

As. Willard

Geothermal Association
Hawaii Institute of Geophysics
MAR 18 1975

University of Hawaii at Manoa

Hawaii Geothermal Project

MEMORANDUM

March 17, 1975

TO: HGP Executive Committee

SUBJECT: Response to ERDA's Concerns on the HGP Proposal

Attached is the response that was sent to Paul Kruger today, justifying selection of the proposed drilling site and requesting early approval of our proposal.

During our recent telephone conversation, Paul had requested that I outline future plans for geothermal development in view of apparent availability of private capital. I would have preferred not to have added this additional factor for his consideration until after the initial research hole had been funded, but felt compelled to present some alternatives in response to his direct inquiry.



John W. Shupe
Director

JWS:ds

Attachment



University of Hawaii at Manoa

Hawaii Geothermal Project
Holmes Hall 240 • 2540 Dole Street
Honolulu, Hawaii 96822

March 17, 1975

Dr. Paul Kruger
Division of Geothermal Energy Research
Energy Research and Development Administration
Washington, D.C. 20545

Ref: 75-G-18

Dear Paul:

Attached are copies of:

1. A summary statement by Dr. Furumoto, listing preliminary results of geophysical surveys completed since the submission of our proposal.
2. A letter from Dr. Abbott documenting the background for the unanimous favorable decision of the Site Selection Committee on the proposed drilling site.

These two statements are intended to respond to the concerns expressed in your letter to me of February 13, 1975; and I will not endeavor to amplify on the geophysical-geological-geoscientific interpretations. There is unanimous agreement on the location of the proposed drilling site -- if not on what will be encountered at various depths. It is the strong consensus of the HGP Executive Committee that the time has arrived to drill a deep research hole at the most likely site, in an effort to resolve some of the apparent ambiguities obtained for this complex geophysical system -- as well as to identify a thermal high.

The fact that private capital for geothermal development is now beginning to surface in Hawaii, reinforces the need for a deep research hole that is well instrumented and which will provide experimental data to assist in the interpretation of geophysical results for subsequent exploration. The \$580,000 requested for drilling in our proposal to ERDA will not be sufficient to extend the research hole to a full 6000-foot depth but, because of the importance of this first exploratory hole, the HGP will endeavor to obtain additional drilling support from: 1) The State of Hawaii, through the \$500,000 allocated by the 1974 Legislature in the Capital Improvements Budget for exploratory geothermal drilling; 2) Private sources -- most likely GEDCO, the Geothermal Exploration and Development Corporation of Honolulu; and 3) The FY 76 ERDA budget.

GEDCO, which is an instrument of George Keller and the Craddick brothers, has opened negotiations with the State Department of Land and Natural Resources (DLNR) on a geothermal exploration program. Apparently there are some legal restraints on immediate geothermal development, and DLNR has brought Dave Anderson to Hawaii for this entire week to consult and advise on regulatory policy which will lead to the optimum development of geothermal power in Hawaii. Bob Kamins and I met this morning with Dave and with representatives of DLNR and DPED (Department of Planning and Economic Development) to outline some alternatives and considerations that will become better defined as the week progresses.

As you and I discussed in our telephone conversation last week, recent trends in Federal funding raise the question as to whether a university based program is the proper vehicle for administering geothermal development through to the proof of concept stage. Although the HGP will continue to provide the major research input for geothermal development in Hawaii, a study has been initiated on the feasibility of establishing an expanded administrative entity to fulfill the developmental role. Such a consortium might include the University, appropriate agencies from the State and the County of Hawaii, and possibly private interests.

In any case, it is essential to get the first research hole underway as soon as possible to obtain the necessary scientific information and to generate the momentum for a major geothermal exploratory and development program. I would strongly urge ERDA's favorable and rapid response to our current proposal. If, for any reason, there should be additional delay in funding the drilling portion of the proposal, we would respectfully request that an evaluation be made on the remaining research programs, so that we can retain continuity of effort and staffing for the project.

During our telephone discussion you mentioned that you may be on the West Coast in late March. I would also strongly urge you to come to Hawaii at that time to evaluate the current situation and to assist us in planning for Hawaii's geothermal future. We hope to see you then.

Sincerely yours,



John W. Shupe
Director

JWS:ds

cc: HGP Executive Committee
Hideto Kono, Director DPED
Chris Cobb, Director DLNR

Thermal Process of the East Rift of
Kilauea from Geophysical Data

Augustine S. Furumoto

March 11, 1975

This is a short note summarizing results of geophysical surveys over the East Rift of Kilauea. Details on data and methods of analysis are being compiled for a later more comprehensive report.

From gravity data, it became apparent that the east rift of Kilauea is underlain by an intrusive zone of dense magma. The intrusive zone approximates a rectangular prism 3.2 km wide starting at a depth of 1 km below sea level and extending down vertically. It has a density contrast of 0.6 g/cm^3 . From microearthquake data it is estimated that the bottom of the intrusive zone is 10 km deep. Magnetic data indicate that part of the intrusive zone is hot enough to be above the Curie temperature. The hot part is about 2.5 km wide and occupies the northern part of the intrusive zone. We have not determined the depth to the hot part as yet.

In Figure 1 the locations of the intrusive zone and the hot part of the zone are shown. Figure 2 shows a vertical cross section of the intrusive zone.

Over the intrusive zone and around it, areas of low electrical resistivities have been found. These are shown as A, B, C, D and E in Figure 1. In the area marked A, the resistivity is as low as 5 ohm-m, compared to 20-40 ohm-m values for other places. It is surmised that the low resistivity could come from hot water convecting upward from hot rocks. However, we have detected no cap rock to detain the hot water.

In areas B and C, the low resistivity values exist at depths of 700 m. As most of B and part of C is outside of the intrusive zone, explanations of low resistivity in terms of hot water do not seem acceptable, unless, there is an impermeable layer at 700 m depth which has trapped the hot water coming off the intrusive zone.

Area D could be explained in a similar manner as Area A.

The drilling site has been proposed at A rather than at B because A is over the intrusive zone. In addition to determining existence or non-existence of a geothermal source, the objective is to find out the mechanism of heat transfer from hot rock to hot water.

Figures 3 and 4 show results of electrical surveys to show that the areas have rather low resistivities.

Data analysis and interpretation are still going on. The conclusions reported here are not to be considered definitive.

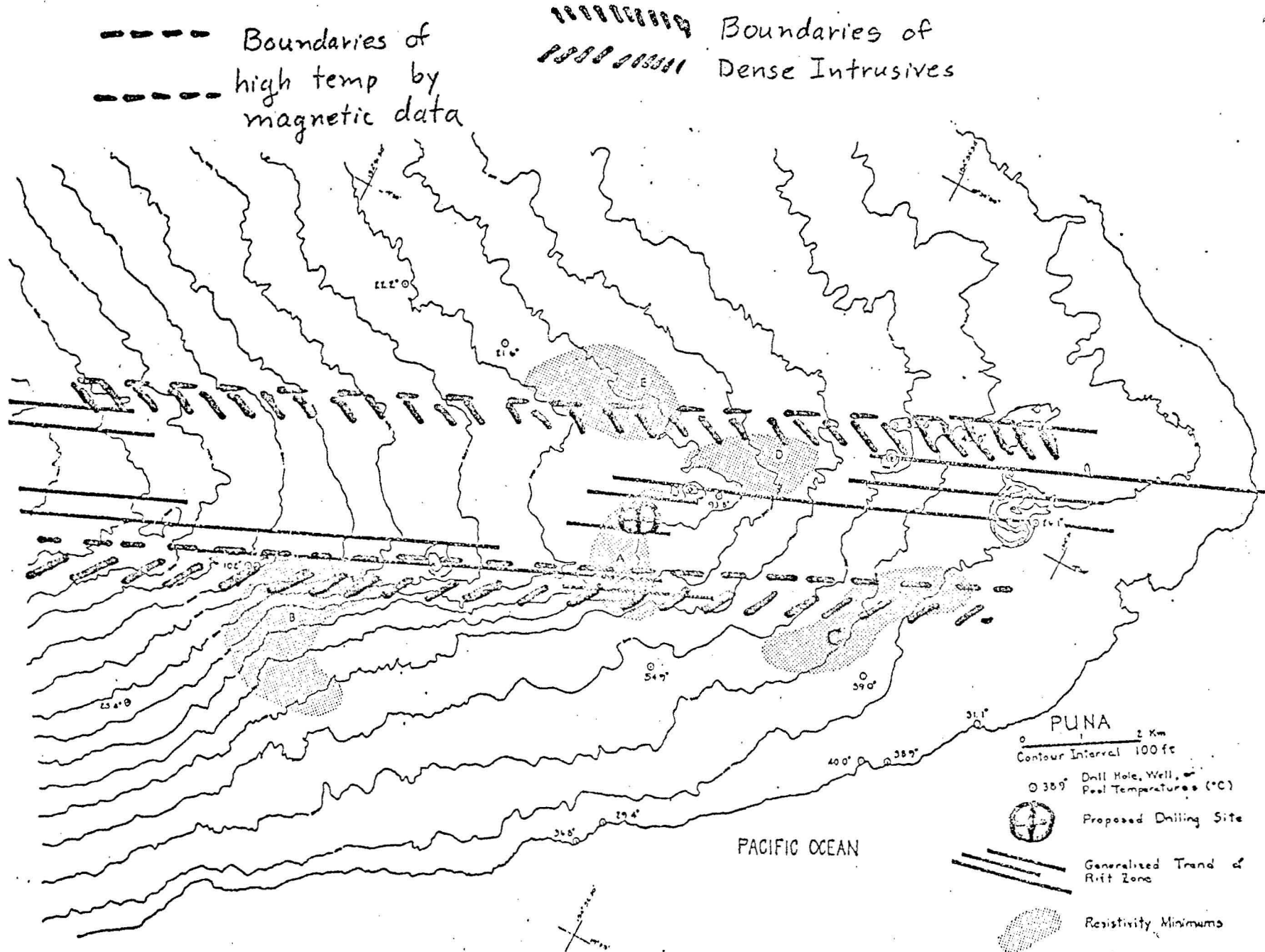


Figure 1. Contour map of the Puna area showing the generalized trend of the rift zone and temperature samplings from drill holes, wells and pools. The resistivity minimums (stippled areas lettered from A to E) are compiled from figures 2 through 5. Areas A and B are considered promising geo-thermal prospects for reasons summarized in the text.

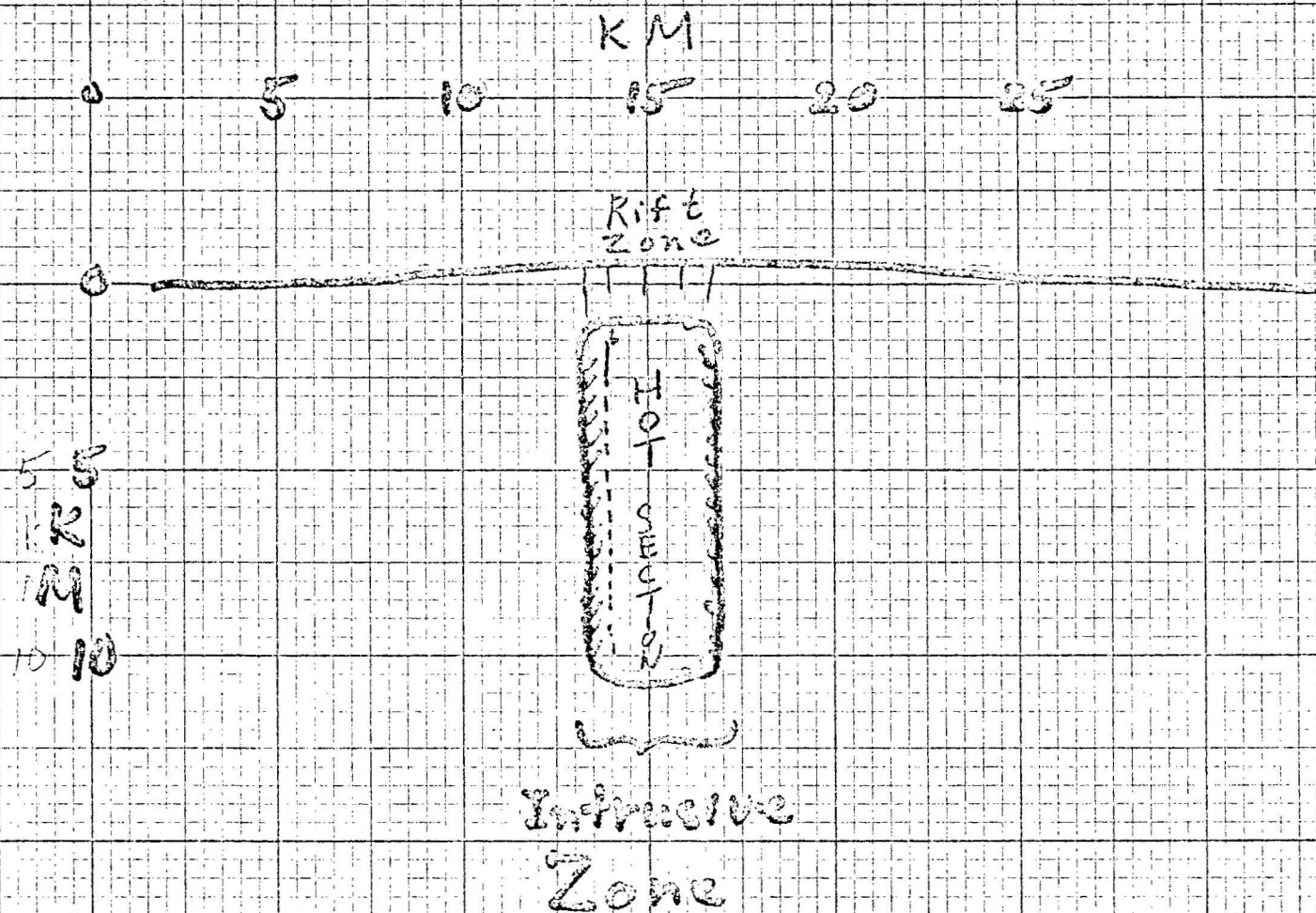


Figure 2.

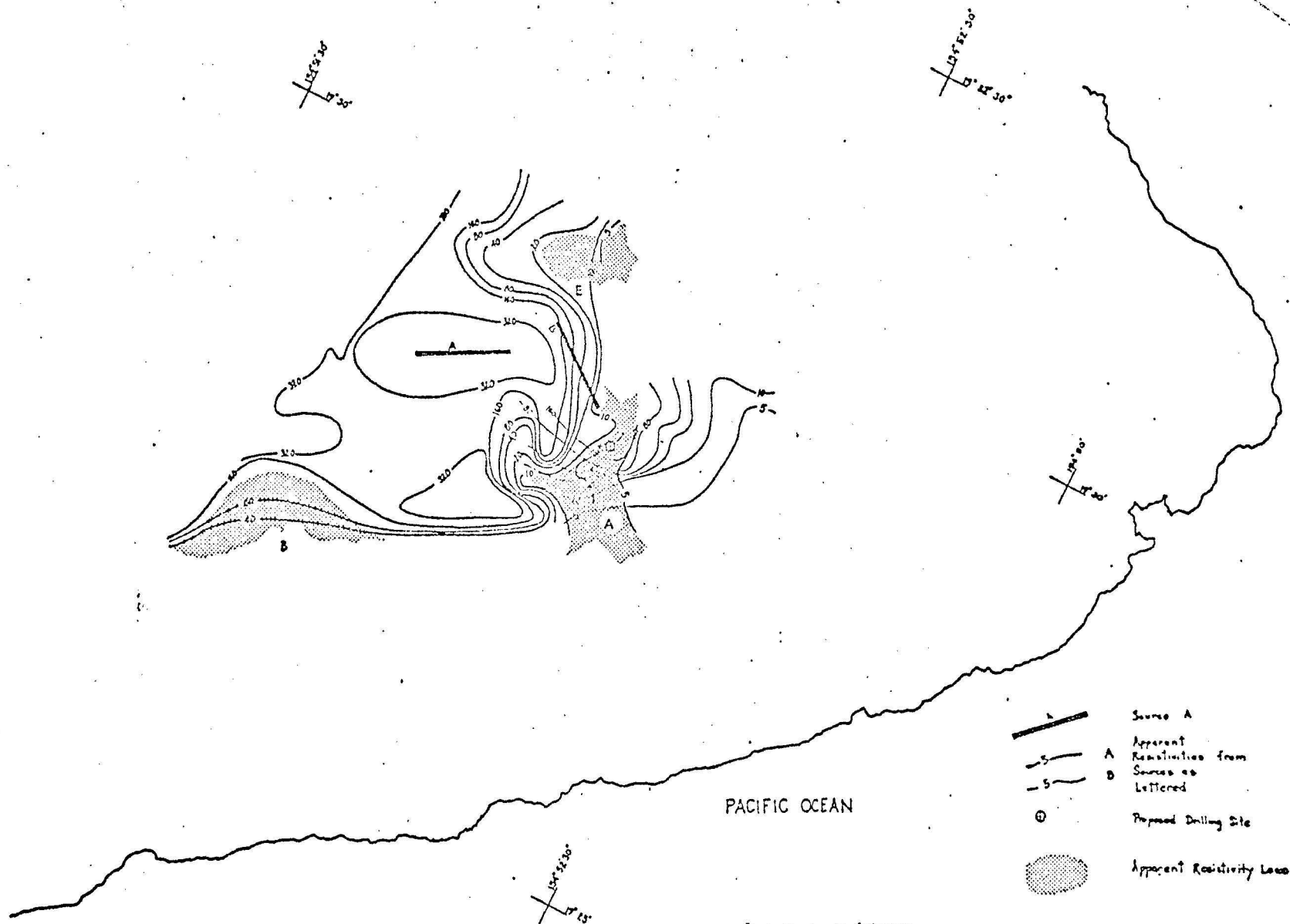


Figure 3. Compilation of apparent resistivity data in Puna from bipole-dipole galvanic mapping (data set II). The data is from a survey of the Hawaii Institute of Geophysics (H.I.G.). The scale of this figure is the same as Figure 1 and the letters show resistivity lows roughly congruent with the areas of Figure 1.

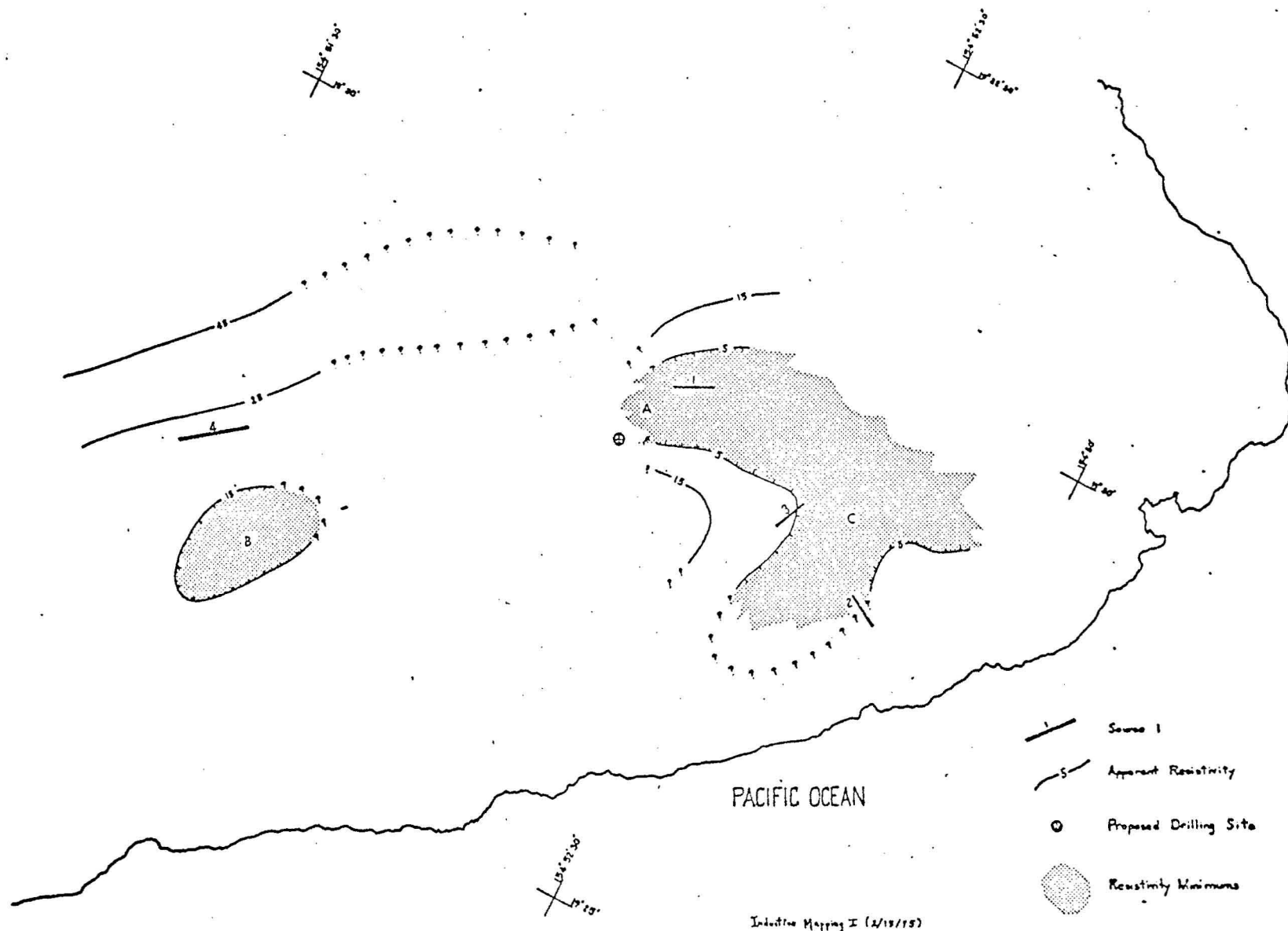


Figure 4. Apparent resistivity contours in Puna based on line-loop (time-domain) inductive sounding (data set I) obtained by H.I.G. (Klein and Kaushikaua, 1975). Contours are controlled by placing resistivity values midway between source and receiver (see text). The scale is the same as that of Figure 1 and the letters show resistivity lows roughly congruent with the areas of Figure 1.



University of Hawaii at Manoa

Department of Geology and Geophysics
2525 Correa Road • Honolulu, Hawaii 96822
Cable Address: UNIHAW

March 17, 1975

Dr. Paul Kruger
Division of Geothermal Energy Research
Energy and Research Dev. Admin.
Washington, D. C. 20545

Dear Paul:

The first purpose of this letter is to describe as accurately and briefly as possible my assessment of the situation that currently exists in the Hawaii Geothermal Project particularly in the areas of geophysical exploration and its closely allied successor, deep drilling. I will not comment at any length on the engineering or social/economic aspects.

The second purpose of this letter is to try to bridge an increasing informational gap between the time of submitting of our proposal for Phase II, effective January 1, 1975 and the present date. As the gap widens, we wish to assure you that we are still in one group and functioning. The progress of the project was brought up short by two negative reviews that were included with your letter of February 13, 1975 to John Shupe.

It is agreed that the reviewers had indeed discovered some weak spots in the proposal, but that in one or two places in the review, there was an unnecessary caustic or vindictive tone which we have endeavored to filter out in order to answer the real core of the problem.

At the time the proposal was submitted, our geophysics was admittedly incomplete. During late November, December, and January the geophysicists completed a good deal more resistivity work, magnetics and gravity and subsequently compiled the data. The reviewer's objection to our drill site selection was the fact that we based our decision in large measure on self potential results, which the reviewers went on to point out were not reliable for geothermal. We were aware of this and when the end of the year resistivity data came in, we held a special meeting of the site selection committee to review our decision. With additional data now in which was not included in the proposal, we came to the conclusions that our initial site selection was still a good one and that the resistivity and other geophysical work supported the selection of the original location.

If we used no geophysical methods at all, as of course was the situation a number of years ago in the location of the New Zealand geothermal fields, the Geysers, and Larderello, but spotted the hole based on geological conditions we would again place it in the same vicinity.

It might be useful to review the personnel of our Site Selection Committee who unanimously agreed that based on the information available to us, the initial site seemed to remain the best. It is not intended here to elaborate on reasons they favor deep drilling on the original site, but to demonstrate the strength and unanimity of opinion of men who have devoted years to the study of Hawaii's volcanoes.

Donald Peterson, Chief Scientist at the U.S. Geological Survey Volcano Observatory favors the site;

Gordon A Macdonald, Senior Professor of Geology, who probably knows the geology of the Puna area of Hawaii better than anyone else in the world favors the site;

Pow F. Fan, Professor of Geology who has run chemical and thermal tests in wells in the Puna district favors the site;

Augustine Furumoto and his principal assistant, Douglas Klein, who have conducted or supervised most of the geophysical work in the several areas in Hawaii, favor the site;

Charles Zablocki, geophysicist with the U.S. Geological Survey Volcano Observatory and who has carried out not only self potential but a whole array of geophysical studies on the island of Hawaii favors the site;

Agatin T. Abbott, professor of geology and chairman of the committee favors the site, for reasons of its geologic structural setting.

Accompanying this letter and serving a third purpose is a short note from Dr. Furumoto in which he very briefly summarizes the results of his geophysical data up to this date. A complete geophysical up-to-date report will be sent to you as soon as it is completed.

Speaking of self-potential, it is rumored, but not yet published, that self-potential when properly interpreted may be a more powerful tool in a search for thermal anomalies than has been previously recognized.

In short, we are of the opinion that we have a good site and that at that site we should drill a deep hole. We do not look for favorable thermal conditions above 6,000 feet below sea level. Gus Furumoto's sketch indicates a depth of 7,000 feet to get into hot material.

So, this part of the letter has tried to indicate to you and to others in ERDA that we think we may have a potential geothermal resource at considerable depth. We ask that consideration and understanding of the complexity of the problems be considered in evaluating the apparent lack of decisiveness and slowness in the appraisal of the results.

George Woollard has pointed out repeatedly that we are dealing with an ambiguous geophysical system and that regardless of how much more or what kind of geophysics is applied the returns are also apt to be ambiguous. An active basaltic shield volcano permeated with ocean water of varying salinities with unknown conditions of permeability and rock density at depth is not a model that will produce readily interpretable geothermal data.

The committee does not feel the angle or direction of inclination of the rift zone is crucial in this matter. Most workers here agree the structures that form the rift zone are probably steeply dipping or close to vertical.

This letter is really longer than I intended. I do not send it as a report because it purposely does not include supportive facts. I should like nevertheless to touch briefly on another aspect of our program. This is the increasing interest shown by private enterprise to drill for geothermal resources in Puna.

There are three such private concerns of which I am aware. One is GEDCO which is formed of Dr. George Keller of the Colorado School of Mines and the Craddick Brother's Drilling Company of Honolulu. The other is the Hawaii Corporation of Honolulu, and the third is identified under the names of Bolles. I do not have any information on Bolles.

It is not so much a matter of which private concern drills, or drills first, as it is their effect on our project and the resulting decisions the administrators of ERDA will make. It is our understanding that private drilling will probably not come about for some time due to restraints imposed by the State of Hawaii before such an enterprise can begin. Nevertheless, we feel the pressures of another type of development of the potential geothermal resources in Puna.

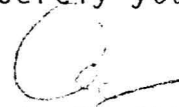
I think the emphasis on the purpose of drilling the HGP hole should now be shifted more strongly toward research, designed to gather geological and geophysical information at depth, and of course, hopefully to encounter a thermal high.

We are fairly uncertain of our deep underground interpretations and I cannot give ERDA much optimistic encouragement that we confidently expect to discover a viable source of geothermal energy. Perhaps our role should shift to one of data collection and let the private sector, if it chooses, drill for a commercial source of geothermal energy based on our results.

Dr. P. Kruger
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March 17, 1975

Thank you for considering these points. May I ask that very serious thought be given in Washington toward keeping the Hawaii Geothermal Project alive during the present period of uncertainty and consolidation, with the hope and intention of funding the project for the drilling of a deep hole in Puna as soon as it is feasible.

Sincerely yours,



Agatin T. Abbott
Professor of Geology,
Co-Principal Investigator
Hawaii Geothermal Project

ATA:cy

cc: Dr. George P. Woollard
Dr. Gordon A. Macdonald
Dr. A. S. Furumoto
Dr. J. Craven
Dr. J. Shupe
D. Klein
Dr. C. Zablocki
Dr. P. Yuen
Dr. D. Peterson
Dr. P. Fan
Dr. R. Kamins