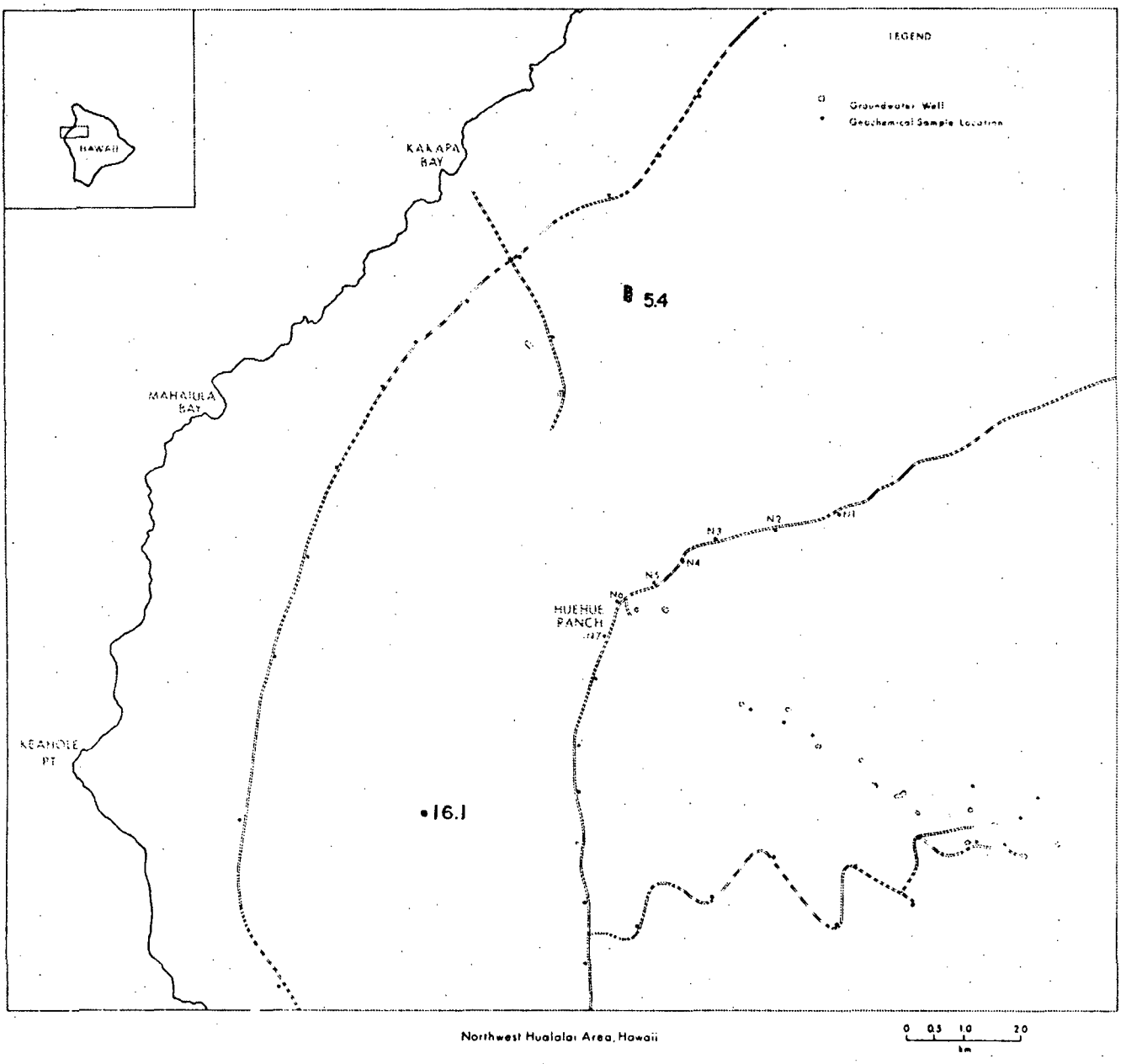


Figure 10

Cl/Mg ratio of groundwater



The trend of the rift zone is shown by eruptive features.

Figure 11

Ground radon emanation

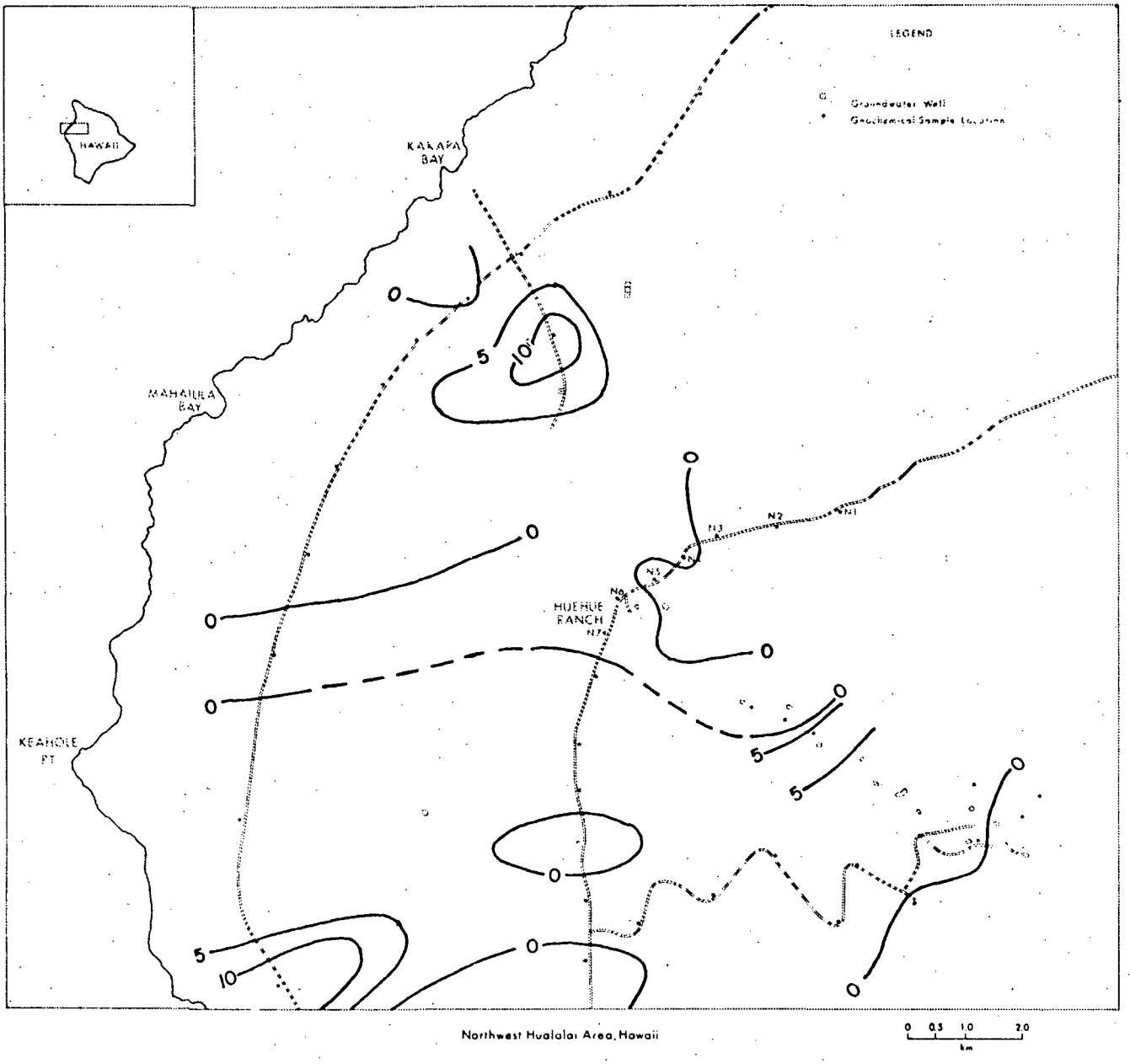
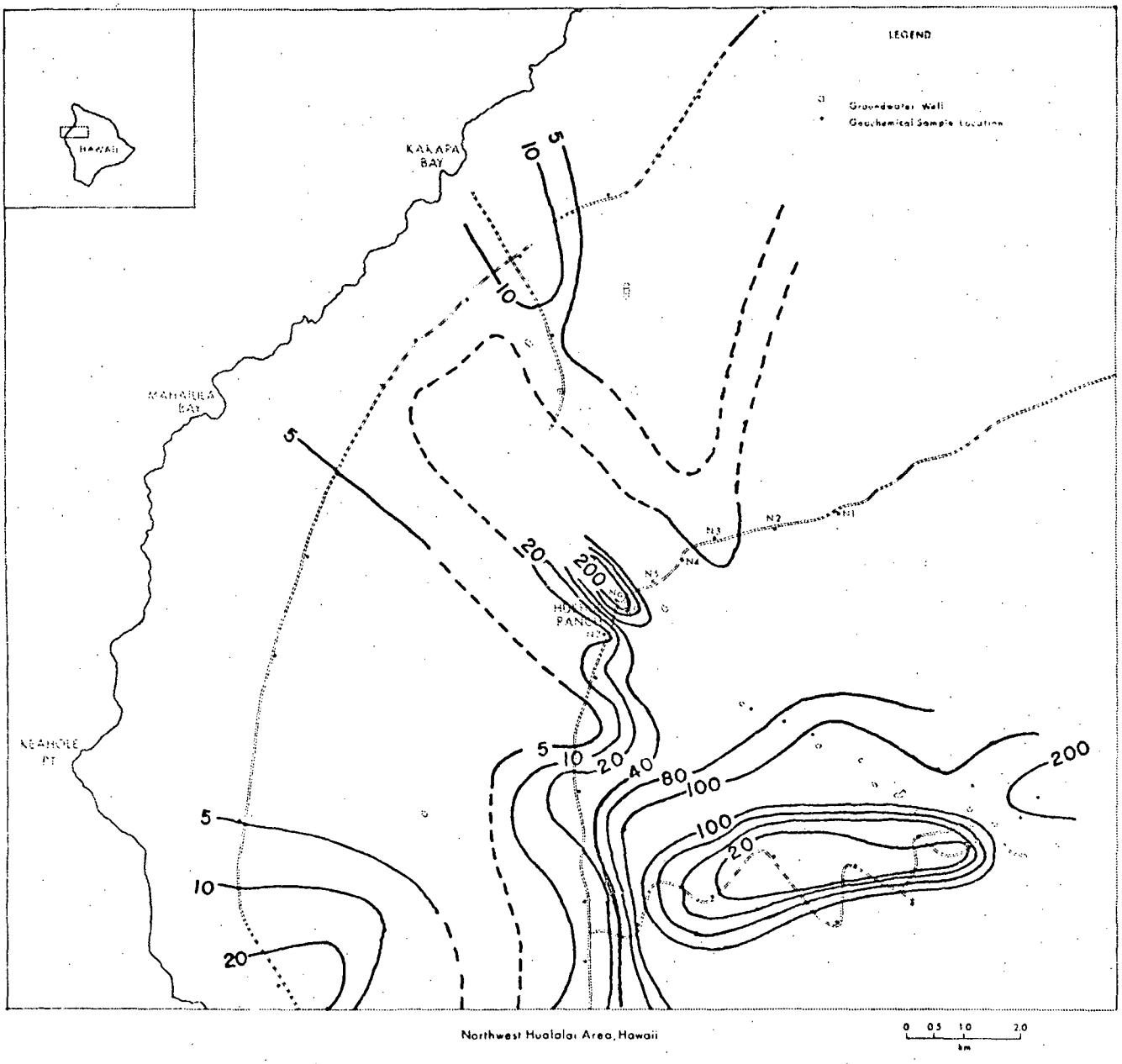


Figure 12

Soil mercury survey



the belt of eruptive features; a broader anomaly (>100 ppb) also occurs further up-rift. The elongate zone of low values on the southwest flank is thought to be related to the limited soil cover over an area of younger flows.

Overall, these data are difficult to interpret due to the great variation in elevation, climate, and soil conditions. The data suggest that there is an area of localized low order anomalies along the trend of the rift zone. Another low order anomaly occurs to the southwest of the rift which might be related to thermal groundwater flow patterns. This anomalous area appears to be continuous into the Kailua-Kona survey area to the south.

The above surveys tend to confirm the existence of at least a low level thermal anomaly along the Hualalai NW rift and we believe that further, more detailed surveys should be conducted at a later date, but are of low priority.

Kailua-Kona

The Kailua-Kona study area, located on the south west flank of Hualalai volcano is formed largely of older tholeiitic basalts with a narrow coastal zone of calcareous soils. Precipitation in the coastal area is quite low but increases substantially with the rapid increase in elevation inland.

Four well locations have water chemistry analyses available from U.S.G.S. files (Fig. 13), however, we have not yet completed a recent analysis of these wells. Of the four locations, three appear to have anomalous Cl/Mg ratios (Fig. 14).

Ground radon measurements outline two distinctly anomalous zones in the center and south of the study area (Fig. 15). Both are bounded by zones of

Figure 13

Kailua-Kona base map

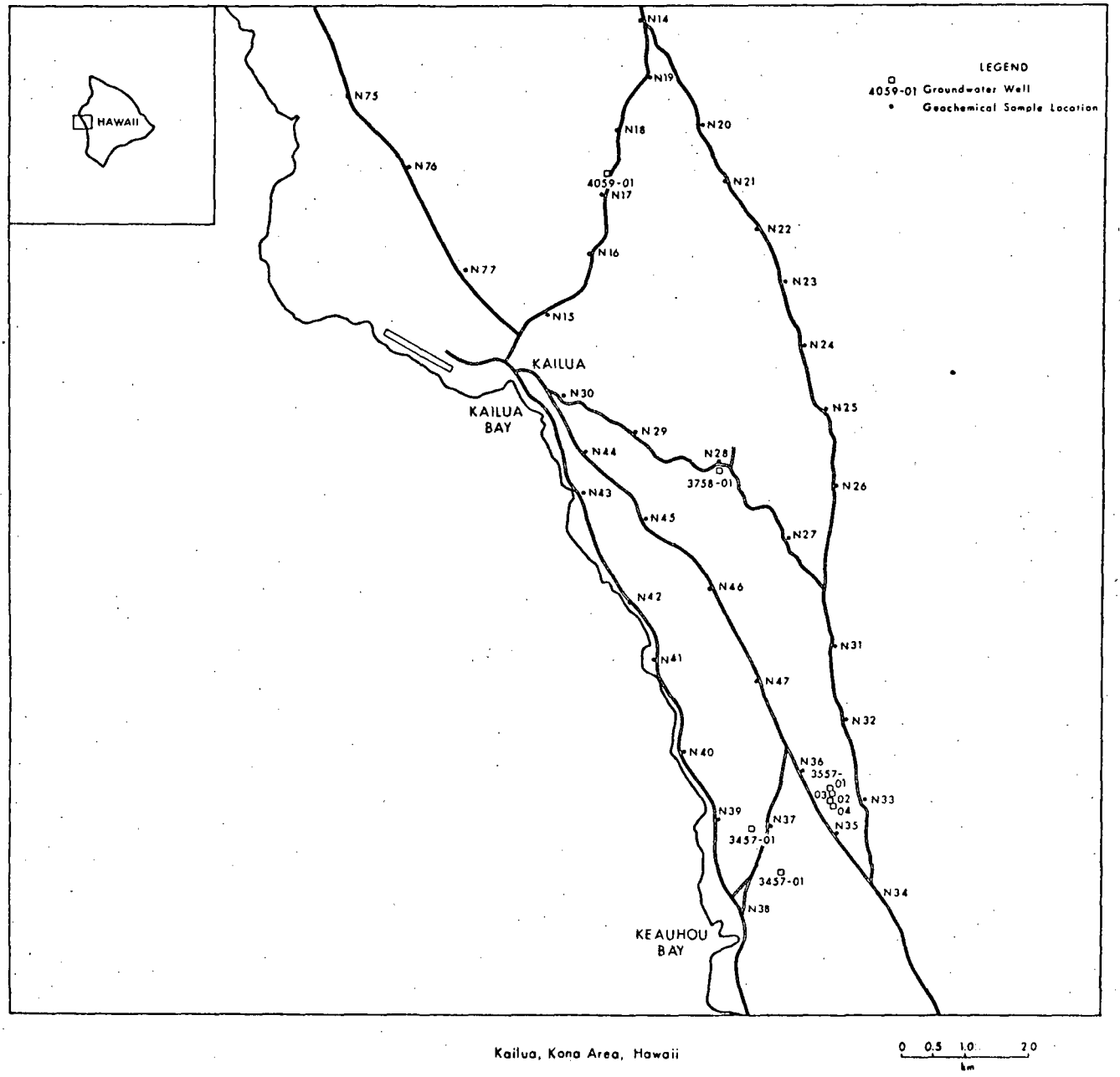


Figure 14

Cl/Mg ratio of groundwater

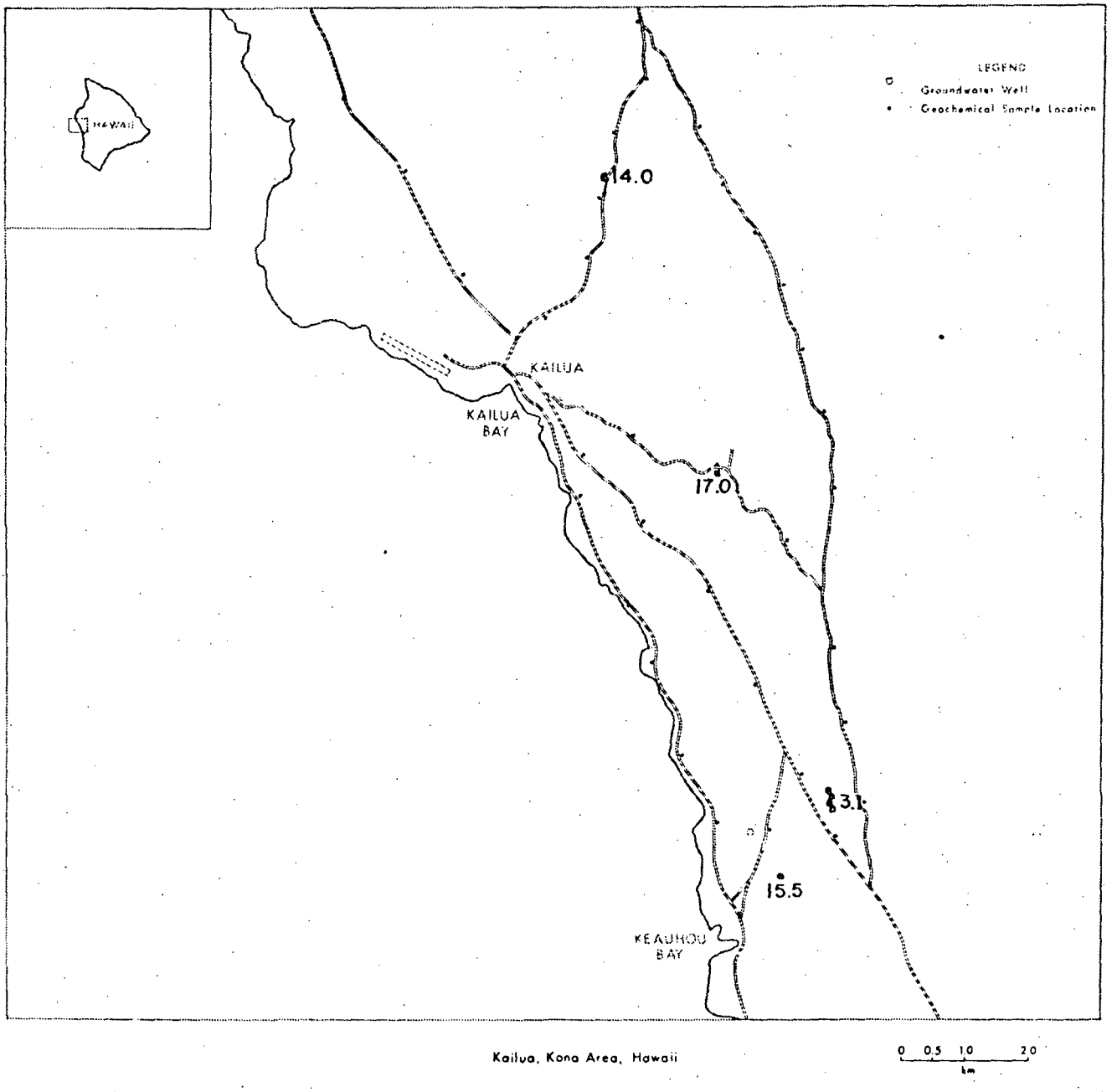
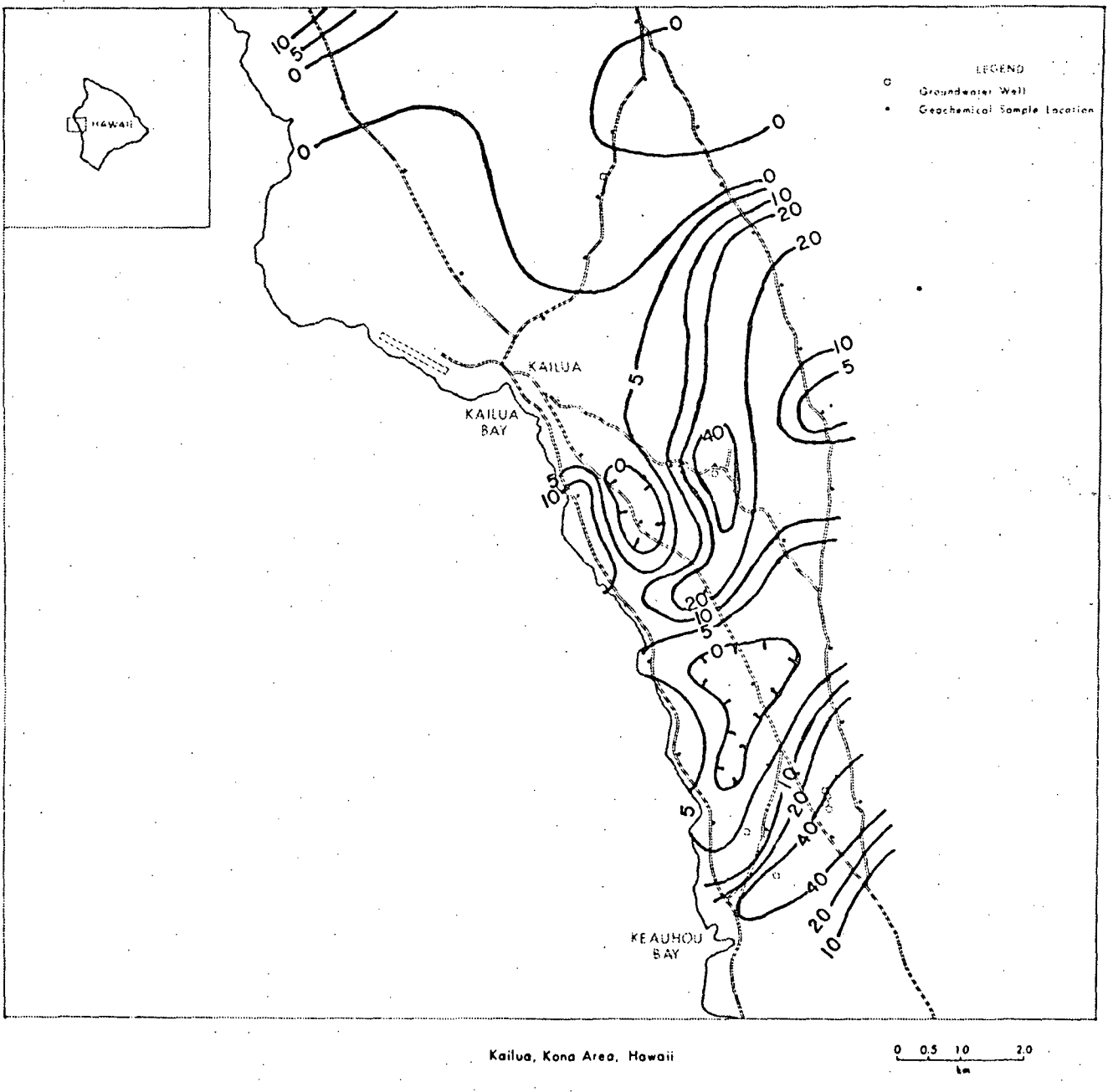


Figure 15

Ground radon emanation



Kailua, Kona Area, Hawaii

negative values. The maximum values observed were above 40 units and both anomalies are open to the east and northeast.

Soil mercury data indicate several localized variations in the coastal area and broad anomalous zone (>80-100 ppb) in the upper elevations east of Kailua (Fig. 16). A feature which is considered to be of note in the area is the particularly strong anomaly (>400 ppb) which is open to the east and northeast of Kailua. The observed mercury variations generally correlate well with the ground radon anomalies in this area.

The survey of the Kailua area shows strong geochemical anomalies with quite good coincidence between the survey techniques applied. The data indicate that the anomalous area is open to the northeast which suggests that it is associated with Hualalai volcano. This may indicate that thermal groundwaters are flowing down-dip from the summit area.

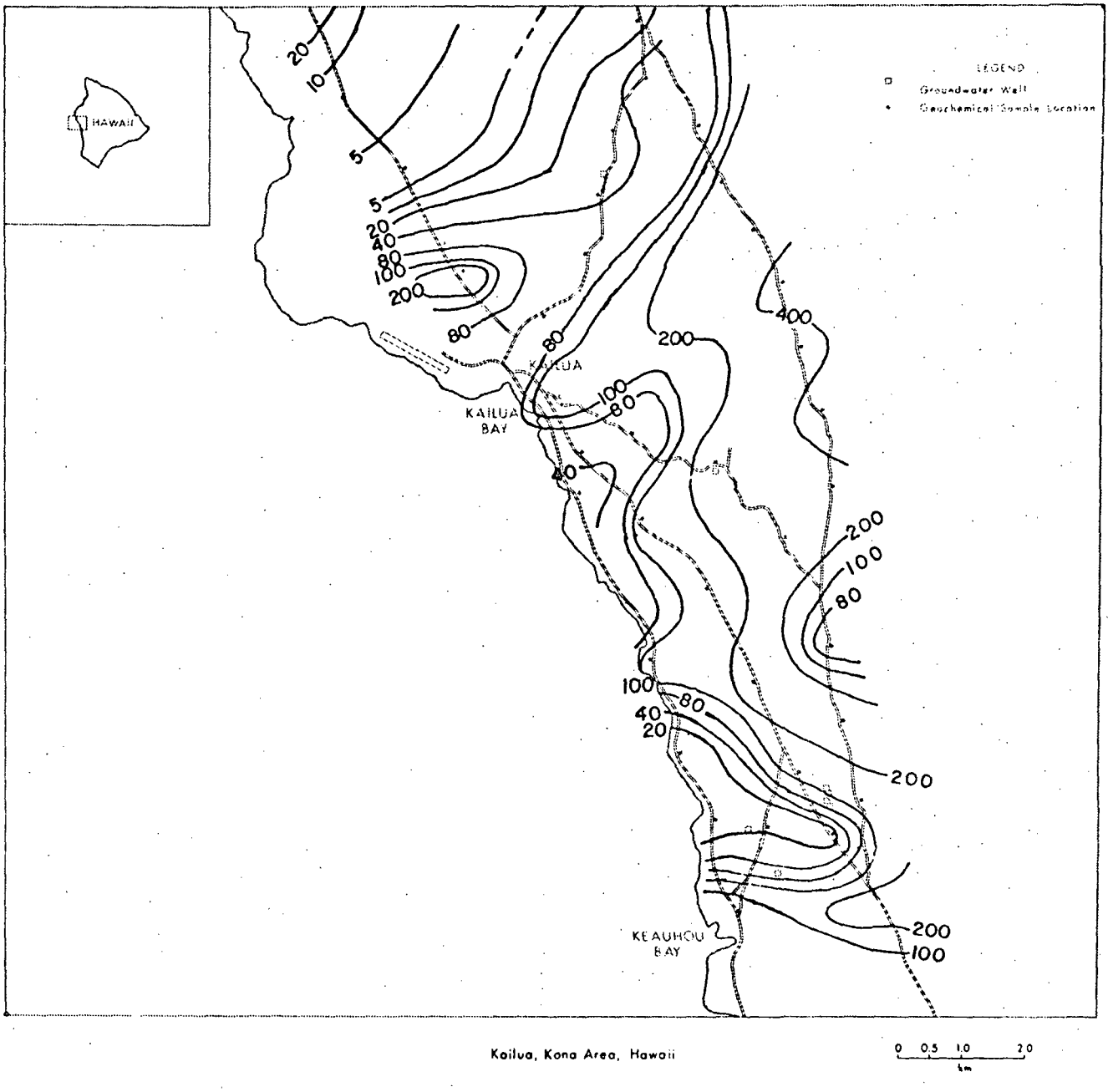
The magnitude, correlation, and location of the results of these surveys strongly suggest that a thermal anomaly is present in the Kailua-Kona district. More detailed work in Kailua-Kona is warranted, especially in the relatively unpopulated area to the northeast of Kailua Town.

Keaau

The Keaau study area is located on the lower east flank of Mauna Loa at an altitude of approximately 100 m (Fig. 17). The ground contour has a gentle slope to the south and east and is made up of well weathered tholeiitic basalt flows. The area has a typically high windward rainfall and is extensively cultivated in sugarcane. The surveys conducted in this area were, of necessity, largely limited to public access roadways due to the heavy agricultural activity in this region.

Figure 16

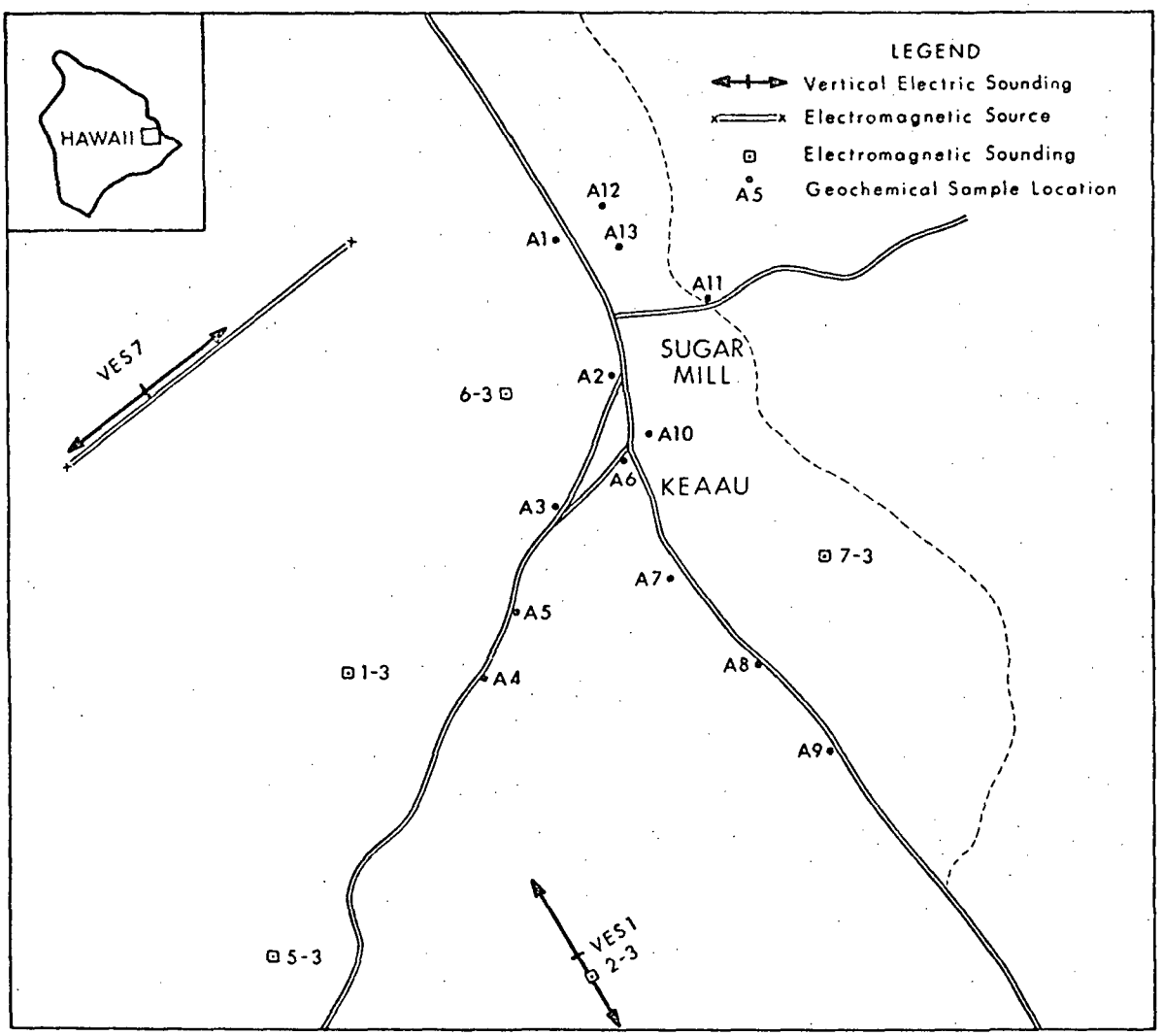
Soil mercury survey



Kailua, Kona Area, Hawaii

Figure 17

Keaau base map



Keaau Area, Hawaii

Only a few groundwater wells are recorded for this region and most are located outside the survey area. Of those wells considered, most have Cl/Mg ratios of approximately 1, however, just to the south of Keaau, two wells sampled were found to have ratios of 8.5 and 7.1, which are, at best, very low level anomalies.

Radon surveys yielded generally low values (Fig. 18), but suggest a localized high trending NE-SW through the survey area. This feature is somewhat substantiated by the results of the soil mercury surveys (Fig. 19).

The limited nature of the survey in this area does not allow an adequate delineation of any anomalous zones, however, the data do suggest that a low order anomaly may be present. Further work in the Keaau area is necessary if only to determine whether the observed anomalies are in fact real and due to the presence of above normal thermal conditions or if they are solely related to non-thermal variations.

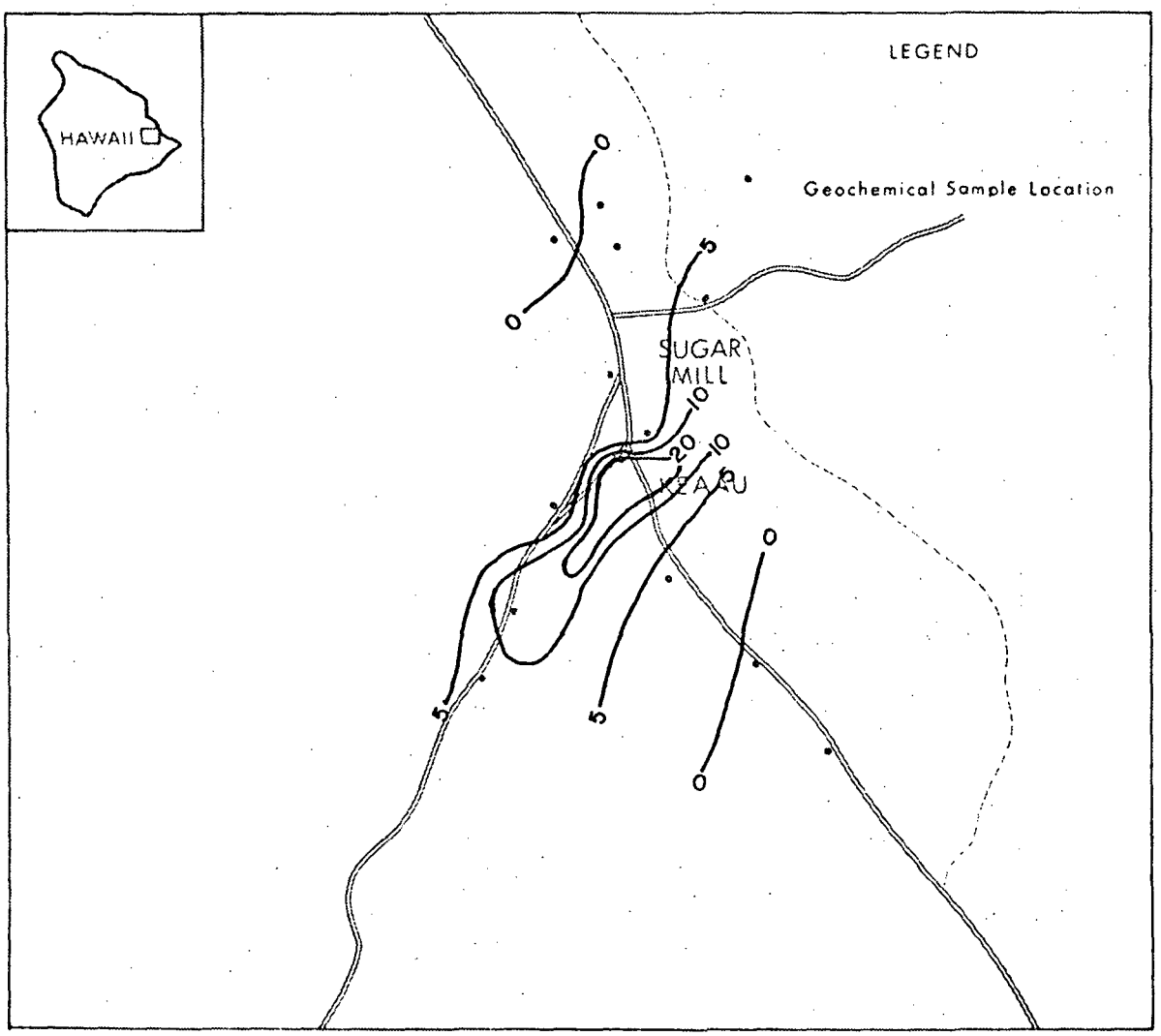
Puna

The Puna district is located on the eastern flank of Kilauea volcano and is now known to have a high temperature geothermal reservoir as evidenced by HGP-A geothermal well. The maximum temperature of the reservoir is known to be at least 350°C and production from HGP-A has been approximately 120,000 lbs/hr with a 60% steam quality (Kroopnick et al, 1978).

Mercury and radon surveys have been underway in the Puna area during most of 1979 (Cox, in press) with the objectives of both further defining the resource area as well as elucidating the mechanisms of mercury and radon transport in a geothermal area. These studies are still underway and will continue on a limited basis during the coming year.

Figure 18

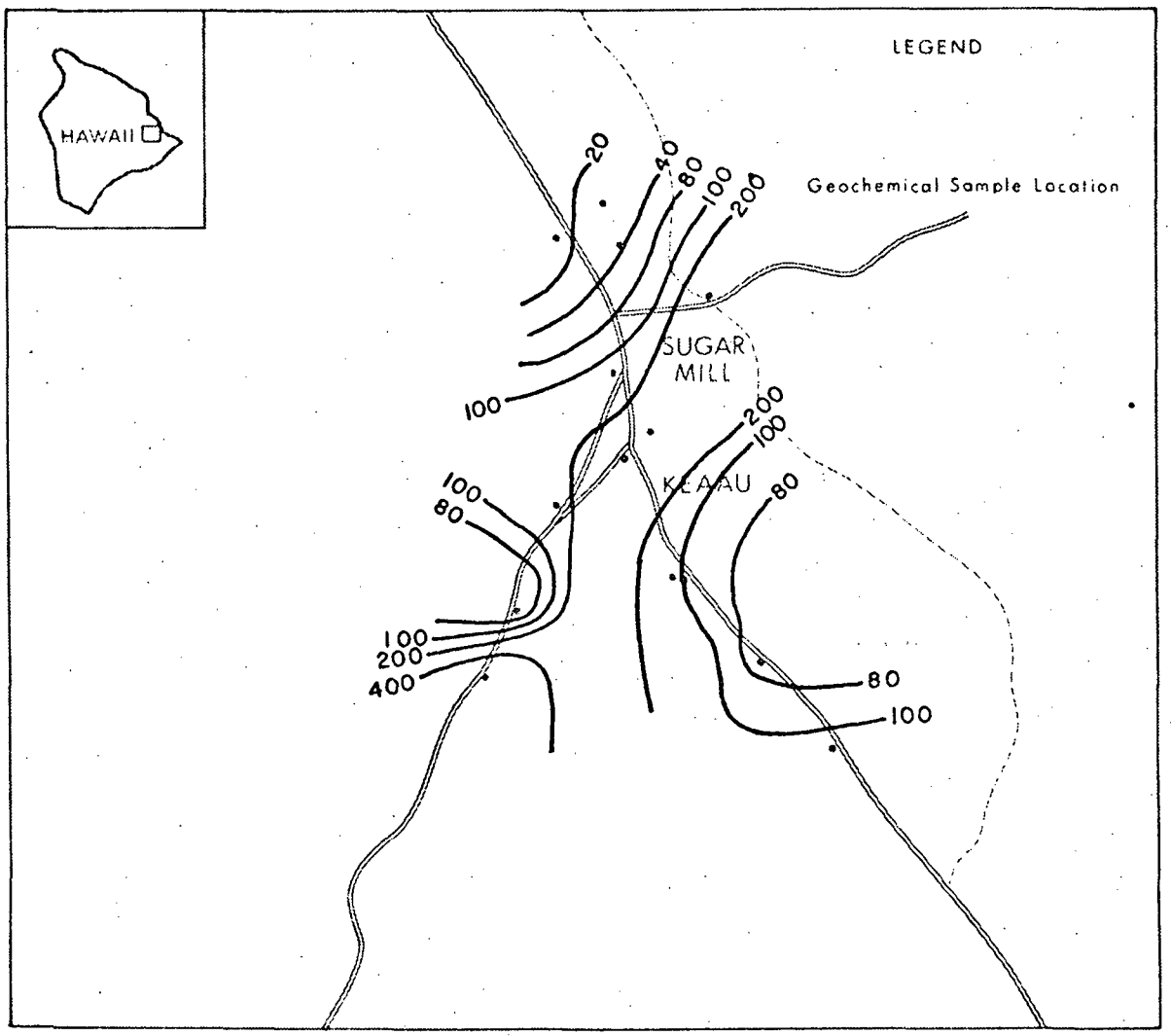
Ground radon emanation



Keaau Area, Hawaii

Figure 19

Soil mercury survey



Keaau Area, Hawaii

Geochemical Surveys on Maui

Lahaina-Kaanapali

The Lahaina survey area is located on the central SW flank of West Maui volcano. The leeward coastal zone is made up largely of alluvial material from the heavily eroded volcano. Soil cover is well developed and the land contour is very gentle along the coast increasing gradually inland toward the remnant of the eroded shield. On the lower slopes, soil is well developed and in only a few areas are the older alkalic basalt lava flows exposed. Post erosional volcanic activity (Middle to Late Pleistocene) has produced two small cinder cones within the survey area (Fig. 20).

The field survey convered two parts of the Lahaina district: Kaanapali to the north and Lahaina to the south. The post erosional volcanics are located just inland of Lahaina town and on a small peninsula at Kaanapali.

Groundwater geochemistry is available for several wells in the survey area. Although some of the groundwaters are within the normal range for the Cl/Mg ratio, several wells near Lahaina have low order anomalies (Fig. 21). Several wells near Kaanapali are also significantly above the normal range as well; the highest observed Cl/Mg value in these wells was 17.9 (5640-0.).

Radon surveys near Lahaina also indicate that a low order anomaly is present and that it becomes stronger to the north toward Kaanapali (Fig. 22). A narrow low positive zone separates this feature from a zone of very high radon outgassing to the northeast of Kaanapali (4 locations over 80 units, and a high value of 408 units).

Mercury surveys in the Lahaina area were limited because of the relatively small amount of undisturbed (uncultivated) soil available.

Figure 20

Kaanapali-Lahaina base map

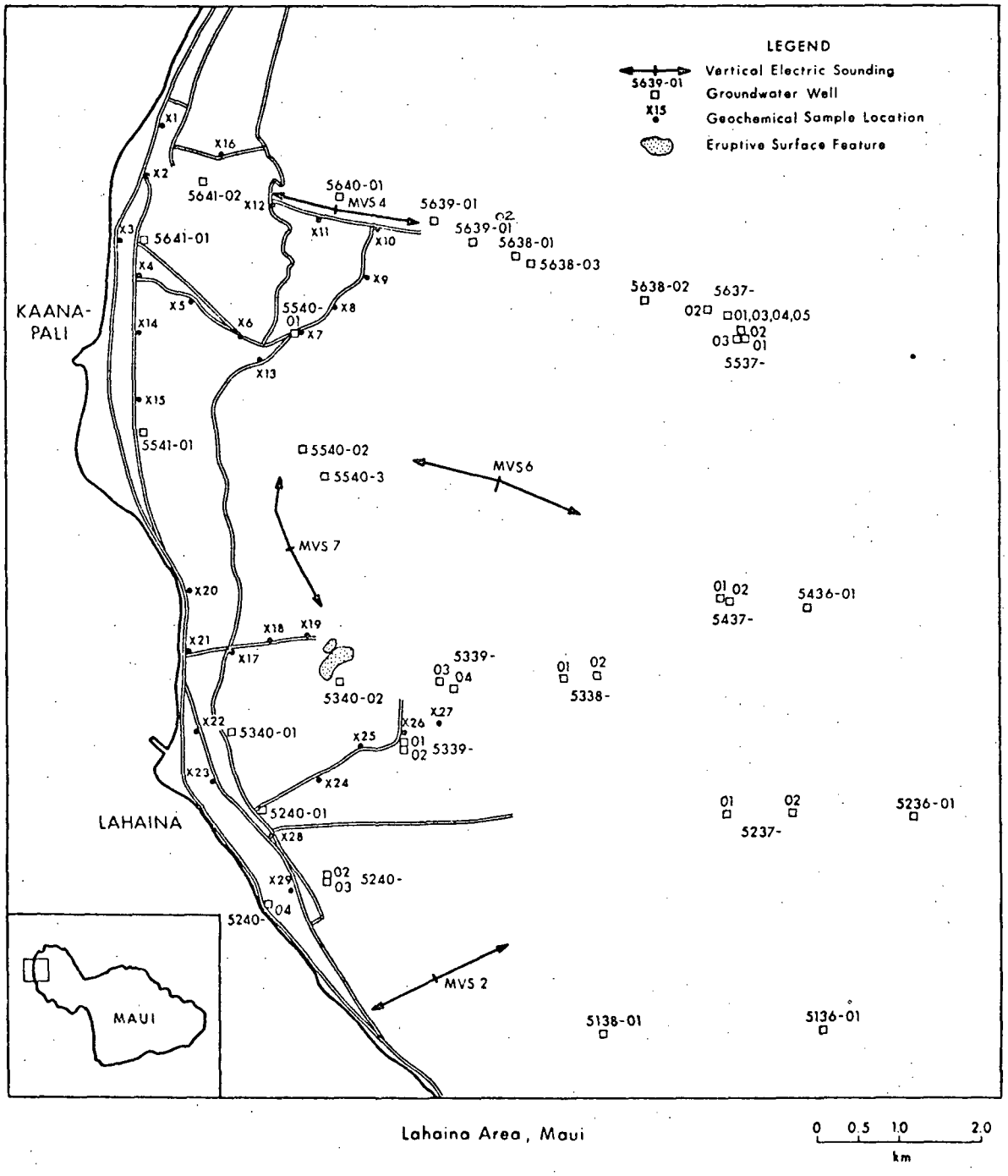


Figure 21

Cl/Mg ratio of groundwaters

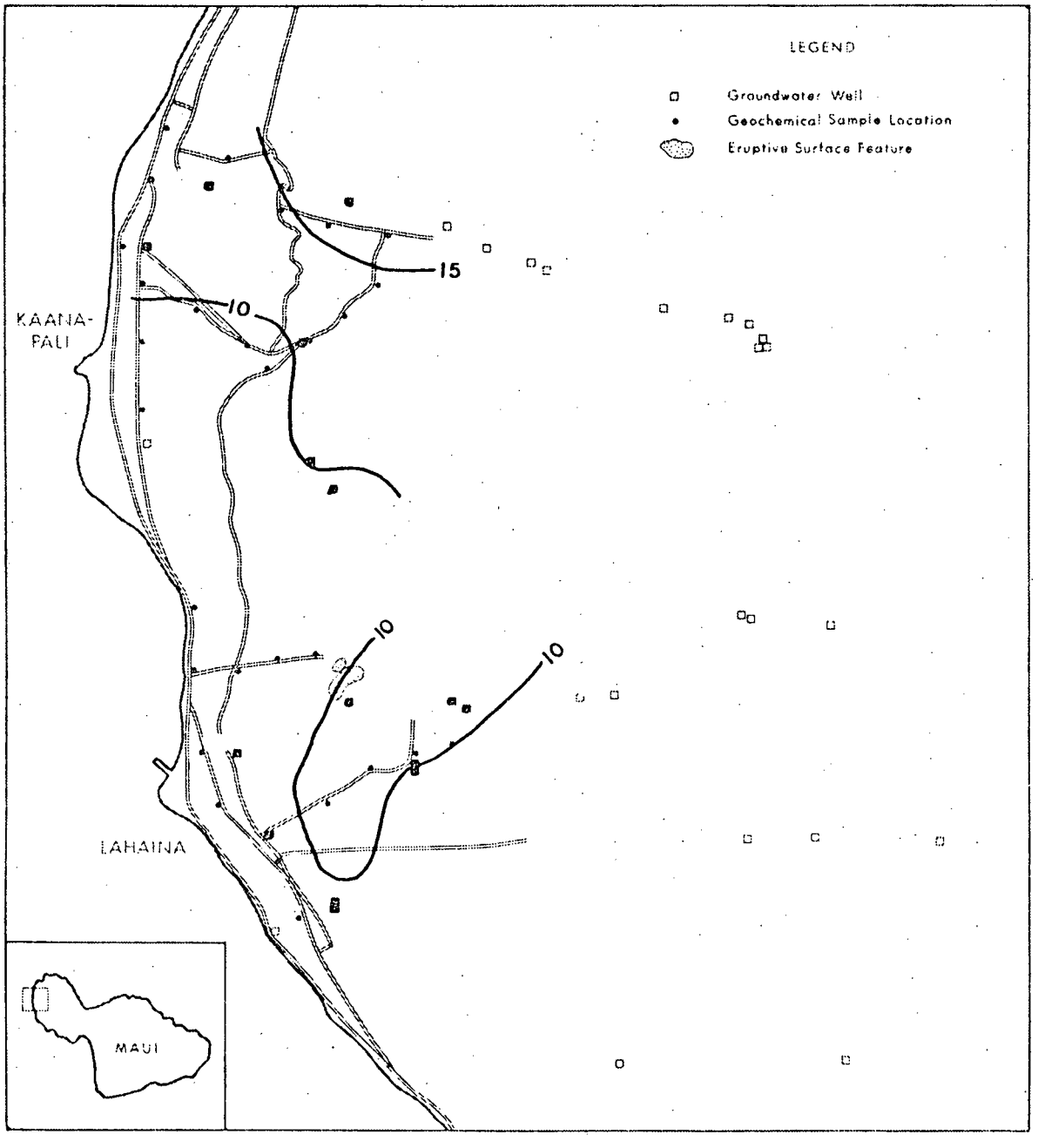
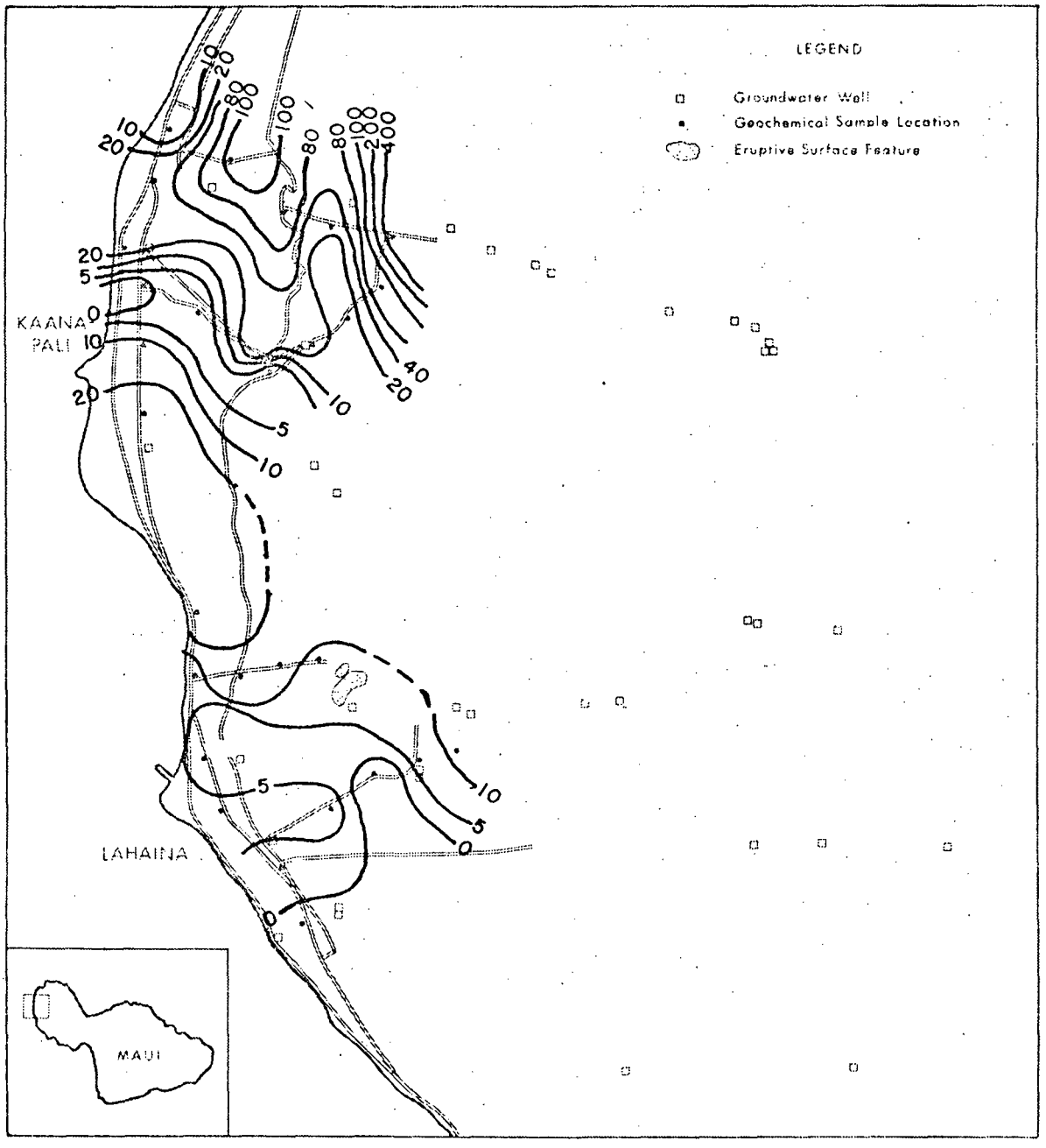


Figure 22

Ground radon emanation



Lahaina Area, Maui

The results show a low order anomaly in the area of the cinder cone at Lahaina town (Fig. 23) and a similar magnitude anomaly at Kaanapali.

The coincidence of several anomalies both at Lahaina town and northeast of Kaanapali strongly suggest that a low order thermal anomaly is present near Lahaina and perhaps a somewhat stronger anomaly is present to the northeast of Kaanapali. Further work is warranted in this area and will be carried out during 1980.

Olowalu-Ukumehame

Olowalu and Ukumehame canyons are located to the southeast of Lahaina within the heavily eroded south flank of west Maui volcano. Although there has been no surface post erosional volcanic activity in this area, extensive intrusion has taken place which has surface expression in the form of dikes and bosses which have been exposed by erosional processes.

The geochemical surveys at this site have been restricted to groundwater sampling and analysis. Two of the wells sampled show strong anomalies, one having an elevated temperature of 33°C and a Cl/Mg ratio of 17.7.

Electrical resistivity surveys (see below) have indicated anomalously low resistivities in this area as well. Even though relatively little data is available for Olowalu-Ukumehame, it is felt that further geochemical surveys of these valleys are justified, and are scheduled for 1980.

Haiku-Paia

This survey area is on the lower northern slope of Haleakala volcano in northeast Maui (Fig. 24). Rainfall is moderate 102 to 200 cm/yr and land use varies from sugarcane in the western section, to small produce farms in the central,

Figure 23

Soil mercury survey

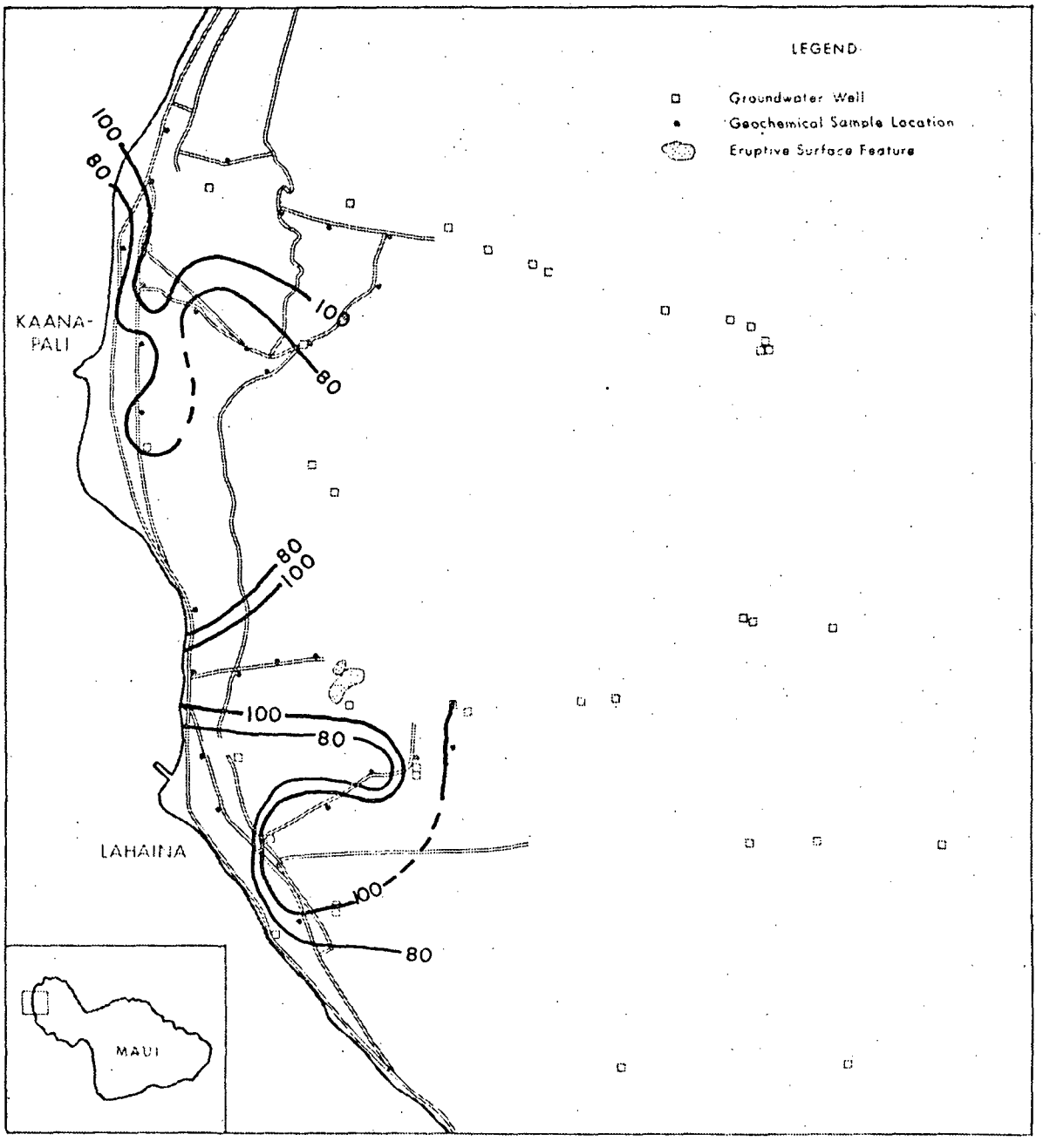
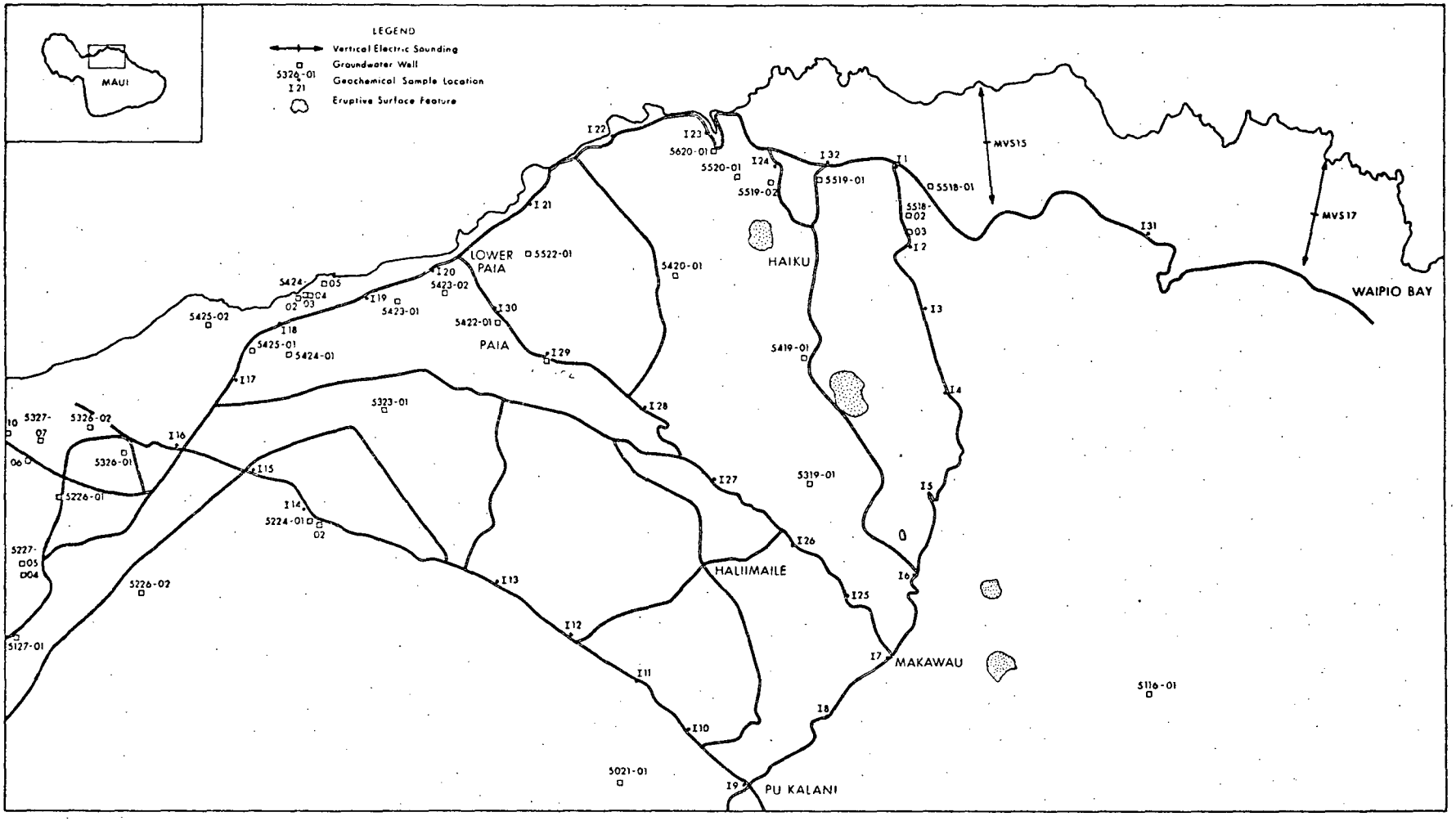


Figure 24

Haiku-Paia base map



and forest in the east. A rather diffuse rift zone passes through the area and is marked by a NNW trend of cinder cones and other eruptive features extending from the summit of Haleakala to near the coast. Several large faults parallel to and apparently associated with the rift are also indicated to pass through the center of the survey area.

Groundwater geochemical data delineate several areas in which Cl/Mg ratios are significantly elevated (Fig. 25); the high values are found along the coastal strip. The highest Cl/Mg values observed (21 and 58) are in the central north of the area. All Cl/Mg ratios decrease inland with higher elevation, apparently because the lower elevation wells penetrate basal groundwater rising to discharge at the coast, whereas the higher elevation wells are tapping perched groundwaters derived from higher elevation.

Groundwater temperatures show a pattern similar to that of the Cl/Mg ratio: higher temperatures (23 to 24°C) along the coast decreasing inland toward higher elevation (20 to 21°C) (Fig. 26). This is again considered to be the result of groundwater derived from higher elevation. Although we believe that the rift zone may have a channeling effect on the higher level water, more geochemical data are necessary before any firm conclusions can be drawn concerning the hydrogeology of this area.

Radon surveys in this area yielded some of the highest outgassing rates measured in Hawaii (Fig. 27). In that the measured radon emanation from the soil in this area is relatively high, only those radon values in excess of 20 units are considered to be significant, however, it is believed that the general pattern of radon values observed is valid. Very high radon counts (416 units) follow the strike of the rift (and associated faulting) and appear to decrease peripherally, notably to the west where a negative value zone has been defined.

Soil mercury concentrations apparently correlate well (Fig. 28) with the pattern observed for radon with elevated concentrations over the rift zone (499 ppb).

The results of these geochemical surveys strongly suggest that the rift structure is a significant feature and indicate that it is highly probable that there is above normal subsurface heat associated with it. A detailed exploratory survey will be conducted over this area during 1980.

Geochemical Surveys on Oahu

Lualualei Valley

Subsequent to the DHRA Phase I Final Report, extensive geochemical work was conducted in Lualualei valley. This work was detailed in a separate report (Cox et al, 1979) and will not be discussed here. The conclusions of the above report stated that the geological and geochemical evidence strongly suggested that a low temperature thermal anomaly exists within the valley and that shallow drilling for temperature measurements should be done to confirm the surface studies. The final report was submitted to the U.S. Navy and DOE and a decision on further studies is pending.

Waimanalo-Maunawili

Maunawili valley, on the eastern (windward) side of Oahu, is located within the caldera area of the extinct Koolau volcano. Limited radon and mercury surveys are presently underway in this area, as is groundwater geochemical sampling. We have not yet obtained sufficient data with which to make even a preliminary assessment of the possibility of geothermal potential in this area.

Figure 25

Cl/Mg ratio of groundwater

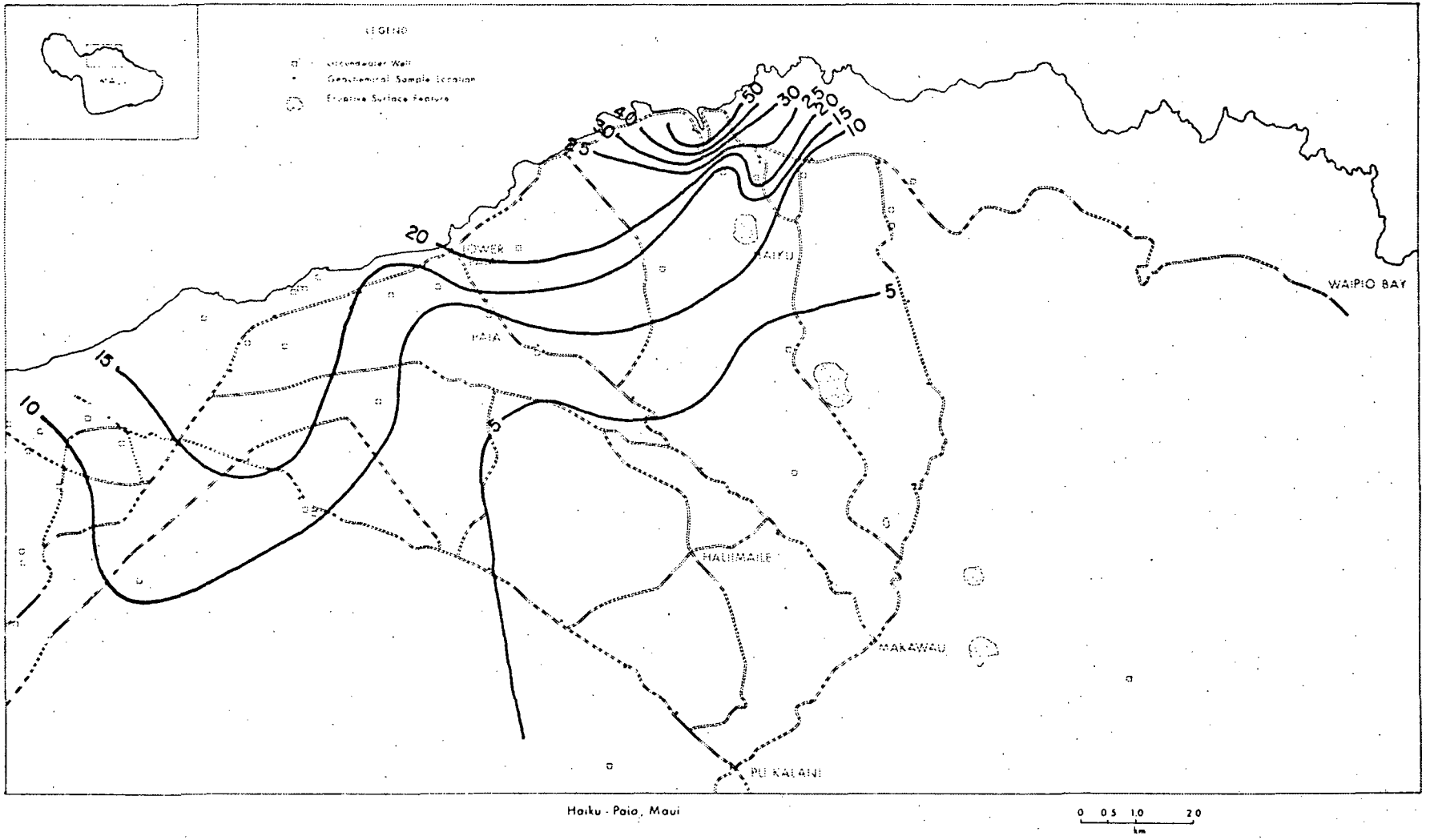
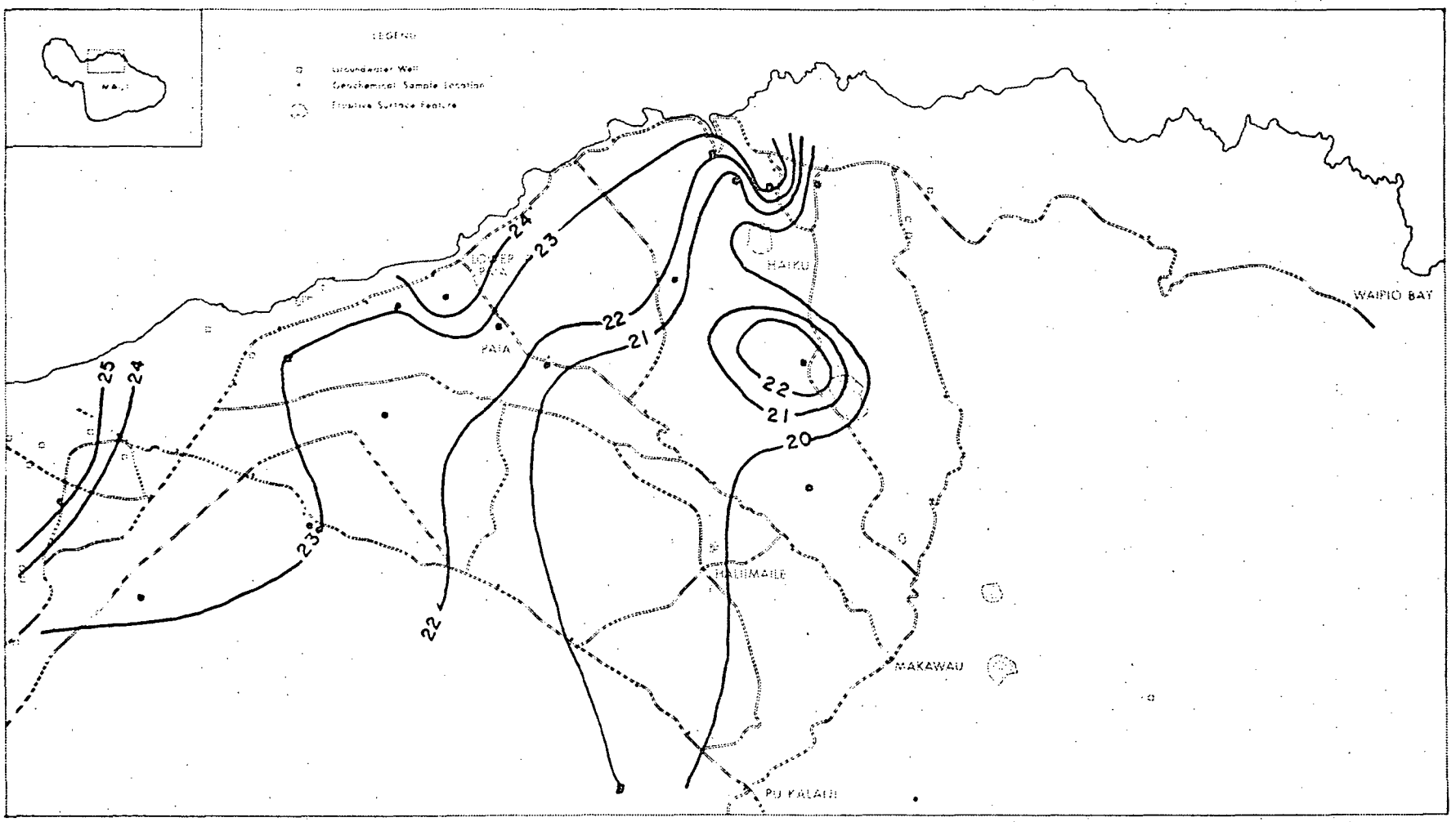


Figure 26

Temperature (°C) of groundwater



Haiku - Paia, Maui

Figure 27

Ground radon emanation

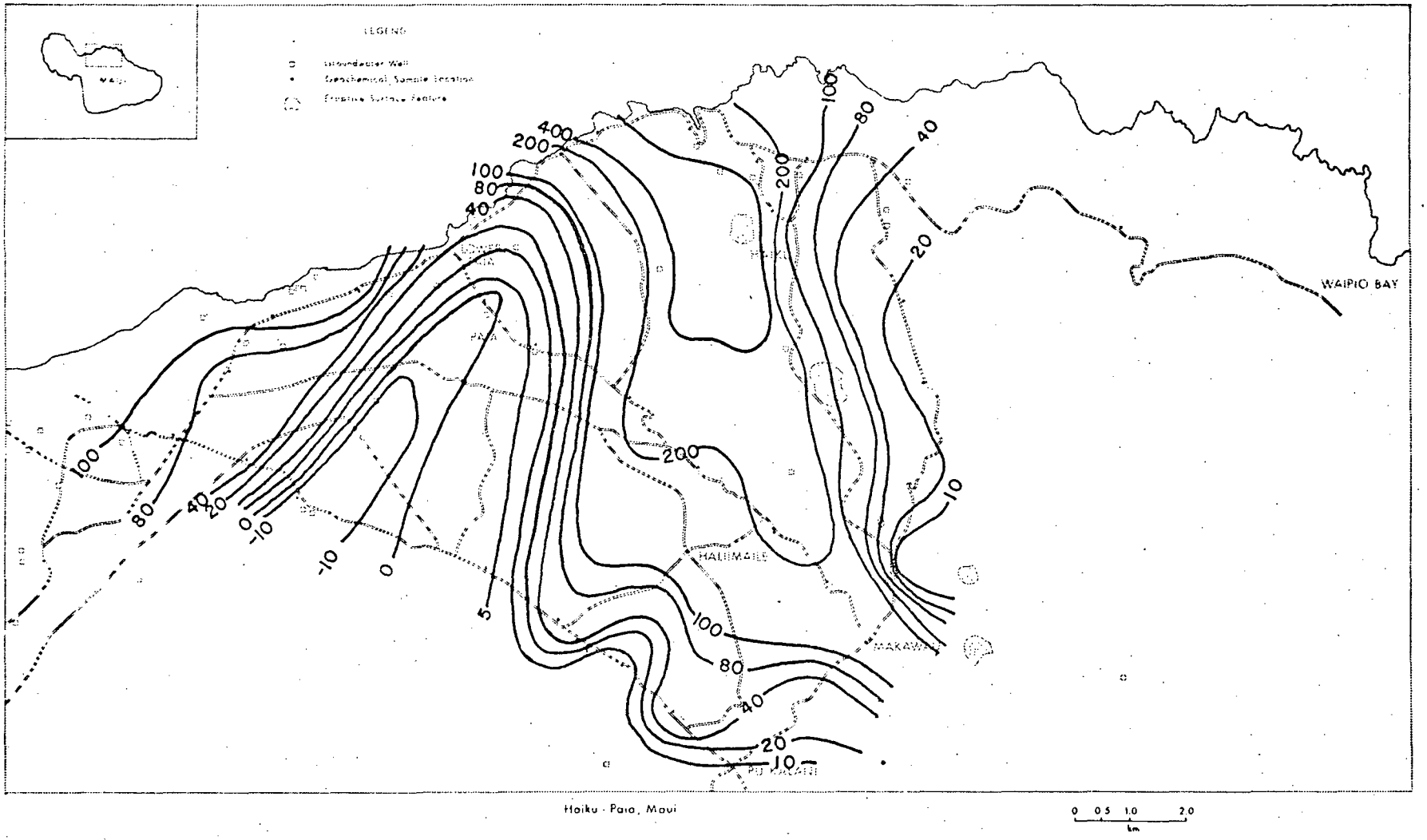
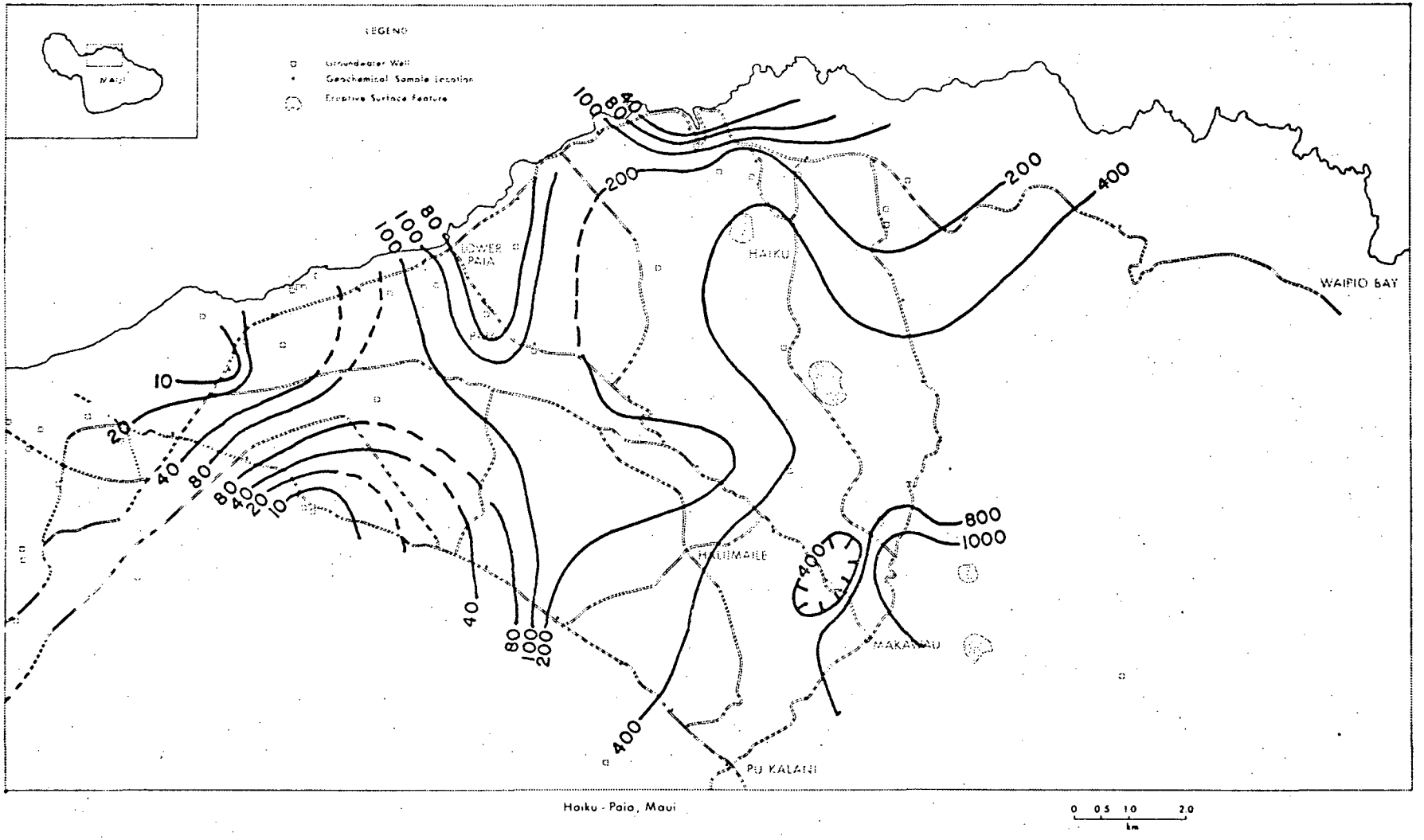


Figure 28

Soil mercury survey



Haiku - Paia, Maui

Summary of Geochemical Results

The geochemical surveys conducted during the last year have, to a greater or lesser degree, confirmed the preliminary conclusions drawn during Phase I of the Direct Heat Resource Assessment. On the basis of these preliminary results of the Phase II surveys, we have classified each of the areas studied according to their potential indicated by the work to date as follows:

A: high order anomaly;

B: moderate to high order anomaly;

C: low order anomaly;

D: no significant anomaly observed.

Hawaii

Kailua-Kona	A
Kawaihae	B
Hualalai Northwest Rift	C
Keaau	D

Maui

Haiku-Paia	A
Olowalu-Ukumehame	A
Lahaina-Kaanapali	B
Lahaina Town	D

Oahu

Lualualei Valley	B
Waimanalo-Maunawili	insufficient data

III. GEOPHYSICAL EXPLORATION PROGRAM

Introduction

The basic strategy of the electromagnetics (EM) subtask of Phase I of the Direct Heat Resource Assessment involved two levels of exploration: first, the prospective area was covered with DC soundings to obtain shallow (1000 m) geoelectric structure; second, the same area was covered with controlled-source time-domain EM soundings using a fixed, grounded-wire source to obtain deeper (to 5 km) geoelectric structure. The shallow structure determined by DC soundings is used to obtain better resolution of the deeper structures from the TDEM data.

Geophysical Surveys on Hawaii

DC and electromagnetic data had been collected in five areas on Hawaii island previous to 1979. Those areas are Kawaihae, southeast rift of Hualalai, east rift of Kilauea, southwest rift of Kilauea, and the south rift of Mauna Loa. Only the data from Kilauea's east rift has been analyzed in detail; the results have been reported elsewhere (Keller et al., 1977). During the past year, a total of 30 DC and 30 TDEM soundings were completed in two new areas -- northwest rift and summit of Hualalai volcano, Keaau, and as well as the three previously mentioned areas -- Kawaihae, south rift of Mauna Loa, and Kilauea's east rift (Fig. 2). The Hawaiian island work was jointly financed by the DOE and the U.S. Geological Survey, Branch of Electromagnetism and Geomagnetism. As detailed analysis is intended for all the data from each of the seven areas, the work in each area will be described individually.

Kawaihae

Six Schlumberger soundings were completed between Kamuela and Kawaihae. The area was difficult to work in because of the extensive pipe network and poor vehicular access. Nevertheless, most of the soundings were interpretable and show that the area between Kamuela and Puu Kawaiwai is underlain be a resistor at several hundred meters depth. These findings are anomalous for Hawaii because rocks below sea level usually have a very low resistivity due to saturation with saltwater. This area is also anomalously resistive on a bipole resistivity map done in 1973 (Keller et al, 1977) and has an anomalous magnetic field pattern. Our preliminary interpretation is that the area is underlain by a shallow intrusive, possibly connected with Puu Kawaiwai and the 80,000 year old Puu Loa vents of Kohala volcano.

Northwest Rift of Hualalai

Eight Schlumberger soundings were completed between the summit of Hualalai and the historic vent on the northwest rift zone named Puhi o Pele. Eight TDEM soundings were also located in the vicinity of Puhi o Pele. After interpretation of half of the Schlumberger soundings, the only anomalous discovery is that of a conductive zone 500 m deep beneath Hualalai's summit. This zone could be dike-impounded groundwater; however, its low resistivity might indicate an elevated temperature or a large amount of dissolved solids in the water.

Southwest Rift of Hualalai

Eight TDEM soundings were completed in this area in 1974 but were never analyzed. A partial workup of the data this year did not show any resistivities lower than 100 ohm-m.

Keaau

Four Schlumberger soundings and nine TDEM were completed between the Hilo end of Stainback highway and Ainaloa drive (off highway #130). Preliminary analysis shows no large anomalous conductors shallower than 5 km over the whole area. Schlumberger soundings defined a thick lens of freshwater in agreement with the known hydrology of Keaau. Geothermal prospects do not look good here.

Lower East Rift of Kilauea-Puna

Four new Schlumberger soundings and ten new TDEM soundings were completed. Preliminary analysis of the new data shows again that Puna has lower resistivity in general than any of the areas investigated so far. The EM and DC work done before 1979 show an area of dike-impounded water above Pahoa and the 1955 eruptive vents, an area lacking a significant freshwater lens between the 1955 vents and the coast, and an area of anomalously high conductivity westward of Puu Honuaula and the HGP-A well location. The new data were located in order to detail the structure near the 1955 vents and also the anomalous area to the west. Preliminary analysis so far indicates that the main geothermal reservoir in Puna is between Puu Honuaula and Kapoho.

Southwest Rift of Kilauea

Two lines of TDEM soundings were run perpendicular to this rift zone in 1974; one through the town of Pahala and one about 6 km to the north. Analysis of electric field data has indicated the existence of a buried contact parallel to the rift trace and 1-2 km northwest of it. A similar contact was detected near Kilauea summit, and appears to be related to the Mauna Loa-Kilauea contact rather than the SW rift zone. More data analysis will be required before a geothermal assessment will be possible.

South Point-South Rift of Mauna Loa

Three Schlumberger soundings were completed to complement several previous TDEM soundings in the area. As in Kawaihae, extensive pipe networks provided considerable interference and limited the surveyable area. The northernmost Schlumberger soundings was the only anomalous one in that it exhibited lateral distortion while crossing a prehistoric fissure. A -140 mV SP anomaly was also observed over this fissure. Again, more data analysis will be required for a geothermal assessment.

Geophysical Surveys on Maui

Seventeen resistivity soundings, using Schlumberger electrode configurations, were made on the island of Maui to determine the applicability of direct current resistivity methods for locating geothermal resources. Twelve were located between the towns of Honolua and Maalaea on west Maui and five were located on the isthmus and around Haleakala.

Final interpretation which will utilize computer inversion and geologic comparisons will not be complete until mid 1980. Preliminary analysis show

a deep conductive layer in the Olowalu and Ukumehame region. This layer is between 300 and 1300 ft deep and is less than 4 ohm-m in resistivity. This anomalously conductive layer appears to lie beneath a 15-25 ohm-m layer interpreted to be saltwater saturated rock. A warm water well (33°C) and an extensive dike swarm and boss complex located inside Ukumehame Canyon all suggest geothermal processes. A high level, aeromagnetic survey has delineated a minor volcanic pipe zone 500 m (±500 m) beneath Olowalu and Ukumehame canyon (Malahoff and Woollard, 1965).

The major rift system of Haleakala has been delineated by both aeromagnetic and gravity surveys. The site of a historic lava flow (1790) on the southwest rift and a site in Hana on the east rift were chosen for additional Schlumberger soundings. These are areas of high resistivity contrasts and we suggest that the time domain electromagnetic method be employed in these areas. In similar terrain on the island of Hawaii, it has been shown that the TDEM method is quite successful in delineating a conductive body at depth.

Additional work should be done on Maui, beginning with site specific geophysics in the Olowalu-Ukumehame area; however, extreme topographic relief make much of the area inaccessible. Four or five additional Schlumberger and several TDEM soundings could define the lateral and depth extent of the conductive body. Any microearthquake activity could be recorded by one seismograph while other types of surveys were being employed. The strong aeromagnetic anomalies suggest a ground magnetic survey in Olowalu, southwest rift and east rift zone of Hakeakala be undertaken to better define those magnetic bodies. Self potential studies successfully define geothermal areas on the Big Island and may also prove successful on Maui.

Geophysical Surveys on Oahu

Work on Oahu has been concentrated in two areas -- Lualualei Valley in the Waianae caldera area and Kailua-Waimanalo Valleys in the Koolau caldera area. The Koolau coverage was completed in 1976 as part of the first Hawaii Geothermal Project. Work in Lualualei Valley was completed in spring 1979 and has been reported (Cox et al, 1979).

Lualualei Valley

Three Schlumberger soundings were located in the valley in order to complement a rotating quadripole and self potential survey done previously (Tasci, 1975). The soundings were able to delineate valley sediments, warmwater saturated basalts, and a basement resistor. The resistive basement was shallowest in the northern part of the valley, in agreement with the 1975 survey, and is thought to be part of a caldera dike complex. In conjunction with geological and geochemical data, these soundings were used to suggest four drill sites.

Kailua-Waimanalo

Eight Schlumberger soundings were completed in 1976 in southern Kaneohe, Maunawili in Kailua, Waimanalo, and upper Nuuanu valley. The soundings were of limited utility for determining deep resistivities because of the complex sedimentary geology of these valleys and the very low resistivities of the sediments (less than 1 ohm-m); however, a resistive basement was located at 400 m depth near Kawainui Swamp. Self potentials were mapped in Waimanalo Valley to localize the source of hot water observed in one well there. SP's varied less than 70 mV over most of the valley with

some moderate values observed near the west end of the valley. A -20 mV anomaly appeared to be correlated with reef limestone outcrops. Deeper soundings are required in order to determine the resistivity structure associated with the volcanic plug at 1600 m outlined be seismic refraction and gravity data.

Summary of the Non-seismic Geophysical Results

On the basis of our results thus far, we can rank each of the areas according to their potential for each island:

Hawaii

Puna (Kilauea east rift)
Kawaihae
Kilauea SW rift
Hualalai NW rift
South Point (Mauna Loa south rift)
Hualalai SE rift
Keaau

Maui

Olowalu-Ukumehame
Haiki-Paia - insufficient data
Lahaina-Kaanapali
Lahaina town

Oahu

Lualualei
Kailua-Waimanalo - insufficient data

IV. SUMMARY OF PHASE II WORK, 1979

The geophysical and geochemical data acquired thus far strongly suggest that thermal anomalies exist in the following areas:

Hawaii: North Kona;

Maui: Haiku-Paia, Olowalu-Ukumeheme canyons;

Oahu: Lualualei Valley.

Although the surface exploration program has been completed in Lualualei Valley, continued field surveys are required in the other locations under investigation. This work will attempt to determine the source and depth of the identified anomalies as well as to define their areal limits. It is hoped that, upon successful completion of the surface studies, exploratory drilling will proceed in these areas as the next major phase of work.

Even though the identified anomalies in some of the other survey sites are not as strong as those listed above, continued geochemical and geophysical surveys will be conducted on a limited scale in a few of the latter locations. These surveys should both provide us with further insight into the mechnisms of the anomalous geochemical and geophysical behavior observed as well as allow us to identify potential interferences of the survey techniques by non-geothermal phenomena.

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APPENDIX I

Oahu Groundwater Chemistry

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NA =	180.00	CL =	126.00	BA =		CAR=		N =		CD =		ZN =		SO4=	
K =	3.40	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	6.40	I =		FE =		HCO=		NO3=		TH =	0.00	CU =		O2 =	
MG =	7.00	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	

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NA =	680.00	CL =	1410.00	BA =		CAR=		N =		CD =		ZN =		SO4=	
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CA =	96.00	I =		FE =		HCO=		NO3=		TH =	0.00	CU =		O2 =	
MG =	61.00	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	

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NA =	690.00	CL =	1480.00	BA =		CAR=		N =		CD =		ZN =		SO4=	
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CA =	101.00	I =		FE =		HCO=		NO3=		TH =	0.00	CU =		O2 =	
MG =	60.00	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	

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CA =	40.00	I =		FE =		HCO=		NO3=		TH =	0.00	CU =		O2 =	
MG =	80.00	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	

SOURCE=
COMENT:

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NA =	380.00	CL =	1330.00	BA =		CAR=		N =		CD =		ZN =		SO4=	
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CA =	127.00	I =		FE =		HCO=		NO3=		TH =	0.00	CU =		O2 =	
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SOURCE=
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K =	2.90	BR =		SR =		CO2=	38.00	NO2=		PB =	0.01	SB =		H2S=	
CA =	14.00	I =		FE =	0.01	HCO=	113.00	NO3=	4.30	TH =	0.00	CU =	0.03	O2 =	6.50
MG =	12.00	PO4=	0.25	MN =	0.05	CO3=		NH4=		AS =	0.05	CR =	0.05	P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	246.00

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NA =	90.00	CL =	141.00	BA =		CAR=		N =		CD =		ZN =		SO4=	8.00
K =		BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	95.00	I =		FE =		HCO=		NO3=		TH =	0.00	CU =		O2 =	
MG =	50.00	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	

SOURCE=
COMENT:

8 ID#=3-2709-08 TYP=WELL COU=OAHU LOC= LUALUALEI LAT,LON= 212720. 1580908.00 DAT=1978.

ELE=	100.00	WAD=	6.20	WED=	190.00	FLO=		SPC=		PH =		EH =		TEM=	26.00
LI =		F =		B =		ALK=		HAR=		HG =		SE =		SIO=	164.69
NA =	92.00	CL =	147.00	BA =		CAR=		N =		CD =		ZN =		SO4=	
K =	2.60	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	11.00	I =		FE =		HCO=		NO3=		TH =	0.00	CU =		O2 =	
MG =	9.60	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	

SOURCE=
COMENT:

9 ID#=3-2712-01 TYP=WELL COU=OAHU LOC= WAIANAE LAT,LON= 212748. 1581202.00 DAT=1978.

ELE=	30.00	WAD=		WED=	180.00	FLO=		SPC=		PH =		EH =		TEM=	24.50
LI =		F =		B =		ALK=		HAR=		HG =		SE =		SIO=	94.11
NA =	75.00	CL =	143.00	BA =		CAR=		N =		CD =		ZN =		SO4=	58.00
K =	3.60	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	24.00	I =		FE =		HCO=		NO3=		TH =	0.00	CU =		O2 =	
MG =	39.00	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	

SOURCE=
COMENT:

10 ID#=3-2808-01 TYP=WELL COU=OAHU LOC= NANAKULI LAT,LON= 212813. 1580802.00 DAT=1978.

ELE=	437.00	WAD=	441.30	WED=	395.00	FLO=		SPC=	1350.00	PH =	7.80	EH =		TEM=	26.50
LI =		F =	0.60	B =		ALK=	80.00	HAR=	280.00	HG =		SE =		SIO=	81.27
NA =	120.00	CL =	138.00	BA =		CAR=		N =	0.07	CD =		ZN =	13.00	SO4=	260.00
K =	4.00	BR =		SR =		CO2=	2.50	NO2=		PB =		SB =		H2S=	
CA =	116.00	I =		FE =	1.30	HCO=	97.00	NO3=	0.30	TH =	0.00	CU =		O2 =	
MG =	27.00	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	711.00

SOURCE=
COMENT:

11 ID#=3-2808-02 TYP=TUNNEL COU=OAHU LOC= LUALUALEI LAT,LON= 212851. 1570806.00 DAT=1978.

ELE=	1500.00	WAD=		WED=		FLO=		SPC=		PH =		EH =		TEM=	19.00
LI =		F =	0.12	B =		ALK=		HAR=		HG =		SE =		SIO=	57.75
NA =	19.00	CL =	23.00	BA =		CAR=		N =		CD =		ZN =		SO4=	33.00
K =	3.00	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	11.00	I =		FE =		HCO=		NO3=		TH =	0.00	CU =	0.15	O2 =	
MG =	6.50	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	

SOURCE=
COMENT:

12 ID#=3-2809-06 TYP=TUNNEL COU=OAHU LOC= WAIANAE TUN LAT,LON= 212827. 1580920.00 DAT=1978.

ELE=	418.00	WAD=		WED=		FLO=		SPC=		PH =		EH =		TEM=	22.00
LI =		F =		B =		ALK=		HAR=		HG =		SE =		SIO=	72.72
NA =	27.00	CL =	26.00	BA =		CAR=		N =		CD =		ZN =		SO4=	48.00
K =	2.70	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	21.00	I =		FE =		HCO=		NO3=		TH =	0.00	CU =		O2 =	
MG =	29.00	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	

SOURCE=
COMENT:

13 ID#=3-2811-02 TYP=WELL COU=OAHU LOC= MAKAHA VAL. LAT,LON= 212822. 1581136.00 DAT=1978.

ELE=	378.00	WAD=	35.00	WED=	528.00	FLO=		SPC=		PH =		EH =		TEM=	28.00
LI =		F =		B =		ALK=		HAR=		HG =		SE =		SIO=	81.27
NA =	34.00	CL =	48.60	BA =		CAR=		N =		CD =		ZN =		SO4=	3.00
K =	3.50	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	21.00	I =		FE =		HCO=		NO3=		TH =	0.00	CU =		O2 =	
MG =	24.00	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	

SOURCE=
COMENT:

14 ID#=3-2812-01 TYP=TUNNEL COU=OAHU LOC= MAKAHA SHAFT LAT,LON= 212857. 1581246.00 DAT=1978.

ELE=	140.00	WAD=	16.70	WED=	168.00	FLO=		SPC=	560.00	PH =	7.20	EH =		TEM=	26.00
LI =		F =	0.32	B =		ALK=	147.68	HAR=	180.00	HG =		SE =	0.01	SIO=	85.55
NA =	46.00	CL =	92.00	BA =		CAR=		N =		CD =		ZN =	0.05	SO4=	48.00
K =	3.70	BR =		SR =		CO2=		NO2=	0.01	PB =	0.02	SB =		H2S=	
CA =	20.00	I =		FE =	0.05	HCO=		NO3=	0.75	TH =	0.00	CU =	0.04	O2 =	
MG =	34.00	PO4=		MN =	0.01	CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	

SOURCE=
COMENT:

15 ID#=3-2911-02 TYP=TUNNEL COU=OAHU LOC= MAKAHA TUN I LAT,LON= 212946. 1581124.00 DAT=1978.

ELE=	750.00	WAD=		WED=		FLO=		SPC=		PH =		EH =		TEM=	20.00
LI =		F =		B =		ALK=		HAR=		HG =		SE =		SIO=	72.72
NA =	21.00	CL =	24.00	BA =		CAR=		N =		CD =		ZN =		SO4=	3.00
K =	2.80	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	13.00	I =		FE =		HCO=		NO3=		TH =	0.00	CU =		O2 =	
MG =	12.00	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	

SOURCE=
COMENT:

16 ID#=3-2912-01 TYP=WELL COU=OAHU LOC= MAKAHA LAT,LON= 212852. 1581303.00 DAT=1978.

ELE=	491.00	WAD=	83.50	WED=	640.00	FLO=		SPC=	530.00	PH =	7.20	EH =		TEM=	25.00
LI =		F =	0.13	B =		ALK=	126.00	HAR=	190.00	HC =		SE =		SIO=	141.16
NA =	45.00	CL =	89.00	BA =		CAR=		N =	1.90	CD =		ZN =		SO4=	43.00
K =	4.20	BR =		SR =		CO2=	16.00	NO2=		PB =		SB =		H2S=	
CA =	26.00	I =		FE =		HCO=	154.00	NO3=		TH =	0.00	CU =		O2 =	
MG =	31.00	PO4=	0.25	MN =	10.00	CO3=		NH4=		AS =		CR =		P =	0.08
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	344.00

SOURCE=
COMENT:

MASTER FILE CONTAINS 16 RECORDS

APPENDIX II

Maui Groundwater Chemistry

1 ID#=6-3625-01 TYP=DUG COU=MAUI LOC=LA PEROUSE BAY LAT,LON= 203617. 1562523.00 DAT=1979.

ELE=	8.00	WAD=	0.00	WED=	10.00	FLO=		SPC=		PH =		EH =		TEM=	22.50
LI =	0.01	F =	0.30	B =		ALK=		HAR=		HG =		SE =		SIO=	85.00
NA =	348.00	CL =	1482.00	BA =		CAR=		N =		CD =		ZN =		SO4=	405.00
K =	41.00	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	56.00	I =		FE =		HCO=		NO3=		TH =		CU =		O2 =	
MG =	178.00	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	

SOURCE=H.I.G.(8/79)
COMENT:

2 ID#=6-3726-02 TYP=DUG COU=MAUI LOC=KANAHENA (G.FULTZ) LAT,LON= 203720. 1562626.00 DAT=1979.

ELE=	13.00	WAD=	0.00	WED=	15.00	FLO=		SPC=		PH =		EH =		TEM=	23.50
LI =	0.01	F =	0.55	B =		ALK=		HAR=		HG =		SE =		SIO=	
NA =	833.00	CL =	1470.00	BA =		CAR=		N =		CD =		ZN =		SO4=	452.00
K =	51.00	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	58.00	I =		FE =		HCO=		NO3=		TH =		CU =		O2 =	
MG =	162.00	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	

SOURCE=H.I.G.(8/79)
COMENT:NOT PUMPED, POLLUTED

3 ID#=6-3726-03 TYP=DUG COU=MAUI LOC=KANAHENA (HUNTER) LAT,LON= 203715. 1562622.00 DAT=1979.

ELE=	15.00	WAD=	0.00	WED=	18.00	FLO=		SPC=		PH =		EH =		TEM=	24.50
LI =	7.20	F =	0.60	B =		ALK=		HAR=		HG =		SE =		SIO=	87.00
NA =	847.00	CL =	1435.00	BA =		CAR=		N =		CD =		ZN =		SO4=	450.00
K =	46.00	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	61.20	I =		FE =		HCO=		NO3=		TH =		CU =		O2 =	
MG =	172.00	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	

SOURCE=H.I.G.(8/79)
COMENT:

4 ID#=6-3925-01 TYP=WELL COU=MAUI LOC=MAKENA-68 LAT,LON= 203912. 1562559.00 DAT=1978.

ELE=	352.00	WAD=	0.40	WED=	382.00	FLO=		SPC=		PH =	7.35	EH =		TEM=	20.40
LI =		F =	0.06	B =		ALK=	200.00	HAR=	388.00	HG =		SE =	0.01	SIO=	21.30
NA =	336.00	CL =	612.00	BA =		CAR=		N =		CD =		ZN =	0.10	SO4=	52.00
K =	24.00	BR =		SR =		CO2=		NO2=	6.00	PB =	0.01	SB =		H2S=	
CA =	38.00	I =		FE =	0.13	HCO=	244.00	NO3=	7.10	TH =	0.00	CU =	0.10	O2 =	
MG =	67.50	PO4=		MN =	0.05	CO3=		NH4=		AS =	0.01	CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	1110.00

SOURCE=DOH(9/64), DOWALD(3/77), H.I.G.(10/78)
COMENT:

5 ID#=6-4019-01 TYP=TUNNEL COU=MAUI LOC=POLI POLI PARK LAT,LON= 204049. 1561958.00 DAT=1979.

ELE=	6200.00	WAD=		WED=		FLO=		SPC=		PH =		EH =		TEM=	10.30
LI =		F =	0.14	B =		ALK=		HAR=		HG =		SE =		SIO=	
NA =	9.80	CL =	2.10	BA =		CAR=		N =		CD =		ZN =		SO4=	4.60
K =	2.10	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	4.70	I =		FE =		HCO=		NO3=		TH =		CU =		O2 =	
MG =	1.80	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	

SOURCE=DOWALD(3/77), H.I.G.(8/79)
COMENT:SPRING IN TUNNEL, PERCHED AQUAFER

6 ID#=6-4020-02 TYP=TUNNEL COU=MAUI LOC=CORNWALL TUNNEL LAT,LON= 204044. 1562055.00 DAT=1979.

ELE=	4850.00	WAD=		WED=		FLO=		SPC=		PH =		EH =		TEM=	11.80
LI =		F =	0.00	B =		ALK=		HAR=		HG =		SE =		SIO=	
NA =	7.70	CL =	5.60	BA =		CAR=		N =		CD =		ZN =		SO4=	10.10
K =	1.90	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	7.50	I =		FE =		HCO=		NO3=		TH =		CU =		O2 =	
MG =	3.60	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	

SOURCE=DOWALD(3/77), H.I.G.(8/79)
COMENT:SPRING FROM SHORT TUNNEL OR EXCAVATION, PERCHED AQUIFER.

7 ID#=6-4020-04 TYP=TUNNEL COU=MAUI LOC=WAIKAALO SPRING LAT,LON= 204012. 1562044.00 DAT=1979.

ELE=	5400.00	WAD=		WED=		FLO=		SPC=		PH =		EH =		TEM=	11.80
LI =		F =	0.55	B =		ALK=		HAR=		HG =		SE =		SIO=	
NA =	13.00	CL =	2.10	BA =		CAR=		N =		CD =		ZN =		SO4=	6.60
K =	3.85	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	3.70	I =		FE =		HCO=		NO3=		TH =		CU =		O2 =	
MG =	3.36	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	

SOURCE=H.I.G.(8/79)
COMENT:SPRING FROM SHORT TUNNEL OR EXCAVATION, PERCHED AQUIFER.

8 ID#=6-4021-01 TYP=TUNNEL COU=MAUI LOC=WAIKAAHI TUNNEL LAT,LON= 204054. 1562104.00 DAT=1979.

ELE=	5880.00	WAD=		WED=		FLO=		SPC=		PH =		EH =		TEM=	14.00
LI =		F =	0.07	B =		ALK=		HAR=		HG =		SE =		SIO=	
NA =	7.00	CL =	3.70	BA =		CAR=		N =		CD =		ZN =		SO4=	9.70
K =	1.70	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	3.20	I =		FE =		HCO=		NO3=		TH =		CU =		O2 =	
MG =	3.60	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	

SOURCE=DOWALD(3/77), H.I.G.(8/79)
COMENT:SPRING FROM SHORT TUNNEL OR EXCAVATION, PERCHED AQUIFER.

9 ID#=6-4021-02 TYP=TUNNEL COU=MAUI LOC=WAIHOU SPRING LAT,LON= 204004. 1562123.00 DAT=1979.

ELE=	4760.00	WAD=		WED=		FLO=		SPC=		PH =		EH =		TEM=	13.00
LI =		F =	0.20	B =		ALK=		HAR=		HG =		SE =		SIO=	
NA =	15.00	CL =	9.70	BA =		CAR=		N =		CD =		ZN =		SO4=	9.40
K =	5.30	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	5.30	I =		FE =		HCO=		NO3=		TH =		CU =		O2 =	
MG =	5.03	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	

SOURCE=H.I.G.(8/79)
COMENT:SPRING FROM SHORT TUNNEL OR EXCAVATION, PERCHED AQUIFER.

10 ID#=6-4600-01 TYP=WELL COU=MAUI LOC=HANA RANCH LAT,LON= 204601. 1560015.00 DAT=1979.

ELE=	250.00	WAD=	3.00	WED=	280.00	FLO=		SPC=		PH =		EH =		TEM=	19.50
LI =	0.00	F =	0.11	B =		ALK=		HAR=		HG =		SE =		SIO=	
NA =	49.00	CL =	67.90	BA =		CAR=		N =		CD =		ZN =		SO4=	15.70
K =	4.00	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	12.90	I =		FE =		HCO=		NO3=		TH =		CU =		O2 =	
MG =	16.10	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	

SOURCE=DOWALD(3/77), H.I.G.(8/79)
COMENT:

11 ID#=6-4600-02 TYP=WELL COU=MAUI LOC=HANA (COUNTY-A) LAT,LON= 204636. 1560026.00 DAT=1979.

ELE=	266.00	WAD=	1.50	WED=	288.00	FLO=		SPC=		PH =		EH =		TEM=	20.20
LI =	0.00	F =	0.17	B =		ALK=		HAR=		HG =		SE =		SIO=	
NA =	77.50	CL =	115.00	BA =		CAR=		N =		CD =		ZN =		SO4=	12.30
K =	4.80	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	2.80	I =		FE =		HCO=		NO3=		TH =		CU =		O2 =	
MG =	3.90	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	

SOURCE=H.I.G.(8/79)
COMENT:THE COUNTY PEOPLE LOST A CAMERA BELOW THE WATER TABLE, CONSEQUENTLY THE WELL IS NOT BEING PUMPED

12 ID#=6-4600-03 TYP=WELL COU=MAUI LOC=HANA (COUNTY-B) LAT,LON= 204633. 1560032.00 DAT=1979.

ELE=	306.00	WAD=	2.00	WED=	323.00	FLO=		SPC=		PH =		EH =		TEM=	18.00
LI =		F =	0.05	B =		ALK=		HAR=		HG =		SE =		SIO=	
NA =	32.00	CL =	30.10	BA =		CAR=		N =		CD =		ZN =		SO4=	51.50
K =	1.70	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	1.20	I =		FE =		HCO=		NO3=		TH =		CU =		O2 =	
MG =	1.50	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	

SOURCE=DOWALD(3/77), H.I.G.(8/79)
COMENT:

13 ID#=6-4824-01 TYP=WELL COU=MAUI LOC=KIHEI EXPLORATORY LAT,LON= 204827. 1562422.00 DAT=1978.

ELE=	593.00	WAD=	2.80	WED=	640.00	FLO=		SPC=	612.00	PH =	7.70	EH =		TEM=	23.22
LI =		F =	0.70	B =		ALK=	190.00	HAR=	102.00	HG =		SE =		SIO=	55.00
NA =	104.00	CL =	81.00	BA =		CAR=		N =		CD =		ZN =		SO4=	6.00
K =	11.50	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	12.60	I =		FE =		HCO=	232.00	NO3=	12.00	TH =	0.00	CU =		O2 =	
MG =	21.00	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	408.00

SOURCE=USGS(3/71), DOWALD(3/77), H.I.G.(10/78)
COMENT:

14 ID#=6-4835-01 TYP=TUNNEL COU=MAUI LOC=UKUMEHAME PUMP-P LAT,LON= 204847. 1563558.00 DAT=1978.

ELE=	79.00	WAD=	6.00	WED=	143.00	FLO=		SPC=		PH =	7.50	EH =		TEM=	33.11
LI =		F =	0.15	B =	2.00	ALK=	108.00	HAR=	330.00	HG =		SE =		SIO=	76.00
NA =	220.00	CL =	459.00	BA =		CAR=		N =		CD =		ZN =		SO4=	40.00
K =	17.00	BR =	6.00	SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	94.00	I =	0.04	FE =		HCO=	130.00	NO3=	11.00	TH =	0.00	CU =		O2 =	
MG =	26.00	PO4=	0.05	MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	921.00

SOURCE=U.H., DOWALD(3/77), H.I.G.(10/78)
COMENT:

15 ID#=6-4837-01 TYP=TUNNEL COU=MAUI LOC=OLOWALU PUMP-O LAT,LON= 204859. 1563709.00 DAT=1978.

ELE=	20.00	WAD=	2.00	WED=	20.00	FLO=		SPC=		PH =	7.60	EH =		TEM=	25.87
LI =		F =	0.06	B =	0.90	ALK=	98.00	HAR=	500.00	HG =		SE =		SIO=	58.30
NA =	260.00	CL =	676.00	BA =		CAR=		N =		CD =		ZN =		SO4=	86.00
K =	6.50	BR =	4.00	SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	152.00	I =	0.02	FE =		HCO=	120.00	NO3=	5.90	TH =	0.00	CU =		O2 =	
MG =	96.00	PO4=	0.10	MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	956.00

SOURCE=U.H., DOWALD(8/79), H.I.G.(10/78)
COMENT:

16 ID#=6-4937-01 TYP=TUNNEL COU=MAUI LOC=OLOWALU SHAFT-N LAT,LON= 204931. 1563712.00 DAT=1978.

ELE=	165.00	WAD=	3.50	WED=	309.00	FLO=		SPC=	4670.00	PH =	7.10	EH =		TEM=	25.61
LI =		F =	0.05	B =	1.00	ALK=	116.00	HAR=	890.00	HG =		SE =		SIO=	73.50
NA =	255.00	CL =	669.00	BA =		CAR=		N =	1.90	CD =		ZN =		SO4=	76.00
K =	11.90	BR =	2.50	SR =		CO2=	18.00	NO2=		PB =		SB =		H2S=	
CA =	112.00	I =	0.03	FE =	10.00	HCO=	141.00	NO3=	6.40	TH =	0.00	CU =		O2 =	
MG =	78.00	PO4=	0.21	MN =		CO3=		NH4=		AS =		CR =		P =	0.07
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	1900.00

SOURCE=USGS(12/74), DOWALD(3/77), H.I.G.(10/78)
COMENT:

17 ID#=6-5130-02 TYP=WELL COU=MAUI LOC=WAIKAPU 2 LAT,LON= 205154. 1563038.00 DAT=1978.

ELE=	518.00	WAD=	10.30	WED=	1020.00	FLO=		SPC=	461.00	PH =	8.10	EH =		TEM=	21.55
LI =		F =	0.08	B =		ALK=	194.00	HAR=	69.00	HG =		SE =		SIO=	52.50
NA =	36.00	CL =	36.00	BA =		CAR=		N =	2.80	CD =		ZN =		SO4=	15.00
K =	3.00	BR =		SR =		CO2=	3.00	NO2=		PB =		SB =		H2S=	
CA =	17.00	I =		FE =	10.00	HCO=	236.00	NO3=		TH =	0.00	CU =		O2 =	
MG =	13.00	PO4=	1.00	MN =	10.00	CO3=		NH4=		AS =		CR =		P =	0.34
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	288.00

SOURCE=USGS(3/74), DOWALD(3/77), H.I.G.(10/78)
COMENT:

18 ID#=6-5133-01 TYP=SPRING COU=MAUI LOC=WAIKAPU SPRING LAT,LON= 205137. 1563304.00 DAT=1979.

ELE=	1480.00	WAD=		WED=		FLO=		SPC=		PH =		EH =		TEM=	19.25
LI =		F =		B =		ALK=		HAR=		HG =		SE =		SIO=	
NA =	12.00	CL =	13.70	BA =		CAR=		N =		CD =		ZN =		SO4=	13.20
K =	1.40	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	3.20	I =		FE =		HCO=		NO3=		TH =		CU =		O2 =	
MG =	4.56	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	

SOURCE=H.I.G.(8/79)
COMENT:LOCATED ~800 METERS UP VALLEY FROM "5132-02" AT THE BASE OF THE LEFT WALL(USGS QUADRANGLE MAP)

19 ID#=6-5240-01 TYP=TUNNEL COU=MAUI LOC=PIONER MILL PUMP-C LAT,LON= 205255. 1564044.00 DAT=1978.

ELE=	34.00	WAD=	3.00	WED=	39.00	FLO=		SPC=		PH =	7.20	EH =		TEM=	26.82
LI =		F =	0.08	B =	0.50	ALK=	159.00	HAR=	830.00	HG =		SE =		SIO=	64.40
NA =	465.00	CL =	1030.00	BA =		CAR=		N =		CD =		ZN =		SO4=	144.00
K =	17.00	BR =	12.00	SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	123.00	I =	0.30	FE =		HCO=	194.00	NO3=	22.00	TH =	0.00	CU =		O2 =	
MG =	119.00	PO4=	0.20	MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	2040.00

SOURCE=U.H., DOWALD(3/77), H.I.G.(10/78)
COMENT:

20 ID#=6-5240-02 TYP=TUNNEL COU=MAUI LOC=LAHAINA-A LAT,LON= 205228. 1564017.00 DAT=1978.

ELE=	30.00	WAD=	2.00	WED=	31.00	FLO=		SPC=		PH =		EH =		TEM=	
LI =		F =	0.07	B =		ALK=		HAR=		HG =		SE =		SIO=	67.40
NA =	672.00	CL =	1360.00	BA =		CAR=		N =		CD =		ZN =		SO4=	200.00
K =	22.00	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	134.00	I =		FE =		HCO=		NO3=		TH =	0.00	CU =		O2 =	
MG =	140.00	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	

SOURCE=DOWALD(3/77), H.I.G.(10/78)
COMENT:

21 ID#=6-5240-03 TYP=TUNNEL COU=MAUI LOC=LAHAINA-B LAT,LON= 205227. 1564017.00 DAT=1978.

ELE=	30.00	WAD=	2.00	WED=	31.00	FLO=		SPC=		PH =	7.20	EH =		TEM=	24.93
LI =		F =	0.05	B =		ALK=	202.00	HAR=	800.00	HG =		SE =		SIO=	59.00
NA =	406.00	CL =	1040.00	BA =		CAR=		N =		CD =		ZN =		SO4=	134.00
K =	16.20	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	164.00	I =		FE =		HCO=	246.00	NO3=	15.00	TH =	0.00	CU =		O2 =	
MG =	132.00	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	1370.00

SOURCE=U.H., DOWALD(3/77), H.I.G.(10/78)
COMENT:

22 ID#=6-5319-01 TYP=SPRING COU=MAUI LOC=SILVENO SPRING LAT,LON= 205301. 1561935.00 DAT=1979.

ELE=	860.00	WAD=		WED=		FLO=		SPC=		PH =		EH =		TEM=	19.80
LI =		F =	0.08	B =		ALK=		HAR=		HG =		SE =		SIO=	
NA =	19.00	CL =	17.30	BA =		CAR=		N =		CD =		ZN =		SO4=	11.70
K =	1.90	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	2.50	I =		FE =		HCO=		NO3=		TH =		CU =		O2 =	
MG =	4.10	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	

SOURCE=H.I.G.(8/79)
COMENT:SPRING AT BOTTOM OF GULLEY WALL JUST PRIOR TO MALIKO GULCH.

23 ID#=6-5321-01 TYP=TUNNEL COU=MAUI LOC=KAHEKA PUMP-18 'B' LAT,LON= 205327. 1562132.00 DAT=1979.

ELE=	522.00	WAD=	6.20	WED=		FLO=		SPC=		PH =	7.70	EH =		TEM=	20.50
LI =		F =	0.40	B =	0.10	ALK=	57.00	HAR=	66.00	HG =		SE =		SIO=	53.00
NA =	232.00	CL =	431.00	BA =		CAR=		N =		CD =		ZN =		SO4=	95.00
K =	16.00	BR =	0.72	SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	29.60	I =	0.05	FE =		HCO=	140.00	NO3=	8.60	TH =		CU =		O2 =	
MG =	32.50	PO4=	1.42	MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	279.00

SOURCE=U.H., DOWALD(3/77), H.I.G.(8/79)
COMENT:

24 ID#=6-5323-01 TYP=TUNNEL COU=MAUI LOC=PAIA PUMP-2 'A' LAT,LON= 205344. 1562346.00 DAT=1979.

ELE=	125.00	WAD=	3.90	WED=		FLO=		SPC=		PH =	7.20	EH =		TEM=	22.80
LI =	0.00	F =	0.46	B =		ALK=	115.00	HAR=	250.00	HG =		SE =		SIO=	56.00
NA =	300.00	CL =	543.00	BA =		CAR=		N =		CD =		ZN =		SO4=	178.00
K =	17.00	BR =	3.30	SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	27.30	I =	0.06	FE =		HCO=	140.00	NO3=	14.00	TH =		CU =		O2 =	
MG =	47.90	PO4=	0.68	MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	964.00

SOURCE=U.H., DOWALD(3/77), H.I.G.(8/79)
COMENT:

25 ID#=6-5330-09 TYP=WELL COU=MAUI LOC=MOKUHAU PUMP-1 LAT,LON= 205329. 1563055.00 DAT=1978.

ELE=	353.00	WAD=	23.00	WED=	600.00	FLO=		SPC=	470.00	PH =	7.50	EH =		TEM=	23.54
LI =		F =	0.06	B =		ALK=	61.00	HAR=	98.00	HG =		SE =		SIO=	58.00
NA =	38.00	CL =	81.50	BA =		CAR=		N =		CD =		ZN =	0.01	SO4=	116.00
K =	3.30	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	26.00	I =		FE =		HCO=	75.00	NO3=	4.60	TH =	0.00	CU =		O2 =	
MG =	16.00	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	198.00

SOURCE=USGS, DOWALD(3/77), H.I.G.(10/78)
COMENT:

26 ID#=6-5330-10 TYP=WELL COU=MAUI LOC=MOKUHAU PUMP-2 LAT,LON= 205329. 1563055.00 DAT=1978.

ELE=	353.00	WAD=	21.00	WED=	600.00	FLO=		SPC=	400.00	PH =	7.60	EH =		TEM=	23.57
LI =		F =	0.05	B =		ALK=	78.00	HAR=	100.00	HG =		SE =		SIO=	58.30
NA =	67.00	CL =	158.00	BA =		CAR=		N =	1.10	CD =		ZN =		SO4=	196.00
K =	4.80	BR =		SR =		CO2=	3.80	NO2=		PB =		SB =		H2S=	
CA =	39.00	I =		FE =	20.00	HCO=	95.00	NO3=		TH =	0.00	CU =		O2 =	
MG =	23.00	PO4=	0.25	MN =		CO3=		NH4=		AS =		CR =		P =	0.08
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	242.00

SOURCE=USGS(9/74), DOWALD(3/77), H.I.G.(10/78)
COMENT:

27 ID#=6-5330-11 TYP=WELL COU=MAUI LOC=MOKUHAU PUMP-3 LAT,LON= 205330. 1563054.00 DAT=1978.

ELE=	354.00	WAD=		WED=		FLO=		SPC=	370.00	PH =	7.60	EH =		TEM=	23.52
LI =		F =	0.06	B =		ALK=	81.00	HAR=	99.00	HG =		SE =	0.01	SIO=	64.00
NA =	34.00	CL =	47.50	BA =		CAR=	81.00	N =	2.60	CD =		ZN =	0.01	SO4=	7.00
K =	2.50	BR =		SR =		CO2=	4.00	NO2=	0.02	PB =	0.01	SB =		H2S=	
CA =	21.00	I =		FE =	0.02	HCO=	99.00	NO3=	4.43	TH =	0.00	CU =		O2 =	
MG =	14.00	PO4=		MN =	0.05	CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	255.00

SOURCE=USGS(9/74), DOWALD(3/77), H.I.G.(10/78)
COMENT:

28 ID#=6-5339-04 TYP=WELL COU=MAUI LOC=KANAHA-2 LAT,LON= 205341. 1563923.00 DAT=1978.

ELE=	654.00	WAD=	3.20	WED=	749.00	FLO=		SPC=	150.00	PH =	8.00	EH =		TEM=	20.30
LI =		F =	0.10	B =		ALK=	56.00	HAR=	51.00	HG =		SE =		SIO=	50.00
NA =	188.00	CL =	403.00	BA =		CAR=		N =	0.33	CD =		ZN =		SO4=	56.00
K =	5.80	BR =		SR =		CO2=	1.10	NO2=		PB =		SB =		H2S=	
CA =	57.00	I =		FE =	80.00	HCO=	68.00	NO3=		TH =	0.00	CU =		O2 =	
MG =	37.00	PO4=	0.34	MN =		CO3=		NH4=		AS =		CR =		P =	0.08
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	123.00

SOURCE=USGS(2/74), DOWALD(3/77), H.I.G.(10/78)
COMENT:

29 ID#=6-5340-01 TYP=TUNNEL COU=MAUI LOC=PIONR-L WAHIKULI-1 LAT,LON= 205324. 1564057.00 DAT=1978.

ELE=	26.00	WAD=	1.50	WED=	27.00	FLO=		SPC=		PH =	7.40	EH =		TEM=	25.22
LI =		F =		B =	0.10	ALK=	123.00	HAR=	430.00	HG =		SE =		SIO=	51.40
NA =	413.00	CL =	1180.00	BA =		CAR=		N =		CD =		ZN =		SO4=	240.00
K =	13.40	BR =	5.00	SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	166.00	I =	0.02	FE =		HCO=	150.00	NO3=	14.00	TH =	0.00	CU =		O2 =	
MG =	174.00	PO4=	0.20	MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	900.00

SOURCE=U.H., DOWALD(3/77), H.I.G.(10/78)
COMENT:

30 ID#=6-5340-02 TYP=TUNNEL COU=MAUI LOC=KAHOMA SHAFT 5 "M" LAT,LON= 205343. 1564011.00 DAT=1978.

ELE=	322.00	WAD=	2.20	WED=	323.00	FLO=		SPC=	3400.00	PH =	7.40	EH =		TEM=	23.65
LI =		F =	0.05	B =	5.40	ALK=	75.00	HAR=	147.00	HG =		SE =		SIO=	57.30
NA =	536.00	CL =	1070.00	BA =		CAR=		N =		CD =		ZN =		SO4=	157.00
K =	19.20	BR =	2.00	SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	93.00	I =	0.03	FE =		HCO=	91.00	NO3=	3.10	TH =	0.00	CU =		O2 =	
MG =	102.00	PO4=	0.30	MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	630.00

SOURCE=USGS(3/72,8/78), DOWALD(3/77), H.I.G.(10/78)
COMENT:

31 ID#=6-5419-01 TYP=WELL COU=MAUI LOC=ABOVE HAIKU LAT,LON= 205412. 1561938.00 DAT=1979.

ELE=		WAD=		WED=		FLO=		SPC=		PH =		EH =		TEM=	22.00
LI =	0.00	F =	0.18	B =		ALK=		HAR=		HG =		SE =		SIO=	
NA =	30.00	CL =	26.30	BA =		CAR=		N =		CD =		ZN =		SO4=	14.40
K =	2.40	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	6.50	I =		FE =		HCO=		NO3=		TH =		CU =		O2 =	
MG =	6.60	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	

SOURCE=H.I.GG.(8/79), DOWALD('79)
COMENT:

32 ID#=6-5420-01 TYP=WELL COU=MAUI LOC=MAUI HIGH (HAIKU) LAT,LON= 205458. 1562054.00 DAT=1979.

ELE=	349.00	WAD=	4.00	WED=	371.00	FLO=		SPC=		PH =	6.90	EH =		TEM=	19.00
LI =		F =	0.90	B =	0.00	ALK=	77.00	HAR=	32.00	HG =		SE =		SIO=	53.30
NA =	73.00	CL =	44.30	BA =	0.10	CAR=		N =		CD =		ZN =	0.03	SO4=	51.40
K =	3.80	BR =		SR =		CO2=		NO2=	0.01	PB =	0.01	SB =		H2S=	
CA =	4.00	I =		FE =	0.15	HCO=	79.00	NO3=	3.50	TH =		CU =	0.02	O2 =	
MG =	3.26	PO4=		MN =	0.03	CO3=		NH4=		AS =	0.01	CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	323.00

SOURCE=USGS, DOH(5/75), H.I.G.(8/79)
COMENT:

33 ID#=6-5422-01 TYP=TUNNEL COU=MAUI LOC=PAIA MILL, P 13-A LAT,LON= 205433. 1562238.00 DAT=1979.

ELE=	155.00	WAD=	5.20	WED=	150.00	FLO=		SPC=		PH =		EH =		TEM=	22.50
LI =	0.00	F =	0.40	B =		ALK=		HAR=		HG =		SE =		SIO=	
NA =	174.00	CL =	531.00	BA =		CAR=		N =		CD =		ZN =		SO4=	91.50
K =	14.60	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	38.00	I =		FE =		HCO=		NO3=		TH =		CU =		O2 =	
MG =	53.00	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	

SOURCE=DOWALD(3/77), H.I.G.(8/79)
COMENT:

34 ID#=6-5422-02 TYP=TUNNEL COU=MAUI LOC=PAIA PUMP 17 LAT,LON= 205414. 1562209.00 DAT=1979.

ELE=	295.00	WAD=	4.00	WED=		FLO=		SPC=		PH =		EH =		TEM=	21.20
LI =	0.00	F =	0.60	B =		ALK=		HAR=		HG =		SE =		SIO=	
NA =	175.00	CL =	316.00	BA =		CAR=		N =		CD =		ZN =		SO4=	70.00
K =	11.00	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	25.50	I =		FE =		HCO=		NO3=		TH =		CU =		O2 =	
MG =	33.30	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	

SOURCE=DOWALD(3/77), H.I.G.(8/79)
COMENT:

35 ID#=6-5423-01 TYP=WELL COU=MAUI LOC=KAILUA GULCH LAT,LON= 205444. 1562339.00 DAT=1979.

ELE=	18.00	WAD=	4.00	WED=		FLO=		SPC=		PH =		EH =		TEM=	23.20
LI =	0.00	F =	0.30	B =		ALK=		HAR=		HG =		SE =		SIO=	99.00
NA =	360.00	CL =	706.00	BA =		CAR=		N =		CD =		ZN =		SO4=	120.00
K =	23.00	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	42.60	I =		FE =		HCO=		NO3=		TH =		CU =		O2 =	
MG =	56.40	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	

SOURCE=DOWALD(3/77), H.I.G.(8/79)
COMENT:OPEN PIT

36 ID#=6-5423-02 TYP=TUNNEL COU=MAUI LOC=LOWER PAIA, P 16-D LAT,LON= 205449. 1562310.00 DAT=1979.

ELE=	25.00	WAD=		WED=		FLO=		SPC=		PH =	7.20	EH =		TEM=	23.50
LI =	350.00	F =	0.05	B =	0.30	ALK=	115.00	HAR=	205.00	HG =		SE =		SIO=	102.00
NA =	840.00	CL =	1572.00	BA =		CAR=		N =		CD =		ZN =		SO4=	220.00
K =	40.00	BR =	1.50	SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	73.20	I =	0.03	FE =		HCO=	178.00	NO3=	12.00	TH =		CU =		O2 =	
MG =	123.00	PO4=	0.40	MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	780.00

SOURCE=U.H.('79), DOWALD(3/77), H.I.G.(8/79)
COMENT:

37 ID#=6-5430-01 TYP=WELL COU=MAUI LOC=WAIEHU HTS PUMP-1 LAT,LON= 205430. 1563044.00 DAT=1978.

ELE=	337.00	WAD=	18.00	WED=	675.00	FLO=		SPC=	405.00	PH =		EH =		TEM=	23.55
LI =		F =	0.15	B =		ALK=	31.00	HAR=	90.00	HG =		SE =		SIO=	62.00
NA =	44.00	CL =	45.00	BA =		CAR=		N =	3.20	CD =		ZN =		SO4=	152.00
K =	2.40	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	12.30	I =		FE =	20.00	HCO=	99.00	NO3=		TH =	0.00	CU =		O2 =	
MG =	7.20	PO4=	0.40	MN =		CO3=		NH4=		AS =		CR =		P =	0.13
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	272.00

SOURCE=USGS(4/75), DOWALD(3/77), H.I.G.(10/78)
COMENT:

38 ID#=6-5430-02 TYP=WELL COU=MAUI LOC=WAIEHU HTS PUMP-2 LAT,LON= 205432. 1563044.00 DAT=1978.

ELE=	337.00	WAD=	18.00	WED=	543.00	FLO=		SPC=		PH =		EH =		TEM=	23.92
LI =		F =	0.35	B =		ALK=		HAR=		HG =		SE =		SIO=	75.40
NA =	37.00	CL =	13.00	BA =		CAR=		N =		CD =		ZN =		SO4=	3.00
K =	1.90	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	8.60	I =		FE =		HCO=		NO3=		TH =	0.00	CU =		O2 =	
MG =	5.36	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	

SOURCE=DOWALD(3/77), H.I.G.(10/78)
COMENT:

39 ID#=6-5519-01 TYP=WELL COU=MAUI LOC=PAUWELA, HAIKU SCH LAT,LON= 205552. 1561931.00 DAT=1979.

ELE=	365.00	WAD=	5.30	WED=	400.00	FLO=		SPC=		PH =		EH =		TEM=	19.10
LI =		F =	0.05	B =		ALK=		HAR=		HG =		SE =		SIO=	
NA =	57.00	CL =	130.00	BA =		CAR=		N =		CD =		ZN =		SO4=	12.20
K =	4.70	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	15.00	I =		FE =		HCO=		NO3=		TH =		CU =		O2 =	
MG =	14.60	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	

SOURCE=DOWALD(3/77), H.I.G.(8/79)
COMENT:

40 ID#=6-5519-02 TYP=WELL COU=MAUI LOC=HAIKU (DR BEHNKE) LAT,LON= 205550. 1561958.00 DAT=1979.

ELE=	360.00	WAD=	210.00	WED=	228.00	FLO=		SPC=		PH =		EH =		TEM=	23.50
LI =		F =	1.30	B =		ALK=	67.00	HAR=	40.00	HG =		SE =		SIO=	40.80
NA =	4.30	CL =	18.10	BA =	0.10	CAR=		N =		CD =		ZN =	0.56	SO4=	23.20
K =	2.30	BR =		SR =		CO2=		NO2=		PB =	0.01	SB =		H2S=	
CA =	1.50	I =		FE =	1.58	HCO=		NO3=	1.20	TH =		CU =	0.02	O2 =	
MG =	0.84	PO4=		MN =		CO3=		NH4=		AS =	0.01	CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	140.00

SOURCE=DOH(7/74), H.I.G.(8/79)
COMENT:

41 ID#=6-5520-01 TYP=TUNNEL COU=MAUI LOC=MALIKO PUMP 11 LAT,LON= 205554. 1582018.00 DAT=1979.

ELE=	30.00	WAD=		WED=		FLO=		SPC=		PH =		EH =		TEM=	20.50
LI =	0.00	F =	0.10	B =		ALK=		HAR=		HG =		SE =		SIO=	
NA =	475.00	CL =	887.00	BA =		CAR=		N =		CD =		ZN =		SO4=	156.00
K =	23.00	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	39.60	I =		FE =		HCO=		NO3=		TH =		CU =		O2 =	
MG =	64.50	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	

SOURCE=DOWALD(3/77), H.I.G.(8/79)
COMENT:WATER COMES FROM TUNNEL TO A HOLDING PIT EXPOSED TO THE SUN AND RAIN

42 ID#=6-5522-01 TYP=TUNNEL COU=MAUI LOC=KUAU PUMP 12 LAT,LON= 205511. 1562221.00 DAT=1979.

ELE=	156.00	WAD=	4.00	WED=		FLO=		SPC=	1260.00	PH =	6.90	EH =		TEM=	21.30
LI =		F =	0.34	B =	0.10	ALK=	103.00	HAR=	110.00	HG =		SE =		SIO=	52.00
NA =	203.00	CL =	295.00	BA =		CAR=		N =	3.90	CD =		ZN =		SO4=	68.00
K =	8.60	BR =	2.80	SR =		CO2=	25.00	NO2=		PB =		SB =		H2S=	
CA =	14.50	I =	0.02	FE =	230.00	HCO=	125.00	NO3=	15.00	TH =		CU =		O2 =	
MG =	18.00	PO4=	0.19	MN =	10.00	CO3=		NH4=		AS =		CR =		P =	0.11
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	710.00

SOURCE=USGS(12/74), DOWALD(3/77), H.I.G.(8/79)
COMENT:

43 ID#=6-5540-01 TYP=WELL COU=MAUI LOC= PUUKOLII LAT,LON= 205559. 1564028.00 DAT=1978.

ELE=	444.00	WAD=	1.40	WED=	472.00	FLO=		SPC=	1490.00	PH =	7.70	EH =		TEM=	21.79
LI =		F =	0.22	B =		ALK=	120.00	HAR=	180.00	HG =		SE =	0.01	SIO=	66.60
NA =	320.00	CL =	62.00	BA =		CAR=		N =		CD =		ZN =	0.01	SO4=	82.00
K =	15.00	BR =	582.00	SR =		CO2=		NO2=	0.01	PB =	0.01	SB =		H2S=	
CA =	36.00	I =		FE =	0.02	HCO=	146.00	NO3=	11.00	TH =	0.00	CU =	0.08	O2 =	
MG =	62.00	PO4=	0.19	MN =	0.01	CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	833.00

SOURCE=DOH(8/69), USGS(9/71), H.I.G.(10/78)
COMENT:

44 ID#=6-5615-01 TYP=WELL COU=MAUI LOC=KEALI'I PT.(STORM) LAT,LON= 205615. 1561552.00 DAT=1979.

ELE=	250.00	WAD=	110.00	WED=	208.00	FLO=		SPC=		PH =		EH =		TEM=	23.50
LI =	0.00	F =	0.20	B =		ALK=		HAR=		HG =		SE =		SIO=	
NA =	33.00	CL =	38.30	BA =		CAR=		N =		CD =		ZN =		SO4=	17.40
K =	1.15	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	4.20	I =		FE =		HCO=		NO3=		TH =		CU =		O2 =	
MG =	4.20	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	

SOURCE=H.I.G.(8/79)
COMENT:POSITION AND ELEVATION TAKEN FROM 7.5 MIN TOPO MAP, WED AND WAD GIVEN BY OWNER - PERCHED AQUIFER

45 ID#=6-5620-01 TYP=TUNNEL COU=MAUI LOC=MALIKO BAY LAT,LON= 205609. 1562031.00 DAT=1979.

ELE=	50.00	WAD=		WED=		FLO=		SPC=		PH =		EH =		TEM=	21.50
LI =		F =	1.20	B =		ALK=		HAR=		HG =		SE =		SIO=	
NA =	66.00	CL =	23.20	BA =		CAR=		N =		CD =		ZN =		SO4=	58.50
K =	2.00	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	0.53	I =		FE =		HCO=		NO3=		TH =		CU =		O2 =	
MG =	0.40	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	

SOURCE=H.I.G.(8/79)
COMENT:TUNNEL BORES INTO THE SIDE OF THE VALLEY WALL, WATER FREE-FLOWS PERCHED AQUIFER

46 ID#=6-5641-01 TYP=TUNNEL COU=MAUI LOC=KAANAPLAI PUMP-D LAT,LON= 205635. 1564131.00 DAT=1978.

ELE=	27.00	WAD=	1.50	WED=	28.00	FLO=		SPC=		PH =	7.10	EH =		TEM=	22.85
LI =		F =	0.22	B =	0.40	ALK=	141.00	HAR=	430.00	HG =		SE =		SIO=	44.00
NA =	864.00	CL =	1530.00	BA =		CAR=		N =		CD =		ZN =		SO4=	210.00
K =	30.00	BR =	9.00	SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	94.00	I =	0.04	FE =		HCO=	172.00	NO3=	13.00	TH =	0.00	CU =		O2 =	
MG =	149.00	PO4=	0.50	MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	1700.00

SOURCE=U.H.(2/70), DOWALD(3/77), H.I.G.(10/78)
COMENT:

47 ID#=6-5641-02 TYP=TUNNEL COU=MAUI LOC=HONOKOWAI PUMP-F LAT,LON= 205657. 1564106.00 DAT=1978.

ELE=	65.00	WAD=	2.00	WED=	65.00	FLO=		SPC=		PH =	7.70	EH =		TEM=	22.68
LI =		F =	0.24	B =		ALK=	97.00	HAR=	400.00	HG =		SE =		SIO=	36.00
NA =	773.00	CL =	1470.00	BA =		CAR=		N =		CD =		ZN =		SO4=	208.00
K =	30.20	BR =	8.00	SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	88.00	I =	0.04	FE =		HCO=		NO3=	4.30	TH =	0.00	CU =		O2 =	
MG =	128.00	PO4=	0.40	MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	1880.00

SOURCE=U.H.(2/70),DOWALD(3/77), H.I.G.(10/78)
COMENT:

48 ID#=6-5731-01 TYP=WELL COU=MAUI LOC=WAIHEE (E. MENDES) LAT,LON= 205734. 1563131.00 DAT=1979.

ELE=	475.00	WAD=	25.00	WED=	530.00	FLO=		SPC=		PH =		EH =		TEM=	22.80
LI =	0.00	F =	0.00	B =		ALK=		HAR=		HG =		SE =		SIO=	
NA =	31.00	CL =	25.20	BA =		CAR=		N =		CD =		ZN =		SO4=	25.00
K =	2.54	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	5.10	I =		FE =		HCO=		NO3=		TH =		CU =		O2 =	
MG =	8.90	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=		O18=		C13=		HE3=		S34=		C14=		T3 =		DIS=	

SOURCE=DOWALD(3/77), H.I.G.(8/79)
COMENT:

49 ID#=6-5840-01 TYP=WELL COU=MAUI LOC=ALAELOA LAT,LON= 205856. 1564001.00 DAT=1978.

ELE=	860.00	WAD=	2.70	WED=	274.00	FLO=		SPC=		PH =	7.24	EH =		TEM=	21.42
LI =		F =	0.15	B =		ALK=	72.00	HAR=	148.00	HG =		SE =	0.01	SIO=	8.70
NA =	177.00	CL =	291.00	BA =		CAR=		N =		CD =		ZN =	0.10	SO4=	21.00
K =	8.50	BR =		SR =		CO2=		NO2=		PB =	0.01	SB =		H2S=	
CA =	12.40	I =		FE =	0.02	HCO=	88.00	NO3=	3.80	TH =	0.00	CU =	0.10	O2 =	
MG =	29.00	PO4=		MN =	0.08	CO3=		NH4=		AS =	0.01	CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	755.00

SOURCE=DOH(7/64), DOWALD(3/77), H.I.G.(10/78)
COMENT:

MASTER FILE CONTAINS 49 RECORDS

APPENDIX III

Hawaii Groundwater Chemistry

1 ID#=8-3702-01 TYP=TUNNEL COU=HAWAII LOC= OLAA SHAFT-7 LAT,LON= 193757. 1550200.00 DAT=1978.

ELE=	220.00	WAD=	15.00	WED=	203.00	FLO=		SPC=	87.00	PH =	7.00	EH =		TEM=	19.70
LI =	0.00	F =	0.14	B =		ALK=	31.00	HAR=	26.00	HG =		SE =		SIO=	33.49
NA =	7.20	CL =	5.08	BA =		CAR=		N =		CD =		ZN =	0.00	SO4=	5.50
K =	2.10	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	6.90	I =		FE =		HCO=	38.00	NO3=		TH =	0.00	CU =		O2 =	
MG =	3.30	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	88.00

SOURCE=
COMENT:

2 ID#=8-3802-02 TYP=WELL COU=HAWAII LOC= KEAAU-2 LAT,LON= 193803. 1550202.00 DAT=1978.

ELE=	215.00	WAD=		WED=	450.00	FLO=		SPC=	78.00	PH =	7.40	EH =		TEM=	19.16
LI =		F =	0.10	B =		ALK=	37.00	HAR=	22.00	HG =		SE =		SIO=	33.49
NA =	6.80	CL =	3.63	BA =	0.10	CAR=		N =		CD =	0.01	ZN =	0.02	SO4=	10.00
K =	1.80	BR =		SR =		CO2=		NO2=	0.01	PB =	0.01	SB =		H2S=	
CA =	4.80	I =		FE =	0.08	HCO=	86.00	NO3=	0.36	TH =	0.00	CU =	0.02	O2 =	
MG =	2.50	PO4=		MN =	0.01	CO3=		NH4=		AS =	0.01	CR =	0.01	P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	80.00

SOURCE=
COMENT:

3 ID#=8-3802-03 TYP=WELL COU=HAWAII LOC= KEAAU MILL-1 LAT,LON= 193804. 1550202.00 DAT=1978.

ELE=	214.00	WAD=	13.40	WED=	379.00	FLO=		SPC=	83.00	PH =	7.80	EH =		TEM=	19.44
LI =		F =	0.10	B =		ALK=	30.00	HAR=	30.00	HG =		SE =		SIO=	27.80
NA =	6.30	CL =	2.49	BA =		CAR=		N =	0.49	CD =		ZN =		SO4=	10.00
K =	1.80	BR =		SR =		CO2=	0.90	NO2=		PB =		SB =		H2S=	
CA =	4.80	I =		FE =	10.00	HCO=	36.00	NO3=		TH =	0.00	CU =		O2 =	
MG =	2.50	PO4=	0.21	MN =		CO3=		NH4=		AS =		CR =		P =	0.07
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	85.00

SOURCE=
COMENT:

4 ID#=8-3802-04 TYP=WELL COU=HAWAII LOC= KEAAU MILL-2 LAT,LON= 193806. 1550202.00 DAT=1978.

ELE=	214.00	WAD=	12.40	WED=	371.00	FLO=		SPC=	88.00	PH =	7.40	EH =		TEM=	19.70
LI =		F =	0.10	B =		ALK=	32.00	HAR=	27.00	HG =		SE =		SIO=	36.36
NA =	6.30	CL =	3.27	BA =		CAR=		N =		CD =		ZN =		SO4=	10.00
K =	1.80	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	4.80	I =		FE =		HCO=	38.00	NO3=	1.50	TH =	0.00	CU =		O2 =	
MG =	2.50	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	82.00

SOURCE=
COMENT:

5 ID#=8-3802-05 TYP=WELL COU=HAWAII LOC= KEAAU MILL-3 LAT,LON= 193807. 1550202.00 DAT=1978.

ELE=	214.00	WAD=	12.40	WED=	375.00	FLO=		SPC=	88.00	PH =	7.40	EH =		TEM=	19.70
LI =		F =	0.10	B =		ALK=	31.00	HAR=	27.00	HG =		SE =		SIO=	33.49
NA =	7.10	CL =	3.86	BA =		CAR=		N =		CD =		ZN =		SO4=	10.00
K =	2.10	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	6.10	I =		FE =		HCO=	38.00	NO3=	1.50	TH =	0.00	CU =		O2 =	
MG =	3.20	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	81.00

SOURCE=
COMENT:

6 ID#=8-3900-01 TYP=WELL COU=HAWAII LOC= KEAAU ORCH-1 LAT,LON= 193937. 1550043.00 DAT=1978.

ELE=	92.00	WAD=	8.50	WED=	137.00	FLO=		SPC=	300.00	PH =	7.10	EH =		TEM=	18.50
LI =		F =	0.10	B =		ALK=	29.00	HAR=	51.00	HG =		SE =		SIO=	33.49
NA =	41.00	CL =	66.60	BA =		CAR=		N =	1.10	CD =		ZN =	10.00	SO4=	10.00
K =	3.50	BR =		SR =		CO2=	4.40	NO2=		PB =		SB =		H2S=	
CA =	8.10	I =		FE =	10.00	HCO=	44.00	NO3=	3.60	TH =	0.00	CU =		O2 =	
MG =	7.80	PO4=	0.21	MN =		CO3=		NH4=		AS =		CR =		P =	0.07
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	197.00

SOURCE=
COMENT:

7 ID#=8-3900-02 TYP=WELL COU=HAWAII LOC= KEAAU ORCH-2 LAT,LON= 193934. 1550045.00 DAT=1978.

ELE=	95.00	WAD=	8.10	WED=	147.00	FLO=		SPC=	380.00	PH =	6.80	EH =		TEM=	19.50
LI =		F =	0.08	B =		ALK=	36.00	HAR=	45.00	HG =		SE =		SIO=	30.49
NA =	54.00	CL =	88.40	BA =		CAR=		N =		CD =		ZN =	18.00	SO4=	10.00
K =	4.00	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	8.80	I =		FE =	40.00	HCO=	44.00	NO3=	3.60	TH =	0.00	CU =		O2 =	
MG =	9.70	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	355.00

SOURCE=
COMENT:

8 ID#=8-4003-01 TYP=WELL COU=HAWAII LOC= PANAEWA-1 LAT,LON= 194035. 1550355.00 DAT=1978.

ELE=	206.00	WAD=	13.10	WED=	306.00	FLO=		SPC=	93.00	PH =	7.50	EH =		TEM=	20.00
LI =		F =	0.11	B =		ALK=	37.00	HAR=	28.00	HG =		SE =		SIO=	36.36
NA =	5.50	CL =	3.42	BA =		CAR=		N =		CD =		ZN =		SO4=	10.00
K =	1.40	BR =		SR =		CO2=	2.30	NO2=		PB =		SB =		H2S=	
CA =	6.40	I =		FE =		HCO=	45.00	NO3=		TH =	0.00	CU =		O2 =	
MG =	2.60	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	76.00

SOURCE=
COMENT:

9 ID#=8-4003-02 TYP=WELL COU=HAWAII LOC= PANAEWA-2 LAT,LON= 194040. 1550352.00 DAT=1978.

ELE=	291.00	WAD=	13.10	WED=	302.00	FLO=		SPC=	88.00	PH =		EH =		TEM=	20.00
LI =		F =	0.22	B =		ALK=	44.00	HAR=	30.00	HG =		SE =		SIO=	36.36
NA =	5.40	CL =	2.70	BA =	0.10	CAR=		N =		CD =		ZN =	0.01	SO4=	10.00
K =	1.60	BR =		SR =		CO2=		NO2=	0.01	PB =	0.02	SB =		H2S=	
CA =	6.20	I =		FE =	0.01	HCO=		NO3=	0.24	TH =	0.00	CU =	0.02	O2 =	
MG =	2.50	PO4=		MN =	0.03	CO3=		NH4=		AS =	0.01	CR =	0.01	P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	80.00

SOURCE=
COMENT:

10 ID#=8-4203-02 TYP=WELL COU=HAWAII LOC= WAIAKEA TH 2 LAT,LON= 194223. 1550352.00 DAT=1978.

ELE=	41.00	WAD=	9.10	WED=	55.00	FLO=		SPC=		PH =	7.00	EH =		TEM=	23.00
LI =		F =		B =		ALK=	41.00	HAR=	38.00	HG =		SE =		SIO=	33.49
NA =	9.20	CL =	10.40	BA =		CAR=		N =		CD =		ZN =		SO4=	9.00
K =	1.60	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	6.60	I =		FE =		HCO=	50.00	NO3=	0.20	TH =	0.00	CU =		O2 =	
MG =	3.30	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	94.00

SOURCE=
COMENT:

11 ID#=8-4203-04 TYP=WELL COU=HAWAII LOC= WAIAKEA-4 LAT,LON= 194222. 1550351.00 DAT=1978.

ELE=	47.00	WAD=	7.10	WED=	201.00	FLO=		SPC=	94.00	PH =	7.20	EH =		TEM=	21.00
LI =		F =	0.14	B =		ALK=	38.00	HAR=	33.00	HG =		SE =		SIO=	37.64
NA =	25.00	CL =	39.80	BA =		CAR=		N =		CD =		ZN =	0.01	SO4=	2.60
K =	2.40	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	7.80	I =		FE =	0.20	HCO=	47.00	NO3=		TH =	0.00	CU =	0.10	O2 =	
MG =	5.90	PO4=		MN =	0.05	CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	107.00

SOURCE=
COMENT:

12 ID#=8-4203-05 TYP=WELL COU=HAWAII LOC= KANOELEHUA-1 LAT,LON= 194222. 1550350.00 DAT=1978.

ELE=	50.00	WAD=		WED=	200.00	FLO=		SPC=		PH =		EH =		TEM=	23.00
LI =		F =		B =		ALK=		HAR=		HG =		SE =		SIO=	38.49
NA =	17.00	CL =	27.00	BA =		CAR=		N =		CD =		ZN =		SO4=	
K =	2.20	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	7.60	I =		FE =		HCO=		NO3=		TH =	0.00	CU =		O2 =	
MG =	4.80	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	

SOURCE=
COMENT:

13 ID#=8-4203-06 TYP=WELL COU=HAWAII LOC= KANOELEHUA-2 LAT,LON= 194223. 1550349.00 DAT=1978.

ELE=	50.00	WAD=	6.50	WED=	200.00	FLO=		SPC=	130.00	PH =	6.20	EH =		TEM=	21.00
LI =		F =		B =		ALK=	32.00	HAR=	42.00	HG =		SE =	0.01	SIO=	38.49
NA =	17.00	CL =	28.00	BA =		CAR=		N =	0.01	CD =		ZN =	0.01	SO4=	5.00
K =	2.20	BR =		SR =		CO2=	39.00	NO2=		PB =	0.01	SB =		H2S=	
CA =	7.80	I =		FE =	20.00	HCO=	39.00	NO3=	0.80	TH =	0.00	CU =	0.10	O2 =	
MG =	5.00	PO4=	0.18	MN =		CO3=		NH4=		AS =	0.01	CR =		P =	0.06
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	109.00

SOURCE=
COMENT:

14 ID#=8-4203-07 TYP=WELL COU=HAWAII LOC= KANOELEHUA-3 LAT,LON= 194224. 1550350.00 DAT=1978.

ELE=	50.00	WAD=		WED=	200.00	FLO=		SPC=	94.00	PH =	7.20	EH =		TEM=	23.00
LI =		F =	0.10	B =		ALK=	39.00	HAR=	33.00	HG =		SE =		SIO=	36.36
NA =	15.00	CL =	24.50	BA =		CAR=		N =		CD =		ZN =		SO4=	2.60
K =	2.10	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	7.60	I =		FE =		HCO=	47.00	NO3=		TH =	0.00	CU =		O2 =	
MG =	4.60	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	107.00

SOURCE=
COMENT:

15 ID#=8-4203-10 TYP=WELL COU=HAWAII LOC= HELCO KAN6-2 LAT,LON= 194222. 1550347.00 DAT=1978.

ELE=	55.00	WAD=	6.00	WED=	210.00	FLO=		SPC=		PH =		EH =		TEM=	20.00
LI =		F =		B =		ALK=		HAR=		HG =		SE =		SIO=	37.49
NA =	22.00	CL =	38.00	BA =		CAR=		N =		CD =		ZN =		SO4=	10.00
K =	2.30	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	8.50	I =		FE =		HCO=		NO3=		TH =	0.00	CU =		O2 =	
MG =	5.80	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	

SOURCE=
COMENT:

16 ID#=8-4203-99 TYP= COU=HAWAII LOC= LAT,LON=********** DAT=1978.

ELE=		WAD=		WED=		FLO=		SPC=		PH =		EH =		TEM=	21.00
LI =		F =	0.02	B =		ALK=	0.00	HAR=		HG =		SE =		SIO=	36.36
NA =	7.90	CL =	9.18	BA =		CAR=		N =		CD =		ZN =		SO4=	10.00
K =	1.80	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	6.80	I =		FE =		HCO=		NO3=		TH =	0.00	CU =		O2 =	
MG =	3.10	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	

SOURCE=
COMENT:

17 ID#=8-4306-01 TYP=WELL COU=HAWAII LOC= PIIHONUA LAT,LON= 194318. 1550618.00 DAT=1978.

ELE=	278.00	WAD=	42.00	WED=	425.00	FLO=		SPC=	93.00	PH =	8.00	EH =		TEM=	17.80
LI =		F =	0.20	B =		ALK=	38.00	HAR=	26.00	HG =		SE =		SIO=	40.64
NA =	8.40	CL =	1.44	BA =		CAR=		N =		CD =		ZN =		SO4=	10.00
K =	2.20	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	5.00	I =		FE =		HCO=	46.00	NO3=	0.30	TH =	0.00	CU =		O2 =	
MG =	3.40	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	83.00

SOURCE=
COMENT:

18 ID#=8-4706-01 TYP=WELL COU=HAWAII LOC= PAPAIKOU LAT,LON= 194715. 1550613.00 DAT=1978.

ELE=	369.00	WAD=	21.00	WED=	425.00	FLO=		SPC=	119.00	PH =	7.30	EH =		TEM=	20.00
LI =		F =	0.26	B =		ALK=	62.00	HAR=	42.00	HG =		SE =		SIO=	34.22
NA =	6.90	CL =	2.10	BA =	0.10	CAR=		N =		CD =		ZN =	0.12	SO4=	10.00
K =	1.40	BR =		SR =		CO2=		NO2=	0.01	PB =	0.01	SB =		H2S=	
CA =	9.50	I =		FE =	0.01	HCO=	66.00	NO3=	0.22	TH =	0.00	CU =	0.01	O2 =	
MG =	5.00	PO4=		MN =	0.01	CO3=		NH4=		AS =	0.01	CR =	0.01	P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	76.00

SOURCE=
COMENT:

19 ID#=8-5003-01 TYP=WELL COU=HAWAII LOC= PEPEEKEO SUG LAT,LON= 195034. 1550545.00 DAT=1978.

ELE=	304.00	WAD=	11.40	WED=	333.00	FLO=		SPC=	162.00	PH =	7.20	EH =		TEM=	21.00
LI =		F =	0.10	B =		ALK=	61.00	HAR=	72.00	HG =		SE =	0.01	SIO=	32.08
NA =	9.30	CL =	9.90	BA =	0.10	CAR=		N =		CD =		ZN =	14.00	SO4=	10.00
K =	1.00	BR =		SR =		CO2=		NO2=	0.01	PB =	0.01	SB =		H2S=	
CA =	11.70	I =		FE =	0.23	HCO=	74.00	NO3=	0.50	TH =	0.00	CU =	0.02	O2 =	
MG =	9.10	PO4=		MN =	0.05	CO3=		NH4=		AS =		CR =	0.05	P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	141.00

SOURCE=
COMENT:

20 ID#=8-5005-04 TYP=WELL COU=HAWAII LOC= MAKAI-2 LAT,LON= 195050. 1550516.00 DAT=1978.

ELE=	74.00	WAD=	6.80	WED=	375.00	FLO=		SPC=		PH =		EH =		TEM=	20.00
LI =		F =		B =		ALK=		HAR=		HG =		SE =		SIO=	
NA =		CL =	5720.00	BA =		CAR=		N =		CD =		ZN =		SO4=	
K =		BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =		I =		FE =		HCO=		NO3=		TH =	0.00	CU =		O2 =	
MG =		PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	

SOURCE=
COMENT:

21 ID#=8-5548-01 TYP=WELL COU=HAWAII LOC= PARKER-1 LAT,LON= 195546. 1554802.00 DAT=1978.

ELE=	814.00	WAD=	6.10	WED=	849.00	FLO=		SPC=	2000.00	PH =	7.50	EH =		TEM=	23.00
LI =		F =	0.52	B =		ALK=	110.00	HAR=	270.00	HG =		SE =		SIO=	68.44
NA =	334.00	CL =	545.00	BA =		CAR=		N =		CD =		ZN =		SO4=	93.00
K =	23.80	BR =		SR =		CO2=	7.10	NO2=		PB =		SB =		H2S=	
CA =	30.00	I =		FE =	20.00	HCO=	140.00	NO3=	3.10	TH =	0.00	CU =		O2 =	
MG =	49.00	PO4=		MN =	10.00	CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	1180.00

SOURCE=
COMENT:

22 ID#=8-5745-01 TYP=WELL COU=HAWAII LOC= PARKER-5 LAT,LON= 195725. 1554553.00 DAT=1978.

ELE=	1213.00	WAD=	16.00	WED=	1236.00	FLO=		SPC=	280.00	PH =	2.00	EH =		TEM=	26.00
LI =		F =	0.33	B =		ALK=	88.00	HAR=	76.00	HG =		SE =		SIO=	70.58
NA =	33.00	CL =	23.00	BA =	0.10	CAR=		N =	3.80	CD =		ZN =	0.12	SO4=	21.00
K =	4.20	BR =		SR =		CO2=	5.20	NO2=	0.01	PB =	0.01	SB =		H2S=	
CA =	7.80	I =		FE =	0.27	HCO=	102.00	NO3=	0.94	TH =	0.00	CU =	0.05	O2 =	
MG =	10.50	PO4=		MN =	0.01	CO3=		NH4=		AS =	0.01	CR =	0.01	P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	210.00

SOURCE=
COMENT:

23 ID#=8-5745-02 TYP=WELL COU=HAWAII LOC= PARKER-4 LAT,LON= 195722. 1554551.00 DAT=1978.

ELE=	1203.00	WAD=	16.00	WED=	1231.00	FLO=		SPC=	280.00	PH =	2.00	EH =		TEM=	26.50
LI =		F =	0.31	B =		ALK=	82.00	HAR=	63.00	HG =		SE =		SIO=	70.58
NA =	35.00	CL =	28.00	BA =		CAR=		N =		CD =		ZN =	15.00	SO4=	28.00
K =	4.40	BR =		SR =		CO2=	6.40	NO2=		PB =		SB =		H2S=	
CA =	8.30	I =		FE =	20.00	HCO=	100.00	NO3=		TH =	0.00	CU =		O2 =	
MG =	10.40	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	207.00

SOURCE=
COMENT:

24 ID#=8-5948-01 TYP=WELL COU=HAWAII LOC= HAPUNA BCH P LAT,LON= 195947. 1554858.00 DAT=1978.

ELE=	244.00	WAD=		WED=	278.00	FLO=		SPC=	1600.00	PH =	7.30	EH =		TEM=	25.00
LI =		F =	0.28	B =		ALK=	78.00	HAR=	202.00	HG =		SE =		SIO=	68.44
NA =	250.00	CL =	436.00	BA =		CAR=		N =		CD =		ZN =		SO4=	68.00
K =	16.40	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	24.00	I =		FE =	78.00	HCO=	95.00	NO3=	5.30	TH =	0.00	CU =		O2 =	
MG =	42.00	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	922.00

SOURCE=
COMENT:

25 ID#=8-6048-02 TYP=WELL COU=HAWAII LOC= M KEA BCH HT LAT,LON= 200010. 1554855.00 DAT=1978.

ELE=	340.00	WAD=	4.50	WED=	376.00	FLO=		SPC=	1500.00	PH =	7.60	EH =		TEM=	26.00
LI =		F =	0.28	B =		ALK=	77.00	HAR=	193.00	HG =		SE =		SIO=	70.58
NA =	237.00	CL =	394.00	BA =		CAR=		N =		CD =		ZN =	36.00	SO4=	256.00
K =	15.50	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	24.00	I =		FE =	0.25	HCO=	94.00	NO3=	3.20	TH =	0.00	CU =		O2 =	
MG =	40.00	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	838.00

SOURCE=
COMENT:

26 ID#=8-6049-01 TYP=WELL COU=HAWAII LOC= M KEA BCH HT LAT,LON= 200015. 1554920.00 DAT=1978.

ELE=	188.00	WAD=	2.00	WED=	218.00	FLO=		SPC=	1520.00	PH =	8.10	EH =		TEM=	25.00
LI =	0.00	F =	0.28	B =		ALK=	78.00	HAR=	193.00	HG =		SE =		SIO=	66.30
NA =	230.00	CL =	406.00	BA =		CAR=		N =		CD =		ZN =		SO4=	74.00
K =	15.00	BR =		SR =		CO2=		NO2=		PB =		SB =		H2S=	
CA =	24.00	I =		FE =		HCO=	95.00	NO3=	1.90	TH =	0.00	CU =		O2 =	
MG =	40.00	PO4=		MN =		CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	838.00

SOURCE=
COMENT:

27 ID#=8-6147-01 TYP=WELL COU=HAWAII LOC= KAWAIHAE-3 LAT,LON= 200132. 1554711.00 DAT=1978.

ELE=	982.00	WAD=	4.60	WED=	1046.00	FLO=		SPC=	1070.00	PH =	7.10	EH =		TEM=	31.00
LI =		F =	0.18	B =		ALK=	81.00	HAR=	331.00	HG =		SE =	0.01	SIO=	51.33
NA =	100.00	CL =	171.00	BA =		CAR=	14.00	N =		CD =		ZN =	0.11	SO4=	9.00
K =	12.80	BR =		SR =		CO2=		NO2=		PB =	0.01	SB =		H2S=	
CA =	23.00	I =		FE =	7.20	HCO=	105.00	NO3=	3.60	TH =	0.00	CU =	0.10	O2 =	
MG =	8.50	PO4=		MN =	12.00	CO3=		NH4=		AS =	0.01	CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	728.00

SOURCE=
COMENT:

28 ID#=8-6148-01 TYP=WELL COU=HAWAII LOC= KAWAIHAE-1 LAT,LON= 200122. 1554809.00 DAT=1978.

ELE=	579.00	WAD=	3.30	WED=	620.00	FLO=		SPC=	1350.00	PH =	7.80	EH =		TEM=	27.00
LI =		F =	0.20	B =		ALK=	66.00	HAR=	192.00	HG =		SE =		SIO=	74.86
NA =	210.00	CL =	352.00	BA =	0.30	CAR=		N =		CD =		ZN =	68.00	SO4=	118.00
K =	16.30	BR =		SR =		CO2=		NO2=	0.01	PB =	0.16	SB =		H2S=	
CA =	28.00	I =		FE =	0.29	HCO=	82.00	NO3=	3.80	TH =	0.00	CU =	0.03	O2 =	
MG =	36.00	PO4=		MN =	0.05	CO3=		NH4=		AS =	0.05	CR =	0.01	P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	741.00

SOURCE=
COMENT:

29 ID#=8-6148-02 TYP=WELL COU=HAWAII LOC= KAWAIHAE-4 LAT,LON= 200121. 1554808.00 DAT=1978.

ELE=	582.00	WAD=	7.60	WED=	626.00	FLO=		SPC=	1400.00	PH =	7.40	EH =		TEM=	26.40
LI =		F =	0.33	B =		ALK=	69.30	HAR=	172.00	HG =		SE =	0.01	SIO=	76.99
NA =	204.00	CL =	370.00	BA =		CAR=		N =		CD =		ZN =	90.00	SO4=	63.00
K =	17.30	BR =		SR =		CO2=		NO2=	0.01	PB =	0.01	SB =		H2S=	
CA =	30.00	I =		FE =	23.00	HCO=		NO3=	0.18	TH =	0.00	CU =	0.02	O2 =	
MG =	38.00	PO4=		MN =	0.01	CO3=		NH4=		AS =		CR =		P =	
H/D=	0.00	O18=	0.00	C13=	0.00	HE3=	0.00	S34=	0.00	C14=	0.00	T3 =	0.00	DIS=	

SOURCE=
COMENT:

ASTER FILE CONTAINS 29 RECORDS