1. Lem & Sub. agreements not made out properly per footnote 2/; as made out does not represent a legal description ~~location, etc.~~ of land.

2. Bank letters — copies of applicants' request to the banks needed.

3. Need a special ore dressing method to recover the titanium.

It appears applicant should interest clay users (pottery makers) in project if doesn't seem likely that the iron and titan + rare earths can be profitably extracted

---

4. What is the specific exploration proposal? Targets?

5. Proposal is prospecting i.e. staking of claims.

The laws of most states do not permit granting of leases on state-owned land.

You do not state how you intend to explore

6. It is doubtful if L&S agreements could be obtained ~~from~~ on federal or state-owned lands.

MME Form 52
Jan. 1959

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF MINERALS EXPLORATION

FOR GOVERNMENT USE ONLY
Operator
Docket No. OME –
Contract No. 14-23-090 –
Contract Date

LIEN AND SUBORDINATION AGREEMENTS[1]

To the United States of America:

That certain land in the County of Honolulu, State of Hawaii, described as follows:[2] 44.6-202 Acres owned by Valley of Temples Corp. Government lein mineral rights agreement signed by W Clapp, Pres., fee simple land 1 claim 750 x 1500. Discovery site & stakes established on above property. 240.37 .6 Acres, Forest Reserve include overburden and outcropping rights, top of mountain and true South direction showing high percentage of Titanium Oxide which indicates definite anomolies of potential Rare Earths, Betifite, Brannerite and Davidite deposits,, limited to areas actually staked and so shown on Exhibit A hereto.

hereinafter called the "land", is the subject of a proposed exploration contract, hereinafter called the "Contract", between the United States of America, hereinafter called the "Government" and

Uranium, Titanium Exploration & Development Corporation[3]

hereinafter called the "Operator". In consideration for and as an inducement to the Government executing the Contract, the undersigned:

1. (a) Being the owner of an interest in the land, hereby grants to the Government a lien upon all of his right, title, and interest in the land and upon any production of minerals therefrom to secure the payment to the Government of the royalty on production provided for by the Contract, and agrees if the Operator's interest should be surrendered or terminated at any time prior to the expiration of the rights of the United States under said Contract to pay royalty to the Government according to the terms of said Contract; or

(b) Being the holder of a claim, lien, or encumbrance against the land, hereby subordinates his claim, lien, or encumbrance in or against the land and in any production therefrom to the rights of the Government under the Contract with respect to royalty on production and liens to secure same.[4]

2. Undertakes and agrees that property in which the Government may acquire an interest or equity under the Contract may be dismantled, severed from the land, and removed as may be provided in the Contract; and the Government's interest and equity in such property shall be prior and superior to any adverse right or claim of the undersigned.

3. Represents and undertakes that there is no claim, lien, or encumbrance upon the undersigned's right, title, claim, or interest in or against the land other than the following: (If "none" insert the word "none". Do not leave blank.)

NONE, except First Mortgage to Pacific Mutual Insurance Co.; Second Mortgage to Dillingham Investment Co.; Improvement District Assessements to City and County of Honolulu.

1/ Production from the land is not required, and in the absence of production there is no obligation to pay royalty to the Government.

2/ Either (a) insert the legal description of the land, or (b) strike out the words "as follows" and insert "in a lease /or contract, deed, or other document/ dated Dec. 30, 1969, and recorded in Book State, Page ___, official records of said county". If (b) is used, the book and page of recordation must be inserted above. If the space provided is insufficient, use an Annex and refer to the Annex in the space.

3/ Insert name exactly as it appears in the Application MME Form 40. Valley of the Temples & Uranium, Titanium Exp. & Dev Corp

4/ Subparagraph 1(a) does not apply to the holder of a claim, lien, or encumbrance.

4. Undertakes and agrees (a) neither to commit any act nor assert any claim in conflict with the provisions of this Agreement; and (b) to give advance notice of the Government's rights under this agreement to any subsequent transferee, mortgagee, encumbrancer, or lessee of any of the undersigned's right, title, claim, or interest in or against the land or any production therefrom, furnishing the Government with two true copies of such notice; and

5. Consents to all amendments (including an agreement of termination) and assignments of the Contract without notice thereof, and undertakes and agrees that this agreement shall extend and apply thereto.

6. Added provisions See Annex No. 1 (State "None" or "See Annex No.____".)

Dated this 8th day of January, 1970.

VALLEY OF THE TEMPLES CORPORATION 47-200 Kahekili Highway (Street)
Kaneohe, Oahu 96744 (City & State)

By W. L. Clapp (Seal)
Its President

_____ (Street)
_____ (City & State)
_____ (Seal)

_____ (Street)
_____ (City & State)
_____ (Seal)

_____ (Street)
_____ (City & State)
_____ (Seal)

_____ (Street)
_____ (City & State)
_____ (Seal)

_____ (Street)
_____ (City & State)
_____ (Seal)

I, Diane C. Garnier (Name), certify that I am the Assistant-Secretary (Title—Secretary, etc.) of the corporation named herein; that W. Lawrence Clapp (Name), who signed this agreement was then President (Title—Pres., Vice-Pres., etc.) of said corporation; that said agreement was duly signed for and in behalf of said corporation by authority of its governing body, and was within the scope of its corporate powers.

Diane C. Garnier
(Corporate Seal)

Annex No. 1: This lien shall expire two years from July 1, 1969 if no production and in any event one year following cessation of production over ninety (90) days.

INT.-GOV. SRS., WASH., D.C. 21103

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By W. L. Clapp (Seal)
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INT.-CORP. SEC., WASH., D.C. 21103

MME Form 52
Jan. 1959

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF MINERALS EXPLORATION

FOR GOVERNMENT USE ONLY
Operator
Docket No. OME –
Contract No. 14-23-090 –
Contract Date

LIEN AND SUBORDINATION AGREEMENTS[1]

To the United States of America:

That certain land in the County of Honolulu, State of Hawaii, described as follows:[2] 44 6, 202 Acres owned by Valley of Temples Corp. Government lein mineral rights agreement signed by W Clapp, Pres., fee simple land 1 claim 750 x 1500. Discovery site & stakes established on above property. 240.87 6 Acres, Forest Reserve include overburden and outcropping rights, top of mountain and true South direction showing high percentage of Titanium Oxide which indicates definite anomolies of potential Rare Earths, Betifite, Brannerite and Davidite deposits, limited to areas actually staked and so shown on Exhibit A hereto.

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hereinafter called the "Operator". In consideration for and as an inducement to the Government executing the Contract, the undersigned:

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(b) Being the holder of a claim, lien, or encumbrance against the land, hereby subordinates his claim, lien, or encumbrance in or against the land and in any production therefrom to the rights of the Government under the Contract with respect to royalty on production and liens to secure same.[4]

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NONE, except First Mortgage to

Pacific Mutual Insurance Co.; Second Mortgage to Dillingham Investment Co.;

Improvement District Assessements to City and County of Honolulu.

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MME Form 52
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Dated this 8th day of January, 1970.

VALLEY OF THE TEMPLES CORPORATION 47-200 Kahekili Highway (Street)

By W. L. Clapp (Seal) Kaneohe, Oahu 96744 (City & State)

Its President

_____ (Street)

_____ (Seal) _____ (City & State)

_____ (Street)

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(Corporate Seal)

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MME Form 52
Jan. 1959

UNITED STATES
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OFFICE OF MINERALS EXPLORATION

FOR GOVERNMENT USE ONLY
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Its President

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(Corporate Seal)

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MME Form 9
Rev. Nov. 65

UNITED STATES
DEPARTMENT OF THE INTERIOR
Geological Survey

OFFICIAL DOCKET FILE

Contract No. _____ Docket No. 6828

Application
- [ ] Denied
- [ ] Withdrawn

Contract
- [ ] Terminated - Not Certified
- [ ] Terminated - Certified
- [ ] Cancelled
- [ ] Royalty Agreement

The records contained in this file are marked (x) and arranged in this order:

Folder No. 1:

Left Side

- [ ] Royalty Audits
- [ ] Certification of Discovery
- [ ] Closing Letter
- [ ] Cost Audits
- [ ] Termination Notice or Agreement
- [ ] Recision Notice
- [ ] Assignment of Contract
- [ ] Contract Amendments
- [ ] Contract with all exhibits and annexes
- [x] Owner's Consent to Lien and Subordination Agreement
- [x] Application and Attachments

Right Side

- [ ] Project Summary (final)
- [ ] Work Completed Analysis (final)

All other material filed in chronological order including the following reports if checked:

- [ ] Field Team Semiannual Report for Certified Project
- [ ] Final Field Team Report (Tab)
- [ ] Operator's Final Report (Tab)
- [ ] Interim Field Team Reports
- [ ] Operator's monthly reports and all attachments
- [ ] On-site Exam. Report (Tab)
- [ ] Settlement Sheets
- [ ] Drill Logs

Additional Folders:

Left Side

Folders No. _____: Reports

- [ ] Analysis of Semiannual Inspection Reports
- [ ] Project Summary (Interim) by MME Engineers

Right Side

- [ ] Field Team Semiannual Report for Certified Project
- [ ] Field Team Interim Reports
- [ ] Operator's Monthly Reports with Transmittal, Narrative and Maps

Folders No. _____: Maps (Use pocket folder or envelope)

Folders No. _____: Settlement Sheets

Folders No. _____: Drill Logs

Folders No. _____: Royalty Material

72195-65

SHERMAN

Sherman takes post in Beirut

Dr. G. Donald Sherman, for 25 years an argiculturalist with the University of Hawaii, has retired from the University, but will take a job at the American University in Beirut, Lebanon. He will be head of the department of soils and irrigation and professor of soils.

Sherman joined the staff of the Hawaii Agricultural Experiment Station in 1944, as professor of soil science and head of the department of soils and agricultural chemistry. He retired as associate director of the experiment stations with the titles of emeritus senior professor of soil science and emeritus associate director.

Dr, Sherman has turned over to us all his mineral collection locations found, percentages of Titanium and faithfully corresponds with us, in a consulting capacity, showing Magnetic areas etc.

Dr. Shermans mineral collection by the way has covered 25 years of hard work.

URANIUM, TITANIUM EXPLORATION & DEVELOPMENT CO.
P. O. BOX 8593
WAIKIKI, HONOLULU, HAWAII 96815

(OFFICIAL) HAWAIIAN ISLANDS DISTRIBUTORS OF A.E.C. APPROVED RADIATION DETECTION INSTRUMENT AND EXPLORATION EQUIPMENT.

AIRBORNE GEOLOGICAL RADIO ACTIVE DETECTION INSTRUMENT SURVEYING.
PHONES: 941-0772 OR 818-453

March 18, 1970

United States Department of the Interior
Geological Survey
Office of Mineral Exploration
(O.M.E.)
Washington D.C.

Dear Sirs:

We Wish to apply for financial assistance according to the rules and regulations set down by your agency, which program lines out the qualifications in your booklet Exploration Assistance Catalogue. Attached you will find geological and mineralogical information, maps, claim, etc. in favorable areas, including Tax Map 4-7-51- Island of Oahu and the other Islands in Hawaii. Dr. Donald G. Sherman, our vice president and consulting geologist, logged over a period of 35 years showing the percentage of Titanium locations and our own findings which are quite abit higher in Titanium Oxides recently found in Australia and now here, indicated from our calculations and Assay reports and Maps.

We feel that we are justified in establishing a reasonable possibility in geographical areas where exist valuable mineral of high commercial value, namely white clays with unusual high percentage of Titanium, (Rutile) Uranium, Betifite, Brannerite and Davidite, one of the few triple Oxides associated with Titanium (one of the newer elements) and black sands with Monazite and also Thorium potential, white clays of exceptional high value of cracking Catalyst used in filtering in petroleum plants, all of which have exceeded our utmost possibilities and expectations. In fact we have considered this discovery secondary. (Namely Fuller Earths)

Our Dr. Sherman (picture and background attached) has surveyed and made maps showing strategic areas of high percentages of Titanium (Rutile) as per certified records. All of Dr. Shermans findings are the original maps of mineralogoly a true significant find and confirmation of associated Uranium Ores associated with Titanium Oxides. Traditionally and chemically, and due to our excessive rain fall (50 to 100 inches per year) showing high readings on our Atomic Energy approved scintillators, both of which have been utilized for airborne and ground exploration, as per pictures enclosed, Federal and State and Fee Simple Land Owners.

We have established a number of mineral claims, in various areas of the Hawaiian Islands signing government lein subordination Exploration Agreements with the Valley of the Temples Corporation (copy attached) M.M.E. Form 62 for the purpose of extensive exploration work to be carried on for the general interest of the U.S. Goverment, our clients claims and ourselves

URANIUM, TITANIUM EXPLORATION & DEVELOPMENT CO.
P. O. BOX 8593
WAIKIKI, HONOLULU, HAWAII 96815
(OFFICIAL) HAWAIIAN ISLANDS DISTRIBUTORS OF A.E.C. APPROVED RADIATION DETECTION INSTRUMENT AND EXPLORATION EQUIPMENT.
AIRBORNE GEOLOGICAL RADIO ACTIVE DETECTION INSTRUMENT SURVEYING.
PHONES: 941-0772 OR 818-453

Also enclosed is evidence that funds for exploration are not avalible from banking insitutions. Dr. Shermans extensive comprehensive exploration reports, I am sure, plus our own findings should make our application most worthy. Our corporation was granted the first mineral exploration rights from the State of Hawaii to explore for possible minerals of any commercial value. Incidentally we are the exclusive distributors of approved Atomic Energy Scintillatorm equipment both for airborne and ground exploration, surveying and detection.

With the unusually high rainfall on the windward side of the Koolau mountains the chemical changes and the high Titanium percentages should reveal the only Uranium and Rare Earths associated with Titanium and Columbium which has been as shown in our attached report on the recent find in Australia of Davidite, a triple oxide and Betifite and Brannerite and other Uranium Ores associated with Titanium, not withstanding the rare earths potential, which samples are being assayed at the present time. In addition to the enclosed future exploration areas as shown on Tax Key 4-7-51- and others, we have our prospecting and exploration crews ready to further our probable mineral finds on Kauai, Maui and Molokai and the black sand beaches with deposits of Monazite and Thorium on the Island of Hawaii and 5 special areas that carry high percentages of Titanium (Rutile) and possibly rare earths. All of which are in the white clay formations ranging from 2 to 3 feet of overcropping from the top of various mountain ranges plus anomlies and high mounds of sedimentary Titanium (Rutile) in the gentle slopes and sedimentary areas that have released these minerals down through the many hundreds of deep seated dykes.

Enclosed find cancelled checks of present and past bills especially for labor expence, jeep costs, helicopter future costs for airborne and ground exploratiom, which will cut costs considerably. Our authentic maps and attached bonafide maps and various reasons to find any ores of highly commercial value, estimate costs for future, labour, materials and man power costs required for staking out additional discovery claim sites and stake work.

Proposal?

Employees, Shelter, Food, Transportation.....$10,000
Helicoptor-calbe $120.00 per hour;.....20 hours.
Purchase of Jeep.....$1800.00
Labor Costs.....$15,00.00
Materials, Scintillators, ground and airborne, squealer, lead sheild Non Magnetic Cable, Gamma Ray Protector, Grids etc.
Assay Costs.....$1000.00
Insurance.....$1000.00

Our corporation has purchased scintillators and we have invested $20,000.00 in time, maps, claims, and grids equipment.

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Estimated time to complete our potential other findings for the Islands of Oahu, Hawaii, Maui, Molokai and Lanai covering approximently 3 months. Extensive proposed exploration work on the Island of Hawaii with black sand beaches showing high deposits of Monazite with Thorium, additional Black Sand areas in two other Islands.

All our claims that have been negotiated with property owners State and Federal and Fee Simple land owners carry a 2 to 3 year contract for exploration work. We carry compensation insurance for all employees which covers damage to persons or property in the course of exploration work. May we say that our company has been granted an exploration permit to explore in all these areas.

We are prepared to submit a 3 part monthly report to the government including voucher claim costs, invoices, transcripts payroll, work preformed both past and present and future. Please send us the voucher explained in # 45 M.M.E. Form 61. May we mention that our islands are blessed with high percentages of Titanium as per our Dr. Sherman, Dr. Jones, and Dr Wentworth and Dr Wells who I am sorry to say has passed away, our findings and encouraging readings of Gamma Rays from our Scintillating equipment tests and short wave filtering equipment an anomoly possibilities, surely should inspire us all to make this project worth while. In addition to our capable mining and soil geologist consultants associated with our corperation, I have had 3 years experiance, discoverd Terbernite in Nevada, however they highgraded and gloryholed the copper findings in World War Two, and the U.S. Government subsudized the road building for delivery to smelter not realizing the heavy concentration of Terbernite at which time Uranium had not come into its own, it all went down the drain. Ihave also had extensive experiance in the Henry Mountains and Utah Areas. I was one of the first pioneers in the feild with the old Gieger Counter, also with some Tungstan experiance, and checked many old mining tailings.

We wish to extend our most sincere wishes and request that your Department of Geological Survey for Exploration Assistance will see fit to grant us the necessary financial assistance to carry on this important work and hope the enclosed report will meet with your approval.

We will be very anxious to welcome the Government inspector to evaluate our mineral findings with great anticipation and pointing out the above average and unusual discoveries in our Hawaiian Islands.

Very truly yours
H. W. Petrine v-pres-treas
Uranium, Titanium Exploration Co.

MME Form 40
(Revised Nov. 68)

Budget Bureau No. 42-R1368
Approval expires Dec. 1971

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

APPLICATION FOR FINANCIAL ASSISTANCE IN MINERALS EXPLORATION

Pursuant to Public Law 85—701 (72 Stat. 700; 30 U.S.C. 641)

OFFICE COPY OCT 19 INITIALS

NAME OF APPLICANT *(Full legal name and mailing address as they should appear on contract if one is executed.)*

Uranimum, Titanium Exploration & Development Corporation
3280 Round Top Drive, Honolulu, Hawaii 96822

APPLICANT DO NOT USE THIS BLOCK

DOCKET NUMBER: 6828

DATE RECEIVED: 10/19/70

REGION: II

DIVISION CODE:

BUSINESS ORGANIZATION *(Check one)*

- INDIVIDUAL [ ]
- CORPORATION [X]
- PARTNERSHIP [ ]
- OTHER *(Specify)* [ ]

LIST CORPORATE OFFICERS OR PARTNERS HERE, IF APPLICABLE

NAME	ADDRESS	TITLE
Arthur G. Gilman,	2943 Kalakaua Ave.	President
William Crowder,	4356 Punihi	Vice President, Sec.
William Petrine	3280 Round Top Dr.	Ex. Vice President & Gen. Manager.
Dr. G. Donald Sherman,	828 Onaha	Vice President & (Geogolist) Consulant

STATE IN WHICH FIRM IS ORGANIZED: Oahu, Hawaii

MINERAL(S) FOR WHICH YOU WISH TO EXPLORE: Uranium Ores and Rare Earths, Titanium

ESTIMATED COST OF PROJECT: Minimum $50,000.00

PROPERTY NAME	LOCATION COUNTY	STATE
State, Federal & Fee Simple Lands	Oahu	Hawaii
	Kauai	Kauai
	~~Molokai~~	
	Maui	

GENERAL INSTRUCTIONS

Before filling out this application, please read the *OME Regulations for Obtaining Federal Assistance in Financing Explorations for Mineral Reserves* (30 CFR Chap. II). To assure prompt action, your application must provide all applicable material and information specified on the back of this application form. Avoid unnecessary correspondence and delays by submitting complete and accurate information. *Please submit two copies of this application and all accompanying papers* except as otherwise noted. Place your name and address on each sheet. Each item of information, maps, and reports required as a part of this application is described on the back of this form. Identify each attached statement by the item number to which it applies. If an item does not apply to your application, show the item number on your statement and after it write "not applicable." Maps or sketches should be used to supplement narrative descriptions of the property location and boundaries in item 2, existing mine workings and geology in item 3, and the proposed exploration work in item 5. When this information is not too complex, all of it may be shown on one map or sketch. All documents and other attachments submitted as a part of this application, except those in item 3(g) which you mark to be returned, become the property of the Government and will not be returned to the applicant. Send true copies, *not originals*, of leases, contracts, and other documents which are an essential part of your business records. *File this application with the Department of the Interior, U.S. Geological Survey, Office of Minerals Exploration, Washington, D. C., 20242, or with the nearest OME Field Office.*

CERTIFICATION

The undersigned, whether as an individual, corporate officer, partner, or otherwise, both in his own behalf and acting for the applicant, certifies that the information set forth in this form and accompanying papers is correct and complete, to the best of his knowledge and belief, and that he would not ordinarily undertake the proposed exploration under current conditions and circumstances at his sole expense.

January 8, 1970
DATED

Uranium, Titanium Exploration & Development Corp.
BY *(Signature)*

William Petrine, Ex. Vice President, Treas. Gen.
TITLE Mgr.

William Petrine

A wilfully false statement or certification to any Department or Agency of the United States Government is a criminal offense.
U. S. Code, Title 18, Sec. 1001.

Financial Eligibility:

(a) Submit evidence of efforts made within 90 days preceding the filing of this application to obtain credit from your bank of account and at least one other banking institution or other private source of credit. Such evidence shall include (1) true copies of your letters to credit sources which show date of loan request, amount and terms requested, and proposed use of loan funds and (2) true copies of replies from credit sources. If the loan was offered under terms which you consider unreasonable, state why you consider them so.

(b) List names and addresses of affiliated, parent, or controlling companies or organizations and state extent and nature of their interest.

(c) State how you propose to furnish your share of the cost of the exploration work.

2. Applicant's Rights in Land:

(a) State your interest in the land and mineral rights, whether owner, lessee, purchaser under contract, or other. If you are not the owner, submit one true copy of the lease, contract, or other document (with address of owner) under which you control the property. Describe all liens, mortgages, or other encumbrances on the land and state book and page number and official place where recorded.

(b) State the legal description (section, township, and range; metes and bounds; patent number of claims) of the land upon which you wish to explore and all adjacent land which you own or control. Describe any part of the land or workings which should not be subject to Government royalty and liens. If the land consists of unpatented claims, state book and page number for each recorded location notice, including amended locations, and official place where recorded. State all the names by which you know the property.

(c) For all land or mineral rights encumbered or not owned, submit five copies of Lien and Subordination Agreements signed by owner on OME Form 52. If the agreements cannot be obtained, state reasons and whether you can furnish a performance bond.

3. Physical Description:

(a) Describe in detail and illustrate with maps or sketches all mining or exploration operations which you know have been or are being conducted upon the land. Include existing mine workings and all production facilities.

(b) State your interest, if any, in operations described in (a)

(c) State, if you know, the past and current production, supporting your statement with copies of settlement sheets, mine records, or published data if available.

(d) Describe known ore reserves, giving quantities and grades.

(e) Describe by narrative and maps or sketches the geologic features of the property, including ore minerals, geologic formations if known, and type of deposit (vein, bedded, etc.).

(f) If you have sampled the area you propose to explore, show where the samples were taken, describe sampling methods used, and provide copies of assay certificates. State your reasons for expecting to find ore.

(g) Send with your application at least *two* copies of all geologic or engineering reports, assay maps, or technologic information which you have, indicating whether you require their return.

4. Accessibility of Property:

(a) To aid the OME representative who may examine the property state name, address, and telephone number of person who will meet him; give directions for reaching the property; and describe accessibility of property and of any mine workings.

(b) Name the shipping and supply points and state the distances to the property.

5. Exploration Work:

(a) Describe fully the proposed exploration work giving individual footages and sizes of openings *for each item of work.* Use narrative, maps, plans, and sections as necessary. Show location of the proposed work as related to geologic features such as veins, ore-bearing beds, contacts of rock formations, etc. Show also the relation of the proposed work to any existing mine workings and to *land boundaries* or to the closest identifiable corner.

(b) If an access road must be built, show the proposed location on the property map and state the length, type and construction methods proposed.

(c) If an OME contract is executed, state how soon thereafter work would be started and finished. State your anticipated average daily or monthly rate of progress for each type of work.

6. Experience:

State your operating experience and background to conduct this exploration work and also that of the person who will supervise the work.

7. Estimate of Costs:

Furnish detailed estimates of the necessary costs for time and materials *for each item of the work proposed in 5(a)* under the headings listed below with a total for each heading and the estimated total cost of the work. Costs for any work to be performed by an independent contractor should be listed separately under category (a) below. Costs for any work that is not to be performed by an independent contractor should be listed under categories (b) through (g).

(a) Independent contracts. State the total cost of any proposed independent contract for all or any part of the work, and the number of units and the unit cost for each type of work, such as per foot of drilling, per foot of drifting, per hour of bulldozer operations, or per cubic yard of material moved. Cost estimates should be supported by bids from three contractors if possible. (*Note*—If none of the work is to be contracted, write "none" after this item.)

(b) Personal services. The cost of supervision, engineering and geological services, outside consultants, and labor should be itemized by numbers and classes of employees; rates of wages, salaries or fees; and periods of employment. State whether these services are available.

(c) Operating materials and supplies. List items of material and supplies giving quantity and price of each. Include under this heading power, water, and fuel, and units of equipment and tools costing less than $50 each.

(d) Operating equipment. List items of equipment and tools costing $50 or more per unit. Give specifications and indicate how each item is to be acquired—i. e., rented, purchased or provided by the applicant. If rented or purchased, state the estimated rental or purchase price. If furnished by the applicant, state condition and present fair market value.

(e) Initial rehabilitation and repairs. Describe the type and the cost of *initial* rehabilitation or repair of existing buildings, fixtures, installations (exclusive of mine workings), and movable operating equipment now owned by the applicant which will be used in the exploration work.

(f) New buildings, fixtures, installations. Describe each building, fixed improvement, and installation to be purchased, constructed, or installed for the exploration work, stating specifications and cost including labor, materials, and supervision.

(g) Miscellaneous. Describe the type and estimate the cost of repairs and maintenance of the operating equipment listed in 7(d). Do not repeat initial repairs listed in 7(e). Show also the costs of analytical work, accounting, workmen's compensation and employees' liability insurance, payroll taxes, and other required costs that do not fall within the previous categories. [*Note*—The Government will not contribute to costs incurred before the date of the contract, or to costs of or incident to: (1) acquiring, using, or possessing land and any existing improvements, facilities, buildings, installations, and appurtenances, or the depreciation and depletion thereof; (2) general overhead, corporate management, interest and taxes (other than payroll and sales taxes); (3) insurance (other than employees' liability insurance); and (4) damages to persons or property (other than authorized repair to or replacement of equipment or other property used in the work).]

MME Form 52
Jan. 1959

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF MINERALS EXPLORATION

FOR GOVERNMENT USE ONLY
Operator
Docket No. OME –
Contract No. 14-23-090 –
Contract Date

LIEN AND SUBORDINATION AGREEMENTS[1]

To the United States of America:

That certain land in the County of Honolulu, State of Hawaii, described as follows:[2] 44 6/202 Acres owned by Valley of Temples Corp. Government lein mineral rights agreement signed by F. Clapp, Pres., fee simple land 1 claim 750 x 1500. Discovery site & stakes established on above property. 240.37 6 Acres, Forest Reserve include overburden and outcropping rights, top of mountain and true South direction showing high percentage of Titanium Oxide which indicates definite anomolies of potential Rare Earths, Betirite, Brannerite and Davidite deposits, limited to areas actually staked and so shown on Exhibit A hereto.

hereinafter called the "land", is the subject of a proposed exploration contract, hereinafter called the "Contract", between the United States of America, hereinafter called the "Government" and

Uranium, Titanium Exploration & Development Corporation[3]
hereinafter called the "Operator". In consideration for and as an inducement to the Government executing the Contract, the undersigned:

1. (a) Being the owner of an interest in the land, hereby grants to the Government a lien upon all of his right, title, and interest in the land and upon any production of minerals therefrom to secure the payment to the Government of the royalty on production provided for by the Contract, and agrees if the Operator's interest should be surrendered or terminated at any time prior to the expiration of the rights of the United States under said Contract to pay royalty to the Government according to the terms of said Contract; or

(b) Being the holder of a claim, lien, or encumbrance against the land, hereby subordinates his claim, lien, or encumbrance in or against the land and in any production therefrom to the rights of the Government under the Contract with respect to royalty on production and liens to secure same.[4]

2. Undertakes and agrees that property in which the Government may acquire an interest or equity under the Contract may be dismantled, severed from the land, and removed as may be provided in the Contract; and the Government's interest and equity in such property shall be prior and superior to any adverse right or claim of the undersigned.

3. Represents and undertakes that there is no claim, lien, or encumbrance upon the undersigned's right, title, claim, or interest in or against the land other than the following: (If "none" insert the word "none". Do not leave blank.)

NONE, except First Mortgage to Pacific Mutual Insurance Co.; Second Mortgage to Dillingham Investment Co.; Improvement District Assessements to City and County of Honolulu.

1/ Production from the land is not required, and in the absence of production there is no obligation to pay royalty to the Government.

2/ Either (a) insert the legal description of the land, or (b) strike out the words "as follows" and insert "in a lease /or contract, deed, or other document/ dated Do, and recorded in Book State Page ____, official records of said county". If (b) is used, the book and page of recordation must be inserted above. If the space provided is insufficient, use an Annex and refer to the Annex in the space.

3/ Insert name exactly as it appears in the Application MME Form 40. Uranium, Titanium Exp. & Dev. Corp. Temples &

4/ Subparagraph 1(a) does not apply to the holder of a claim, lien, or encumbrance.

4. Undertakes and agrees (a) neither to commit any act nor assert any claim in conflict with the provisions of this Agreement; and (b) to give advance notice of the Government's rights under this agreement to any subsequent transferee, mortgagee, encumbrancer, or lessee of any of the undersigned's right, title, claim, or interest in or against the land or any production therefrom, furnishing the Government with two true copies of such notice; and

5. Consents to all amendments (including an agreement of termination) and assignments of the Contract without notice thereof, and undertakes and agrees that this agreement shall extend and apply thereto.

6. Added provisions See Annex No. 1 (State "None" or "See Annex No. ____".)

Dated this 8th day of January, 1970.

VALLEY OF THE TEMPLES CORPORATION 47-200 Kahekili Highway (Street)

By [signature] (Seal) Kaneohe, Oahu 96744 (City & State)

Its President

_____ (Street)

_____ (Seal) _____ (City & State)

_____ (Street)

_____ (Seal) _____ (City & State)

_____ (Street)

_____ (Seal) _____ (City & State)

_____ (Street)

_____ (Seal) _____ (City & State)

_____ (Street)

_____ (Seal) _____ (City & State)

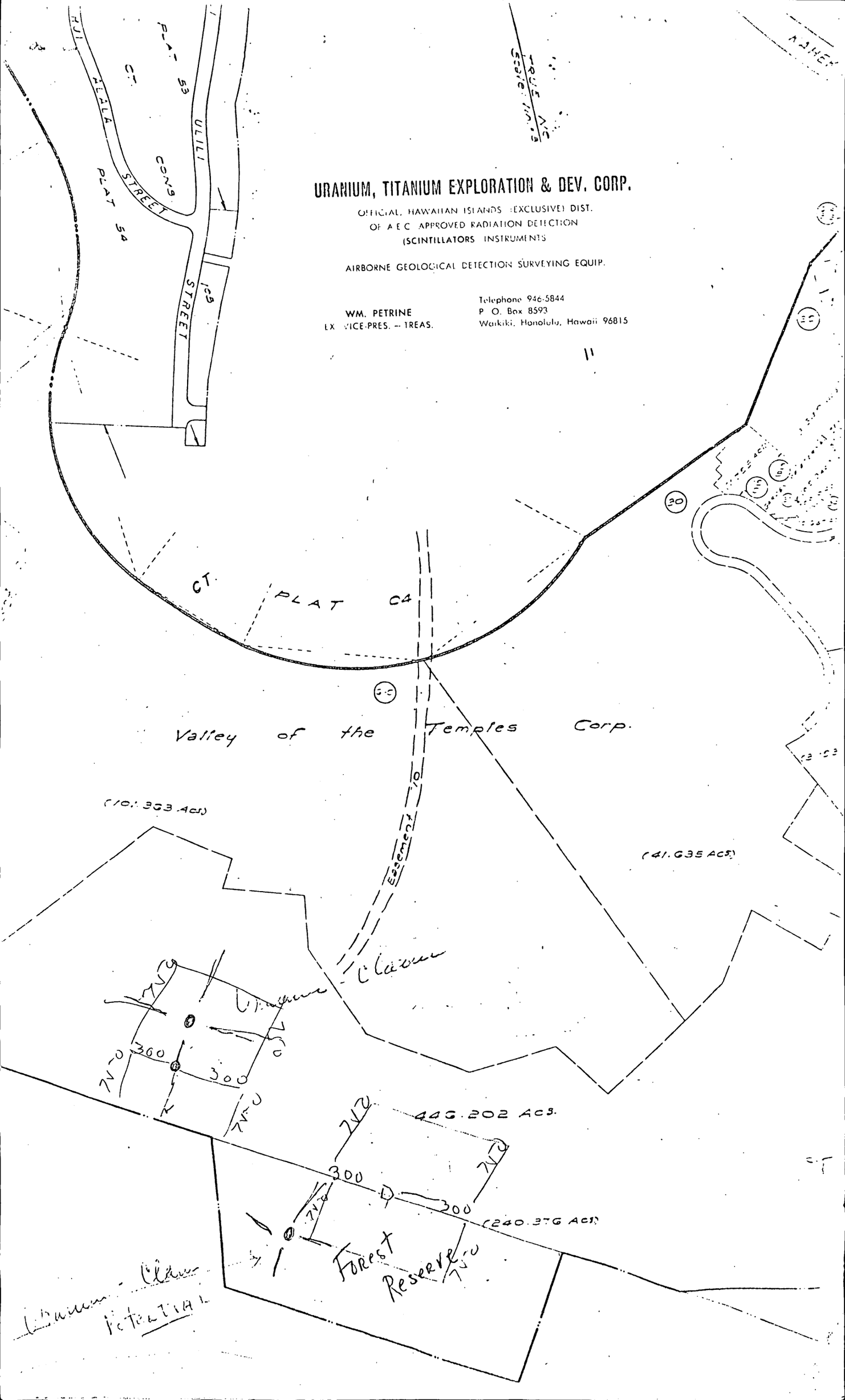
I, Diane C. Garnier (Name), certify that I am the Assistant-Secretary (Title—Secretary, etc.) of the corporation named herein; that W. Lawrence Clapp (Name), who signed this agreement was then President (Title—Pres., Vice-Pres., etc.) of said corporation; that said agreement was duly signed for and in behalf of said corporation by authority of its governing body, and was within the scope of its corporate powers.

[signature]

(Corporate Seal)

Annex No. 1: This lien shall expire two years from July 1, 1969 if no production and in any event one year following cessation of production over ninety (90) days.

INT.-COP. SEC., WASH., D.C. 21103


URANIUM, TITANIUM EXPLORATION & DEV. CORP.
OFFICIAL, HAWAIIAN ISLANDS (EXCLUSIVE) DIST.
OF A.E.C. APPROVED RADIATION DETECTION
(SCINTILLATORS INSTRUMENTS
AIRBORNE GEOLOGICAL DETECTION SURVEYING EQUIP.
WM. PETRINE
EX. VICE-PRES. — TREAS.
Telephone 946-5844
P. O. Box 8593
Waikiki, Honolulu, Hawaii 96815
HALA STREET
PLAT 53
PLAT 54
ULILI STREET
CT.
PLAT 64
Valley of the Temples Corp.
(10.363 ACS)
(41.635 ACS)
Easement
Claim
300
300
446.202 ACS.
300
300
(240.376 ACS)
Forest Reserve
Uranium - Titanium Potential

STATE OF HAWAII)
) SS.
CITY AND COUNTY OF HONOLULU)

On this 25th day of July, 1969, before me personally appeared W. PETRINE, to me known to be the owner of URANIUM, TITANIUM EXPLORATION AND DEVELOPMENT COMPANY, which is a sole proprietorship, and who executed the foregoing instrument and acknowledged that he executed the same as his free act and deed.

Notary Public, First Judicial Circuit
State of Hawaii.
My commission expires: 7-15-69

My Commission expires: _____

STATE OF HAWAII)
) SS:
CITY & COUNTY OF HONOLULU)

On this 22nd day of July, 1969, before me personally appeared W. LAWRENCE CLAPP, to me known to be the PRESIDENT of VALLEY OF THE TEMPLES CORPORATION, a Hawaii corporation; that the seal affixed to the foregoing instrument is the corporate seal of said corporation; that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors; and said W. LAWRENCE CLAPP acknowledged that he executed the same as the free act and deed of said corporation.

Diane C. Garnier
Notary Public, First Circuit,
State of Hawaii

My Commission expires: August 5, 1969

URANIUM, TITANIUM EXPLORATION & DEVELOPMENT CO.
P. O. BOX 8593
WAIKIKI, HONOLULU, HAWAII 96815

(OFFICIAL) HAWAIIAN ISLANDS DISTRIBUTORS OF A.E.C. APPROVED RADIATION DETECTION INSTRUMENT AND EXPLORATION EQUIPMENT.

AIRBORNE GEOLOGICAL RADIO ACTIVE DETECTION INSTRUMENT SURVEYING. PHONES: 941-0772 OR 818-453

MINERAL RIGHTS
AGREEMENT
(LEASE)

This joint venture agreement made this day of July 1, 1969 by and between URANIMUM, TITANIUM EXPLORATION & DEVELOPMENT COMPANY of P. O. Box 8593, Waikiki, Honolulu, Hawaii, and VALLEY OF THE TEMPLES CORPORATION hereafter referred to as the property owner of a certain parcel of land located in the State of Hawaii, Island of OAHU, CITY and COUNTY OF HONOLULU, for all the Exclusive Mineral Rights found due to exploration, developments, etc. For said exclusive mineral rights with above property owner the URANIMUM, TITANIUM EXPLORATION & DEVELOPMENT COMPANY agrees to pay 25% royalty when ores of value are found and delivered to smelting or stock piling facilities.

WITNESSETH: That the above parties hereto desire to enter into a written agreement to permit the URANIMUM, TITANIUM EXPLORATION & DEVELOPMENT COMPANY, or any of its affiliated contractors the right to use any method for development necessary to remove any ores of value from a given and stipulated area for the purpose of pit, strip and overburden areas needed for the removal of said minerals.

Market value of minerals will be determined by standard appraisal methods, either by mining interests, Secretary of the Interior or by Atomic Energy Commission.

VALIDITY: In the event either party wishes to sell or transfer to other interests, be it here advised that full control of discussions be left up to URANIUM, TITANIUM EXPLORATION & DEVELOPMENT COMPANY to negotiate in the best interest and good faith of all concerned.

Property owner will give URANIMUM, TITANIUM EXPLORATION & DEVELOPMENT COMPANY a description and notarized statement of location areas, et. of parcel of land to be explored for the filing of regulation claims in said described areas as well as full permission and authority to evaluate mining ore potential.

This Exclusive Mineral Rights Agreement is for a period of 2 years, and if financially successful in the interest of both parties, the URANIMUM, TITANIUM EXPLORATION & DEVELOPMENT COMPANY will have first option on renewal of contract.

URANIMUM, TITANIUM EXPLORATION & DEVELOPMENT COMPANY shall maintain adequate liability and property damage insurance and shall in all respects hold the property owner harmless from any and all liability which may arise out of this agreement.

The above property owner will be under no financial obligation whatsoever in this joint venture.

URANIMUM, TITANIUM EXPLORATION & DEVELOPMENT COMPANY will be responsible for restoring land and improvements to their original condition.

The URANIMUM, TITANIUM EXPLORATION & DEVELOPMENT COMPANY will have Exclusive Rights to stake out and file any claims found on above described property.

WITNESS: Lillian Jensrud

URANIUM, TITANIUM EXPLORATION & DEVELOPMENT CO.

By W. Petrie
Its OWNER

Dated: July 2, 1969

PROPERTY OWNER:
VALLEY OF THE TEMPLES CORPORATION

By [illegible]
Its PRESIDENT

STATE OF HAWAII)
) SS.
CITY AND COUNTY OF HONOLULU)

On this 25th day of July, 1969, before me personally appeared W. PETRINE, to me known to be the owner of URANIUM, TITANIUM EXPLORATION AND DEVELOPMENT COMPANY, which is a sole proprietorship, and who executed the foregoing instrument and acknowledged that he executed the same as his free act and deed.

Notary Public, First Judicial Circuit
State of Hawaii.

My commission expires: 7-15-69

STATE OF HAWAII)
) SS:
CITY & COUNTY OF HONOLULU)

On this 25th day of July, 1969, before me personally appeared W. Petrine and _____, to me known to be the owner ~~and~~ _____, ~~respectively,~~ of URANIUM, TITANIUM EXPLORATION & DEVELOPMENT COMPANY, a sole proprietorship ~~corporation;~~ that the seal affixed to the foregoing instrument is the corporate seal of said corporation; that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors; and said _____ and _____ acknowledged that they executed the same as the free act and deed of said corporation.

_____
Notary Public, First Circuit,
State of Hawaii

My Commission expires: _____

STATE OF HAWAII)
) SS:
CITY & COUNTY OF HONOLULU)

On this 22nd day of July, 1969, before me personally appeared W. LAWRENCE CLAPP, to me known to be the PRESIDENT of VALLEY OF THE TEMPLES CORPORATION, a Hawaii corporation; that the seal affixed to the foregoing instrument is the corporate seal of said corporation; that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors; and said W. LAWRENCE CLAPP acknowledged that he executed the same as the free act and deed of said corporation.

Diane C. Garnier
Notary Public, First Circuit,
State of Hawaii

My Commission expires: August 5, 1969

First Hawaiian Bank

Honolulu, Hawaii 96801

July 25, 1969

Mr. W. Petrine
Uranium, Titanium Exploration
and Development Company
P. O. Box 8593
Waikiki, Honolulu, Hawaii 96815

Dear Mr. Petrine:

This is in response to your July 16 inquiry regarding a $50,000 loan to be used for uranium exploration costs.

We do not have funds available for this type of request and we would not be interested in a participation loan or a guaranted loan.

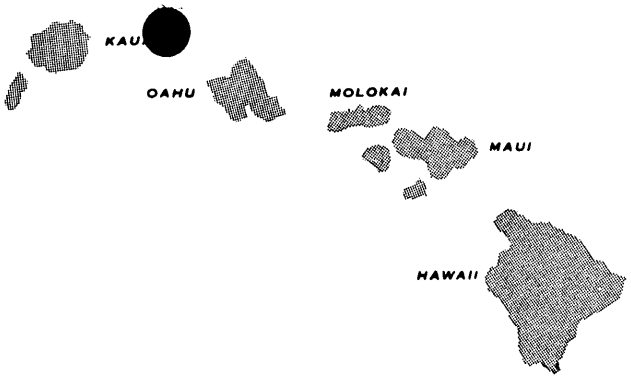
Sincerely,

R. L. Anderson

Robert L. Anderson
Assistant Vice President

RLA:kw

BANK OF HAWAII
ALA MOANA BRANCH
1441 KAPIOLANI BLVD.
HONOLULU, HAWAII 96814



R. K. MIGITA
ASSISTANT CASHIER

TELEGRAPHIC ADDRESS: "BANKOH"

July 25, 1969

Mr. W. Petrine
Uranium, Titanium
Exploration & Development Co.
P. O. Box 8593
Honolulu, Hawaii 96815

Dear Mr. Petrine:

This is in regard to your request for a $50,000 loan to finance the exploration of Uranium ores in Hawaii.

We are sorry to state that we are unable to accommodate you at this time because we are not actively seeking the type of loan that you have requested which is speculative in nature. This condition is caused by continued pressures on the money market and on the ability of banks to obtain loanable funds.

Sincerely,

R. K. Migita

R. K. Migita
Assistant Cashier

RKM:jc

lected and trials made which permit some general discussion of the clays and localities on these islands, though we have far less practical knowledge of these than of their counterpart on Oahu.

DESCRIPTION OF LOCALITIES

Oahu

All the Oahu localities from which good clay has been taken lie along the crest of the Koolau Range from the head of Waikane Valley northward to the vicinity of Puu Kainapuaa, a peak in Latitude 21°-36′ North (Fig. 2). In this distance of about seven miles the summit elevations range from 2,100 to 2,900 feet. On the east side the steep-walled heads of valleys form a nearly continuous cliff with declivity of 50 to 70 degrees. On the west, though the range slope for 4 or 5 miles is maturely dissected to very rugged and heavily-wooded country, the accordant interfluve ridges appear to stand in close approximation to the original constructional surface of the volcanic dome. Moreover, in a number of places in this area, small patches are shown by the topographic map to be but slightly dissected. It is probable that these few small areas are truly remnants of an old surface, which has for a very long period suffered neither degradation nor aggradation to a significant extent (Fig. 3).

The chief exposures of the clay have been revealed by the extensive trail-cutting operations carried on by the Civilian Conservation Corps in 1934 and 1935. They occur almost wholly in places where the trails cross fairly gentle slopes, and never where the trails are cut against steep banks below the gentler upper slope of the range. Where the trails are on the constructional surface, on the lee side of the crest, the clay bed is commonly found in the trail itself, or in a low bank on one side. On the other hand, on the windward or eastern side, where the mountain slope is a cut surface, no clay is found except in the few places immediately at the crest where the clay bed is exposed in section.

The plant cover in the Oahu localities consists of open swampy scrub, with conspicuous club mosses and ferns. In the more protected spots and along the slight depressions at the head of drainage are remnants of a forest, dominated by the ohia lehua (*Metrosideros*). The general aspect is that of a cover which was formerly more largely forest, broken by the open grassy areas which represent tension zones, where the forest has not maintained itself against the destructive effect of wild hogs and of man. In the strict botanical sense there is no plant complex which could be called a bog, comparable to that on the other islands.[4]

[4] This view has been expressed informally by Dr. H. St. John, Dr. Constance Hartt, Miss Marie Neal and Miss Lucy Cranwell, all botanists familiar with upland forest conditions in Hawaii.

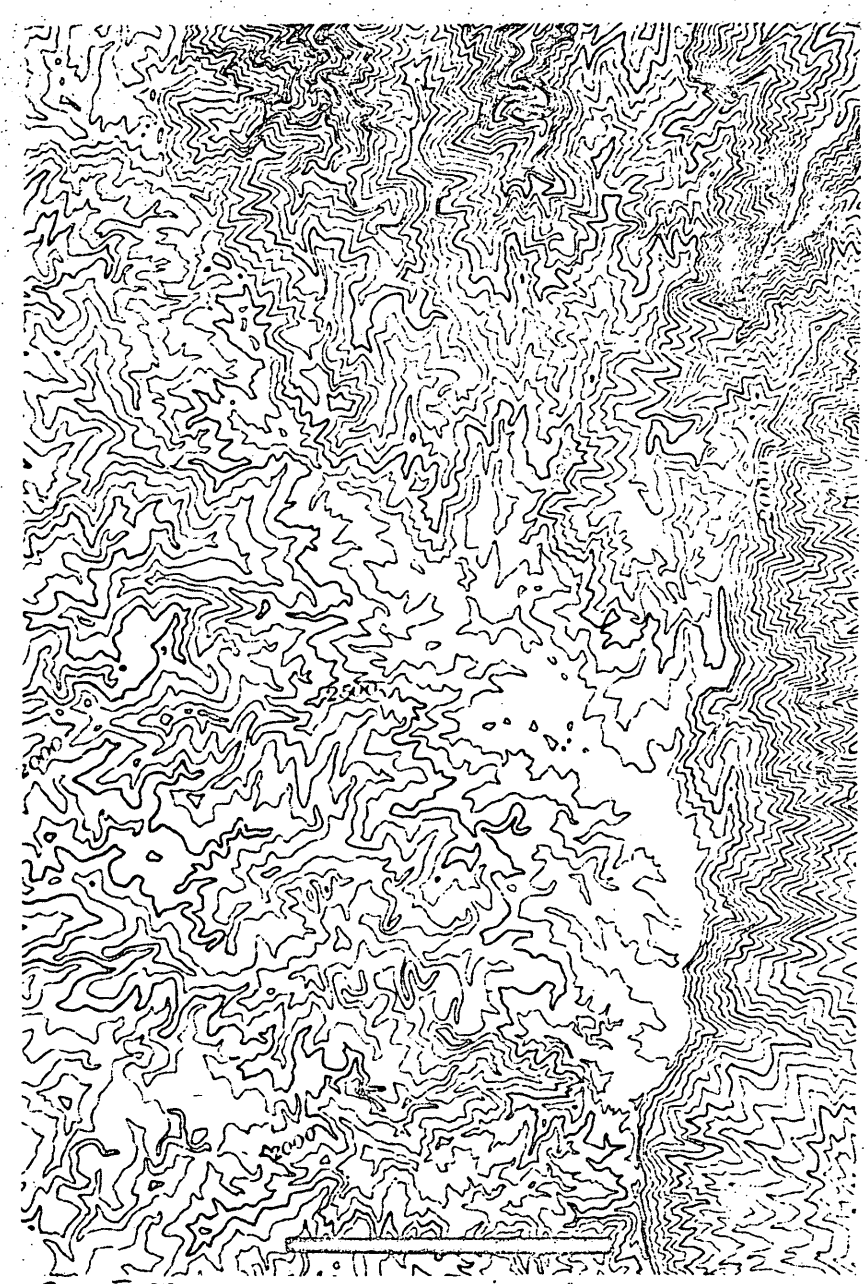


FIG. 3. Contour pattern of the summit of the Koolau Range at the northern end of the area of clay occurrence on Oahu, showing comparatively smooth, little-dissected, probable remnant of constructional surface. To the east is the steep, nearly continuous cliff formed by the heads of windward valleys. The heavy line is one mile long. Contour interval 100 feet. Photograph from the blue-and-brown U.S.G.S. sheet.

URANIUM-BEARING MINERALS

Minerals are naturally occurring elements or compounds with characteristic internal structures and with chemical compositions and physical properties either fixed or varying within a definite range.

Although there are more than 150 uranium-bearing minerals, only a few have ever been found in sufficient amounts to be of economic value. Probably the most important commercial uranium minerals are uraninite or pitchblende, carnotite, tyuyamunite, and coffinite. Other uranium-bearing minerals, however, are being recovered on an increasingly economic scale and may someday be major sources of supply. The davidite occurrence at Radium Hill, Australia, and the autunite mineralization of the Wind River Basin, Wyo., are two such deposits.

Uranium minerals may be divided into two classes, primary and secondary. Primary uranium minerals were formed by heated (hydrothermal) solutions coming from within the earth. Secondary minerals are those formed by the alteration of primary minerals through the action of surface weathering, ground water, or other natural processes.

Following are listed some of the more important primary and secondary uranium minerals:[3]

Primary uranium minerals-

Uraninite or pitchblende—uranium dioxide;
UO_2; U=46.5—88.2 percent;
contains up to 45.3 percent Th, as well as Pb, Y, and other rare earths.

Betafite—oxide of columbium, titanium, and uranium;
$(U, Ca)\ (Cb, Ta, Ti)_3O_9.nH_2O$?;
U=13.7 to 24.5 percent.

Brannerite—oxide of uranium and titanium, with rare earths;
$(U, Ca, Fe, Y, Th)_3(Ti, Si)_5O_{16}$?;
U=27.9 to 43.6 percent.

Davidite—a rare-earth iron-titanium oxide;
$AB_3(O, OH)_7$ or AB_3O_7; $A=Fe^2$, rare earths, U^6, Ca, Zr, Th; $B=Ti, Fe^3, V, Cr$;
U=as much as 4.4 percent.

[3] Formulas and percentages of uranium from Geological Survey Bull. 1009–F, Glossary of Uranium and Thorium-Bearing Minerals (3d ed.), by Judith Weiss Frondel and Michael Fleischer.

7. Much of the titanium oxide ores occur on territorial lands, and in most of the privately owned lands the mineral rights have been reserved by the Territory. The Territory can exercise control over the mining operations and would be justified in spending public moneys for their development.

Some disadvantages in the industrial development of the Hawaiian titanium oxide ores are as follows:

1. The surface deposits are very shallow; thus, the damage from mining operations would be very great and might not meet with public approval. However, a mining permit law could be enacted which would require revegetation of the exposed subsoil, which in most cases is a kaolin clay. The scattered locations would not justify the installation of expensive and efficient ore dressing equipment.
2. The deposits of the titaniferous-ferruginous laterite occur on slopes which will require special types of equipment in order to develop these deposits. The equipment would need to be very mobile.
3. The fine texture of the material will require the development of special ore dressing methods for these deposits. Preliminary work indicates that the successful development of ore dressing methods will not require great expenditures of research funds.
4. The intimate mixture of iron oxides and anatase will require the development of special ore dressing methods for their separation. If titanium exists in the mineral ilmenite, essentially the same problem will exist. The cost of separation and concentration may prove to be too expensive to permit the economical development of these deposits.
5. The potential high damages to crop lands would make operations too expensive.

IRON ORE DEPOSITS

The preceding section on titanium oxide deposits has indicated and described deposits which can also be classified as acceptable iron ores. They would be classified as titaniferous iron ores. The distribution of these ores is too shallow to be considered an adequate source of iron oxide, but they still are large enough to be considered as a source of titanium.

The chemical composition and the mineral composition of these ores have been given in the preceding section on titanium deposits. The highest iron oxide occurs in the subsoil (friable) layer of the Humic Ferruginous Latosols, where it may be as high as 80 per cent Fe_2O_3. The iron oxide minerals which are found in greatest amount are hematite and goethite. On Kauai, there are large and deep deposits of friable iron oxide ores which probably have a titanium oxide content of 5 per cent or less. The dominant iron oxide in these ores is goethite. Some kaolin will be found mixed into some of these deposits.

MANGANIFEROUS SOILS

Many of the Hawaiian soils have a very high manganese oxide content for soils. Kelley *(13)* was first to point out the high content of manganese in Hawaiian soils; as high as 9.7 per cent. This, however, is still too low for commercial development.

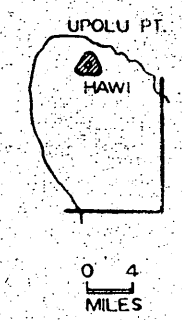


Fig. 3. Location of titanium deposit on Hawaii.

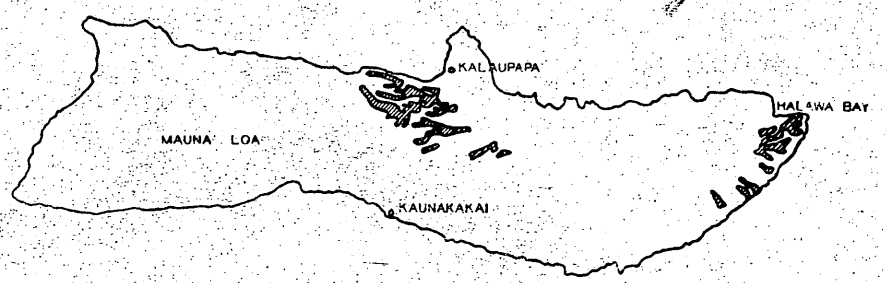


Fig. 4. Distribution of titanium deposits on Molokai.

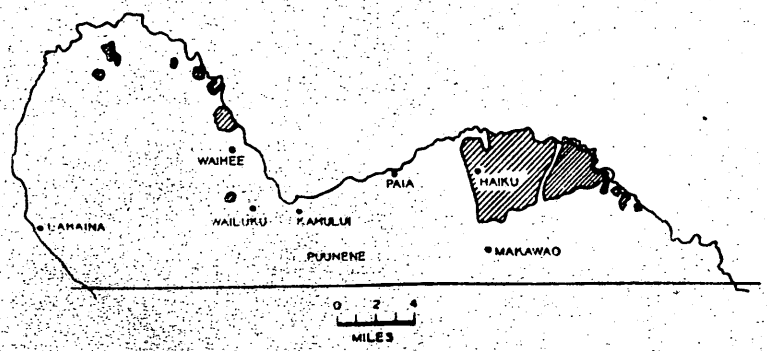


Fig. 5. Distribution of titanium deposits on Maui.

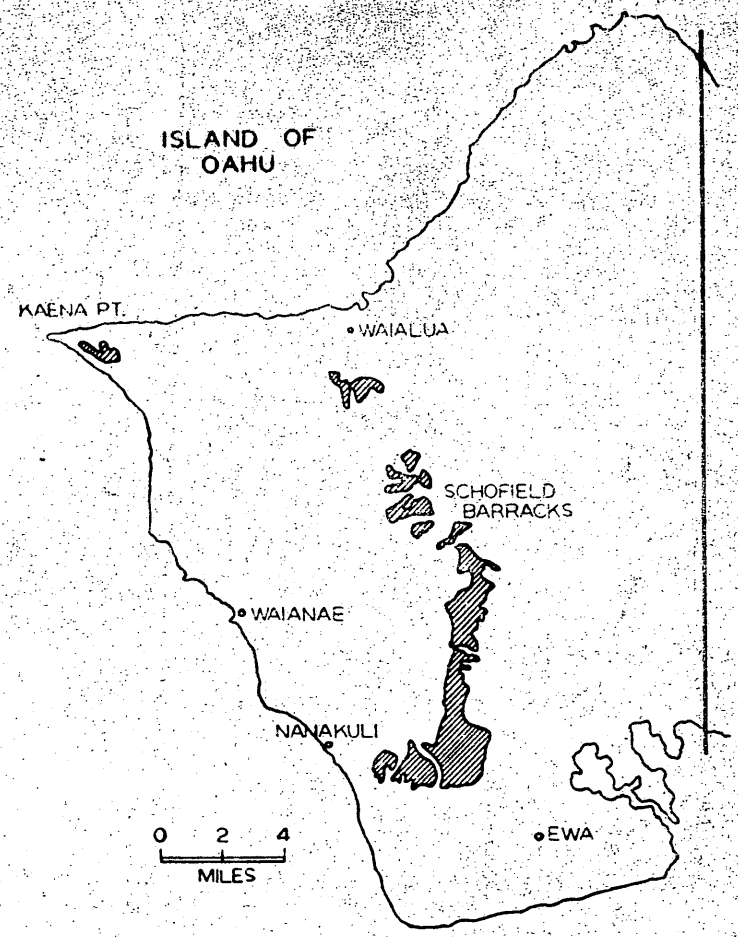


Fig. 2. Distribution of titanium deposits on Oahu.

formation which ranges from 1 foot to 6 feet. Near the surface, it is much richer in titanium oxide. The titanium oxide content of these soils ranges from 8 to 35 per cent. The second type occurs in locations where internal drainage is sufficiently sluggish for poor aeration to develop. The poor aeration causes the differential reduction of the iron oxide and its removal to an area where conditions for its oxidation are more favorable. In these locations the following sequence of mineral formation in the weathered surface horizons will occur: gibbsite ⟹ titanium oxide-kaolin ⟹ concretions of iron oxide containing appreciable titanium oxide ⟹ iron oxides ⟹ iron oxide-kaolin ⟹ kaolin.

This sequence suggests that the titanium oxide-kaolin material has formed by the degradation of former titaniferous-ferruginous laterite crust due to its position in the sequence. This type of titaniferous clay deposits

which occurred with podzolization, a soil forming process of temperate regions. Their hypothesis was based on the following assumptions: (1) Quartz could not accumulate in the Hawaiian Islands because of its absence in the parent rock, and (2) ilmenite was the primary titanium bearing mineral which was considered to be resistant to weathering and, thus, would accumulate. They considered the titanium oxide enrichment in the surface horizon analogous to the origin of quartz in the A_2 horizon of a podzol. Hough's work pointed out that the high titanium oxide soils were the product of advanced stages of weathering.

In 1947, Cline *et al.* (*4*) made a tentative classification of Hawaiian soils. He grouped the Hawaiian soils into groups which tended to reflect the dominant mineral composition of the soil. In his classification, the soils having a high titanium content were grouped together in the Humic Ferruginous Latosol group. The soils belonging to the Mahana, Naiwa, and Haiku families of this group have a very high titanium oxide content.

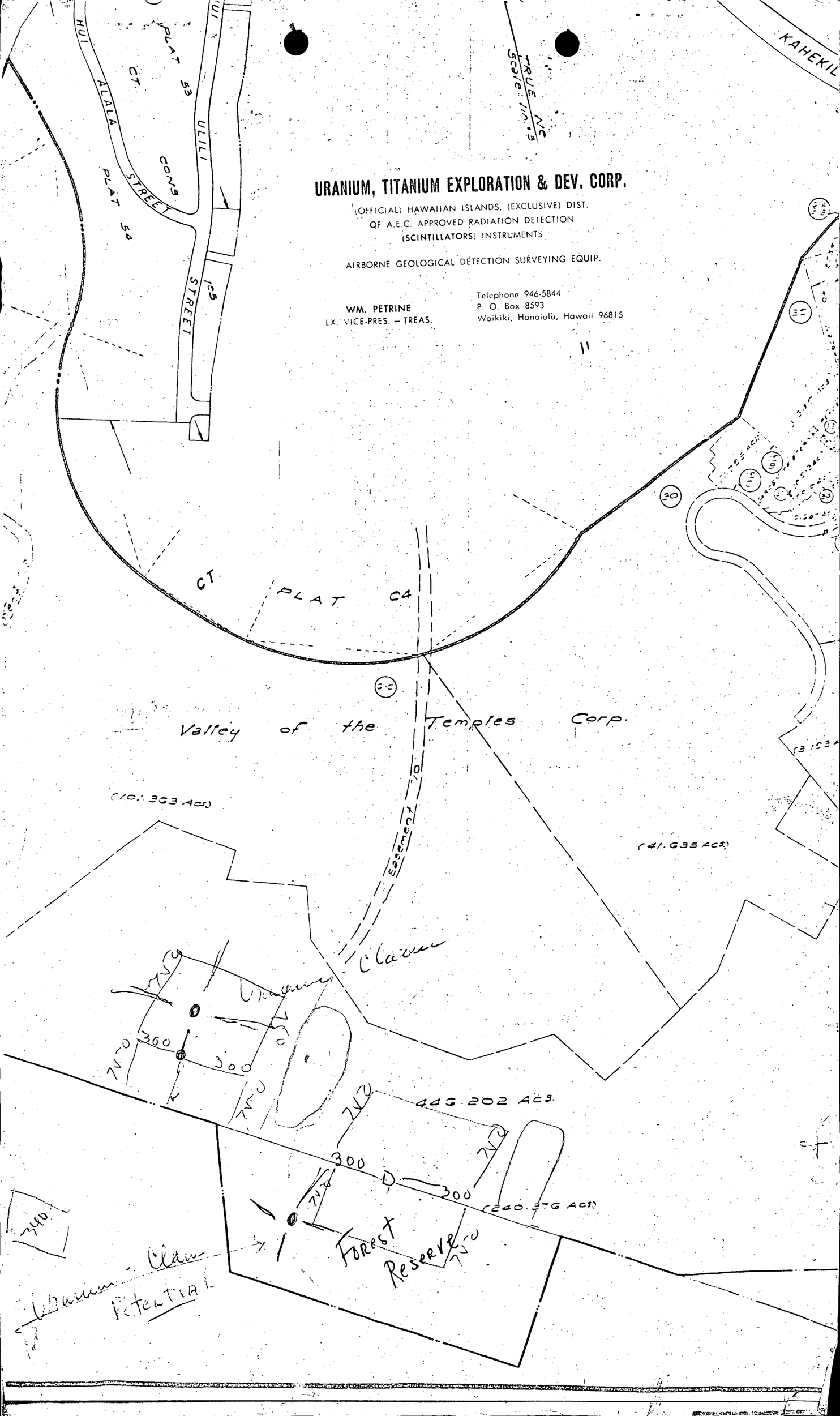
As a result of Cline's classification of Hawaiian soils, research was initiated to determine the genesis of these titanium-rich soils. In 1948, Sherman *et al.* (*22*) reported the general chemical and physical properties of the soils belonging to the Humic Ferruginous Latosol group. Fujimoto *et al.* (*5*) in the same year reported a detailed study of the chemical composition of the soil separates of a titaniferous-ferruginous laterite crust profile. Sherman (*19*), in 1949, reported the relative influence of soil forming factors involved in the formation of Hawaiian soils. In this study, the influence of age or time of exposure to soil forming factors was emphasized, and with its interaction with climate. Under a climate which has alternatingly wet and dry conditions, iron and titanium oxides have accumulated. As rainfall increased in such a situation, the accumulation of these oxides increased. However, this increased accumulation of iron oxides depended on the maintenance of good oxidative conditions in the soil. Under a continuously wet condition, aluminum oxide became the dominant oxide of the soil. The most important factors in the development of the deposits rich in titanium and iron oxides were the length of time of exposure to weathering processes and the intensity of climatic conditions in accelerating weathering processes.

In 1950, Sherman (*20*) described the genesis of the ferruginous laterite crust. In reality, the laterite crusts described were high in both iron and titanium oxides. The enrichment of these crusts with these oxides has resulted from oxide deposition by oxidation and dehydration after ascending to the surface in the capillary waters. The importance of the role of dehydration in the formation of these crusts has been recently shown (*24*). As long as the soil has a protective vegetative cover there is little evidence of an accumulation of titanium and iron oxide in the surface horizon. The exposure of the soil to the sun causes *rapid* dehydration and formation of a crust. Concretions of iron oxide are also formed near the surface of the soil (*23*).

The studies of the distribution of titanium oxide in Hawaiian soils and surface formation reveal that there are two distinct types of titanium-rich deposits (*21*). The most common type, which is represented by titaniferous-ferruginous laterite soils, has been described in a number of publications (*19, 20, 21, 22, 24*). This type is contained in the relatively shallow, surface

FIG. 6. Distribution of titanium deposits on Kauai.

FIG. 7. Distribution of titanium deposits on Lanai.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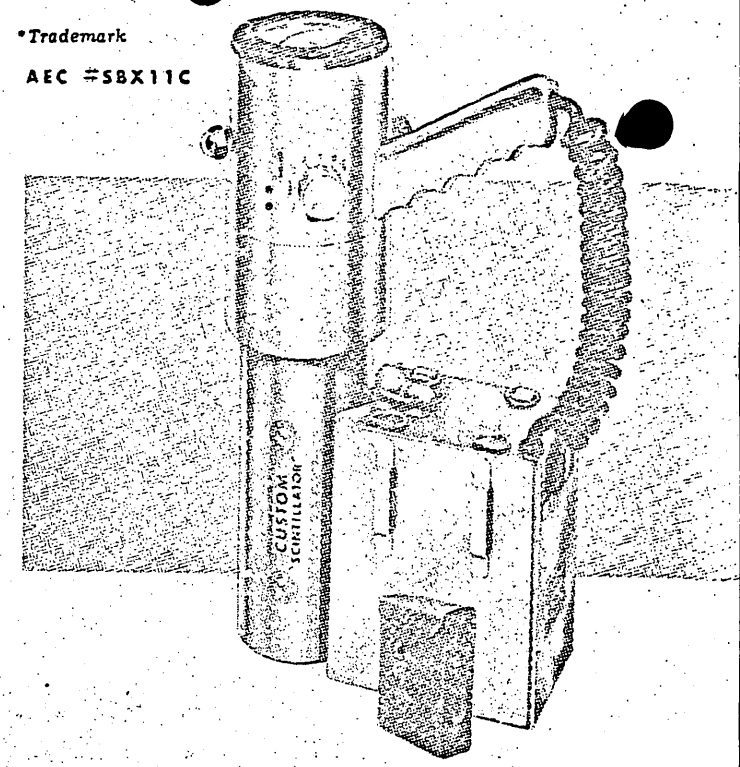

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SPECIFICATIONS

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Ranges ..... .01, .025, .05, .10, .50, and 2.5 MR/HR
Weight ..... 8½ lbs.
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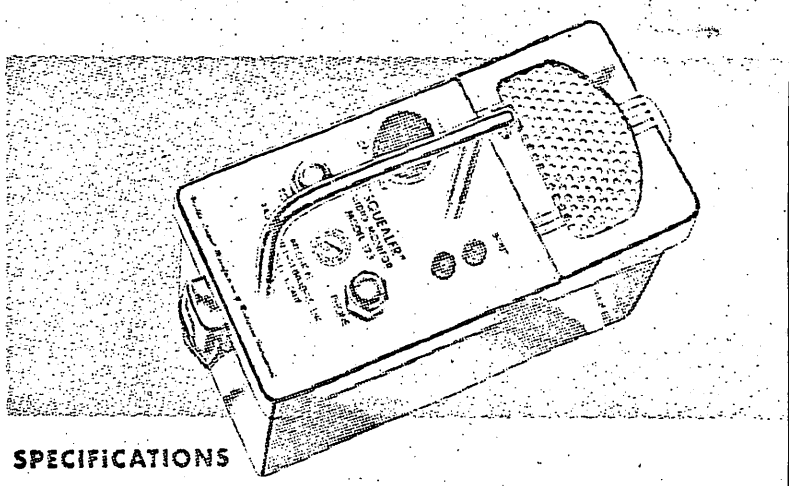

The PRI "Squealer" is an accessory for use with certain PRI instruments. When attached to these instruments it will give a loud warning signal in the presence of radiation. The tone of the sound produced by the "Squealer" varies according to the intensity of the radiation encountered. As the amount of radiation increases, the tone becomes higher in pitch. When making aerial or motor vehicle surveys, the operator can monitor radiation levels without having to watch the meter. This makes it possible to operate the aircraft or vehicle without an assistant to watch the instrument. The signal is loud enough to be heard over the noise of aircraft engines.

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The "Squealer" can be used with PRI "Scintillator" Models 111B, 111C, 115B, 115C, 118B and with the PRI Model 121 "Drill Hole" Geiger Counter. The proper connectors are supplied with the instrument.

The low price includes tubes, batteries, loudspeaker, earphone, two input cables and shoulder strap. Complete instructions are provided.

SPECIFICATIONS

Tube complement:	Battery complement:
two 6088, one NE-2	two V5036 or D99, 1½ volt one V5034 or 915, 1½ volt one V5055 or 455, 45 volt one V5016 or 467, 67½ volt

Size approximately ..... 3½" x 4½" x 6½"
Weight approximately ..... 4¾ lbs.
Shipping weight ..... 9¾ lbs.
Price complete $89.50

14 Clays

Radioactivity of Clay and Rocks. – The atoms of a few naturally occurring elements spontaneously disintegrate. This disintegration is slow but continuous, and it is accompanied by the production of radiation: alpha rays, beta rays and gamma rays. Alpha rays and beta rays are stopped after traveling less than one inch through matter, but gamma rays can go through two feet of water, more than six inches of common formations, or stopped. All geologic formations contain some radioactive isotopes of the following elements – – generally potassium, thorium, and/or uranium –– in varying amounts; this property makes gamma ray measurements valuable for formation logging.

often occurs as continuous, deep deposits. The depth of these deposits ranges from 1 to 15 feet, with the average occurrence being less than 2 feet. The distribution of the soils rich in titanium oxide and the titaniferous clays is shown in the following map of the islands (figure 2). It is difficult to give a reasonable, accurate estimate of the tonnage of soil containing titanium oxide in each of these classes, because of the irregularity of the occurrence of the titaniferous-ferruginous laterite. The composition of Hawaiian soils having a high titanium oxide content is given in table 2.

TABLE 2. THE TYPICAL CHEMICAL COMPOSITION OF TITANIUM OXIDE DEPOSITS IN THE HAWAIIAN ISLANDS.

LOCATION OF DEPOSIT	OXIDE CONTENT IN PER CENT			
	SiO_2	Al_2O_3	Fe_2O_3	TiO_2
Waimea Canyon, Kauai	3.3	8.1	58.0	21.0
Waihee Point, Maui	18.1	9.6	48.7	10.7
Haiku, Maui	14.0	13.2	48.1	18.9
Waimea Canyon, Kauai	12.5	7.8	58.0	14.4
Waimea Canyon, Kauai	3.8	9.9	47.5	25.0
Kilauea, Kauai	3.6	19.7	45.0	8.5
Anahola, Kauai	28.5	25.8	9.9	24.4
Anahola, Kauai	25.5	21.8	19.9	20.0
Lanai City, Lanai	12.1	16.2	45.0	10.8
Near Meyers Lake, Molokai	13.8	7.2	56.6	15.2
Hawi, Hawaii	14.2	16.2	46.8	19.5
Waikolu, Molokai	25.0	11.8	27.4	8.4
Waimea Canyon, Kauai	3.9	5.8	60.8	26.0
Lower Forest Reserve, Molokai	7.8	3.6	60.4	24.0
Waimea Canyon, Kauai	7.4	12.8	60.2	16.4
Koolau Mountains, Oahu	39.0	29.6	9.9	17.6
Koloa Junction, Kauai	28.0	22.8	9.4	12.6
Lower Waimea Canyon, Kauai	1.8	2.8	58.8	34.9

DESCRIPTION OF TITANIFEROUS DEPOSITS

Titaniferous-ferruginous laterite. This type is always found on slopes where the existing climate has definite, alternating wet and dry seasons. Such a climate is conducive to rapid chemical weathering under conditions favoring the alternating reduction and oxidation conditions. In general, these areas occur just below the wet, tropical forest where weathering conditions favor the solution of iron and titanium through their reduction. Certain conditions are apparently necessary before titanium oxide can accumulate in these deposits, and they are as follows:

1. Conditions favoring intense chemical weathering under both reducing and oxidizing conditions. (Under such conditions titanium is released from its normally weathering-resistant minerals and will become soluble in the acid, and probably very reducing, environment.)
2. Conditions favoring the movement of titanium in the percolating water to an area of accumulation. (This hypothesis would have the dissolved titanium moving in the near-surface percolating waters which would carry the titanium to a dryer and more oxidizing environment, where it would be deposited.)

sive view of the succession of original lava flows. However, some specimens have been examined in thin section with the following results:[33]

Four specimens collected at different points along the crest of the Koolau Range within the area of clay occurrence are olivine basalt, or olivine-basalt porphyry; with textures either typical of the fundamental Koolau basalt, or well within its range of textures. Olivine is abundant, also magnetite, and pyroxene. The feldspar is in the labradorite range. These specimens afford no evidence of late, summit lava flows on the Koolau Range of composition significantly less basic than the Koolau series generally.

No rock specimens were collected from the clay area on Molokai, nor on West Maui. Late capping lava flows of trachytic composition are known to occur on West Maui dome, but the specific relation of these to the clay deposits is unknown. As the West-Maui clay seen in the field is uncommonly dark and appears to contain much dark mineral, thought to be ilmenite, it seems at least plausible that the clay may be derived in part from basalt.

In the vicinity of Kokee, Kauai, below the west end of Alakai Swamp, numerous road-cuts lead to the tentative field conclusion that both basaltic flows and intermediate flows occur on that part of the dome. Both are deeply weathered, but show rather contrasting features. The basalt is commonly dark red or purple in color, spheroidal in weathered structure, and shows clear vesicular texture. The supposed trachyte has less spheroidal structure, or none at all, is commonly light lavender to chalky white in color and not significantly vesicular. In places, slabby, light gray blocks of the "trachyte" lie imbedded in a buff, or tan-colored, slope-washed soil. Six specimens from this area were examined in thin section. Three of these are classified as olivine basalt or porphyry, showing moderate to much weathering. A fourth is described as "Clay, pseudomorphous after basalt or closely related rock. The preserved texture strongly suggests a common ophitic or intergranular Hawaiian basalt, rather than any marked differentiate. The secondary minerals are extremely fine grained and were identified tentatively as clay minerals."[34]

Two specimens (H1935 and H1941) appear to be somewhat more acid than basalt. A certain parallelism of the feldspar laths was noted and the plagioclase is more abundant than in most basalts. Orthoclase was tentatively identified in one of the specimens. On the other hand, olivine, magnetite and pyroxene are present. In the Alakai area the clay may

[33] Winchell, Horace. Manuscript report based on microscopic examination of specimens collected by one of us, in comparison with extensive series of specimens of Koolau basalt of Oahu, and limited number of specimens from elsewhere in Hawaii.

[34] Winchell, Horace. *Op. cit.*

in part be derived from intermediate rocks, though basalts are present and appear to have constituted much of the parent material. It is concluded that the clay has been derived from basalt, perhaps exclusively so on the Koolau Range of Oahu, and to an important degree elsewhere. Despite the likelihood that much clay has also been derived from rocks of less basic composition, there seems no basis for concluding that such intermediate parent rocks are essential.

ORIGIN OF THE KOOLAU CLAY

Petrographic study of the Koolau clay suggests that the clay was derived from the weathering of basaltic lavas. It contains tiny grains of plagioclase altered to kaolinite at the edges but with the central cores of some grains sufficiently fresh that albite twinning can be distinguished between crossed nicols. Some of these were collected by washing large samples of clay, and their refractive indices indicated basic labradorite or acid bytownite.

Figure 10 shows a photomicrograph of a nodule of weathered rock collected from the same locality as the Koolau clay. The phenocrysts, probably originally plagioclase, are altered to clear white kaolinite, as shown by the interference colors of these areas which are first order gray (birefringence .005). Moreover, powders representing parts of them tested in oil have the refractive indices of kaolinite, and there is also a suggestion of the worm-like structure often assumed by kaolinite. The groundmass, which originally was probably composed of feldspar grains and ferromagnesian minerals, is now altered to a clay mineral having the properties of illite. The solid black is ilmenite or titaniferous magnetite. Titanium is present in the augite of some Hawaiian lavas and gives it a purple color in thin section. The ferromagnesian minerals of these nodules are too markedly altered to show their original nature. Thus, the relict plagioclase feldspars in the Koolau clay indicate that minerals of basaltic lava contributed to the formation of the clay, and altered nodules reveal that weathering in this area could furnish the clay minerals of which the Koolau clay is composed. Study of other specimens of rock in various stages of weathering, collected from the crest of the Koolau Range and the Alakai Swamp area, as reported above, also points to the same conclusion.

Further indication of the derivation of this clay from basaltic lava is afforded by the chemical analyses. Comparison with a representative analysis of basalt of the supposed parent rock (Analysis *A*), indicates that silica in the gray clays is decreased, while it has increased by nearly 10 per cent in the lighter clay. Alumina generally is considerably higher, as it remains while other oxides are removed. In the gray clays, titania

With these considerations in mind, it will be some time before an increase in demand for titanium ore will occur. The predicted production for 1953 will be between 2,200 and 2,500 tons of metal. The present industrial program calls for the production of 22,000 tons. The industrial users are asking for 200,000 tons annual production of this metal. Such expansion will increase the demand accordingly for ore in the future.

The development of industrial uses of Hawaiian clays depends on deposits having a uniform composition. The titaniferous clays do possess the uniformity necessary for them to be a good industrial clay. The shrinkage factor is still the limiting factor in their use for the manufacture of structural products. Very little effort has been made to develop the clays of the Hawaiian Islands, even though similar clays are being used extensively in other parts of the world. This development should be a part of any future industrial development program.

SUMMARY

A description of mineral resources present in Hawaiian soils and a description of their environment have been presented. The data presented in this paper indicate that the following conclusions are justified:

1. The soils of the Hawaiian Islands have a very high titanium oxide content. The titanium oxide content averages 5 per cent. In individual types of soils there has been an accumulation of titanium oxide content to as much as 35 per cent.
2. The soils having from 8 to 35 per cent titanium oxide can be considered as a source of titanium ore for industrial purposes. These rich deposits are of two types. They are, namely, titaniferous-ferruginous laterite, which has an iron oxide content in excess of 40 per cent, and titaniferous clays, which have a low iron oxide content. The possibility of developing ore dressing methods for the separation of titanium oxide appears to be more feasible for the latter than the former. The development of special ore dressing methods for these ores is absolutely necessary before these deposits can be developed.
3. The titanium oxide probably occurs as anatase-leucoxene in the titaniferous clays; and, while anatase has been identified in the titaniferous-ferruginous laterite, it is being questioned. There is a need for additional mineralogical studies in this type of deposits.
4. The ferruginous laterites have a very high iron oxide content, but due to their high titanium oxide content they are not suitable for industrial development.
5. The manganiferous soils of the Hawaiian Islands can only be considered as a source of manganese in cases of dire need in a national emergency. The manganese oxide does occur in concretions from which it is possible to separate it if cost is not a factor.
6. The Hawaiian Islands have a great variety of clays. These clays vary greatly in their properties, depending on their mineral composition. Kaolin, kaolin free oxide mixtures, montmorin, allophane-gibbsite, and free oxide mixture clays occur in deposits in the islands. The shrinkage factor will limit the industrial utilization of these clays.
7. It is possible to recover a variety of salts from ocean water by solar evaporation in Hawaii.

54-33352

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3. Number 2, above, requires the movement of titanium in percolating waters near the surface; and, in order to have this condition, it is necessary to have an impervious layer near the surface. (This impervious layer may be unweathered parent rock, but more commonly it is the point of contact with the subsoil plastic kaolin clay. The impervious layer at the top of the kaolin clay is developed by the deposition of iron oxide, often as a hard concretionary layer.)
4. A definite dry period is essential to cause the ascending movement of titanium toward the surface, where it is precipitated and dehydrated to the oxide called anatase.

The composition of the titaniferous-ferruginous laterite is determined by the vegetative cover, topography, and age. Vegetative cover is the protective cover of these areas against dehydration of the hydrated oxides. When the protective cover of vegetation is removed, the hydrated oxides are dehydrated. Prior to dehydration, the titanium oxide content is uniform in deposit above the impervious subsoil layer. After dehydration, there is an accumulation of titanium oxide at the surface, usually the upper 2 feet of the deposit. Topography influences the nature and composition of these deposits. They always occur on slopes. The greatest development of titanium oxide deposits occurs on benches or small plateaus of the slope. The deposit is likely to be a foot deep on a steep slope and as much as 10 feet deep on the more level benches. On gentle slopes, the deposit will average close to 4 feet in thickness. The influence of age is reflected in high contents of iron and titanium oxide and in the almost complete desilication of the deposit. Appreciable kaolin is found in the youthful deposits of this type.

There are other physical characteristics to be associated with these deposits. A dehydrated titaniferous-ferruginous laterite crust will have a bulk density in excess of 2.2. The bulk density of the surfaces of most of these deposits is higher than that found in the average soil. The bulk density of the deposits decreases with depth, because of the hydration of the minerals. The crusts are very hard and have a typical purple color.

Titaniferous clays. Wentworth *et al. (26)* described a Hawaiian pottery clay which had a high content of titanium oxide. These clays were found at high and inaccessible elevations of the Koolau Mountain Range on the island of Oahu. In 1947 and 1952 the author found sizeable areas of these titaniferous clays in the Waipuhi and Knudtson Gap areas of Kauai. These deposits are relatively low in iron oxide, being less than 10 per cent, with many less than 5 per cent.

The titaniferous clays are divided tentatively into two types. The difference lies in the nature of the formation of the deposits. The titaniferous clays from the Koolau mountains of Oahu and the Waipuhi area of Kauai can be described as a halloysite clay containing the mineral anatase. The deposit found in the Knudtson Gap on Kauai can be described as clay in which the dominant mineral is illite containing some halloysite and anatase. The former will have a titanium oxide content ranging from 10 to 25 per cent, and the latter will range from 6 to 12 per cent.

Sherman *(21)* described the anatase-halloysite clay as being formed by the probable degradation of a former titaniferous-ferruginous laterite crust. The degradation processes result from the poor internal aeration and drain-

TABLE 5. THE TYPES OF CLAYS FOUND IN THE HAWAIIAN ISLANDS.

CLIMATIC ENVIRONMENT	TYPE OF CLAY MINERALS	CHARACTERISTICS
Semi-arid: Annual rainfall 10 to 25 inches	Montmorin	Plastic sticky clays amounting to from 40 to 50 per cent of soil. High adsorption.
Alternating wet and dry season with strong dry season: Annual rainfall 25 to 75 inches	Kaolin	Granular non-plastic clay containing iron oxides.
Alternating wet and dry season: Annual rainfall 35 to 75 inches	Goethite clays	Subsurface friable ferruginous clays. Floury texture.
Alternating wet and dry season: Annual rainfall 35 to 75 inches	Dehydrated anatase-hematite clays	Massive indurate clays which break down to graphite-like material.
Alternating wet and dry condition with poor internal drainage: Annual rainfall 45 to 90 inches	Anatase-halloysite clays	Purplish-gray, granular clay. Massive but not indurate.
Alternating wet and dry condition with poor drainage: Annual rainfall 35 to 100 inches	Anatase-halloysite-illite clays	Gray massive, non-plastic clay. Impervious in nature.
Continuous wet condition: Annual rainfall 65 to 125 inches	Plastic-goethite-gibbsite-kaolin clay	Plastic, red clay. Very compact, impervious.
Very wet condition: Annual rainfall 120 to 300 inches	Allophane-gibbsite-goethite clay	A greasy, smeary clay having a very low bulk density. Irreversible shrinking on drying.

are accumulated through the decomposition of silicates and through the leaching of bases and soluble silica. The time sequence of weathering is influenced by climate (temperature and rainfall). The sequence of mineral formation due to progressive weathering is as follows:

1. **Arid conditions** (at least 10 very dry months per year):
   primary minerals ⟹ 2:1 layered silicates ⟹ kaolin
2. **Semiarid conditions** (same as above).
3. **Pronounced wet and dry seasons** (at least 8 dry months):
   primary minerals ⟹ kaolin ⟹ hydrated sesquioxides
4. **Approximately even dry and wet seasons:**
   primary minerals ⟹ kaolin ⟹ ferruginous oxides and kaolin
   ⟹ ferruginous oxides ⟹ titaniferous-ferruginous oxides
   ⟹ titanium oxide and kaolin ⟹ kaolin
5. **Sufficient rainfall to keep surface moist at all times:**
   primary minerals ⟹ kaolin ⟹ goethite and gibbsite
6. **Very wet** (over 8 inches rainfall per month):
   primary minerals ⟹ {allophane, goethite, gibbsite} ⟹ {gibbsite, goethite} ⟹ bauxite

Under conditions 3 to 6, the oxides which are accumulating in the weathering horizon are iron oxide, aluminum oxide, and titanium oxide. Theoretically, it is possible, under certain tropical weathering conditions, that the end product of weathering could be dominantly any one of these oxides. However, in nature we obtain various combinations of these oxides. Usually, titanium oxide is the least likely to accumulate, because of a much lower level of this constituent in the general run of parent rocks. The triangle of percentage of the three oxides can be used to show the various types of combination which can occur (see figure 1). It is possible to group the products of tropical weathering as follows:

1. Ferruginous laterites
2. Aluminous-ferruginous laterite
3. Ferruginous bauxite
4. Bauxite
5. Titaniferous-ferruginous laterite
6. Titaniferous bauxite
7. Ferruginous-titaniferous laterite
8. Aluminous-titaniferous laterite
9. Titaniferous laterite

Specimens representing each of these types, except numbers 7, 8, and 9, have been found in the world. It is likely that numbers 7 and 8 will be found, but a titaniferous laterite would be very rare, indeed. The composition of different types of laterites is given in table 1. The nature of the end product of weathering will be determined, primarily, by climate; secondarily, by the composition of the weathering matrix and the time of exposure. In the Hawaiian Islands, the evidence obtained from the mineral composition of the weathered products supports the above hypothesis. Thus, weathered products containing aluminum iron and titanium oxides can be found in the Hawaiian Islands.

of bog specialists headed by Dr. Carl Skottsberg. The results of their special studies have not yet been compiled or published. However, the distinctive nature of the plant cover of the bog areas is very apparent, even to a casual observer. Development of this special floral assemblage, with the stunting of certain plants which normally grow to larger size, and the accumulation of the peat is the result of a combination of causes and effects which include poor soil drainage, high soil acidity and reducing conditions which have led to the development of a relatively iron-free clay from a rock originally rather high in iron and comparatively low in silica.

With a few local variations there are three characteristic layers in the soil profile from the top downward, the peat or humus dark soil at the top, an intermediate layer of clay of varying quality and freedom from plant roots and at the bottom a more or less definite layer indicating accumulation of iron. Below this is weathered rock of various colors (3[illegible]7). The soil conditions are succinctly epitomized by Foster as follows:

"VI ALAKAI-KAWELA-PUU KUKUI ASSOCIATION

Occupying gently rolling more or less flat-topped areas in high rainfall belt, best developed between altitudes of 4,000–5,000 feet but occurring at lower elevations of 2,500 feet in places, there are areas wet enough and cool enough to favor the accumulation of peat. Open areas of grasses, sedges and shrub ohia surrounded by taller ohia and ferns form a characteristic vegetation on poorly drained areas. Larger ohia and associated vegetation borders drainageways. The soils are in part peat and muck and in part gray mineral soils, with a shallow limonitic transition zone to gray soft rock. These areas have an economic value in their ability to absorb water and retard quick run-off."[10]

Production Methods

Except in the few places where the clay has been exposed in trails, prospecting consists of sinking a small spade into the turf mat of the perennially water-soaked surface of open, non-forested areas to determine the thickness of the light-colored clay layer. On Oahu only two or three places have been found where a thickness of 8 inches is maintained over an area as much as ten feet square. Under such conditions digging the clay is a laborious operation, involving the stripping of the humus layer from the top and hampered by rain, water-soaked ground and the extreme toughness of the clay.

The first few hundred pounds of clay dug were carried out by C.C.C. workers, camped in the mountains for trail work and willing to pack it out at a stipulated rate per pound, on their week-end holiday trips to

[10] Foster, Zera C., Soils of Hawaii: *Territorial Planning Board, First Progress Report*, 63, 1939.

FIG. 7. Exposure of Koolau clay at Kawailoa-Summit Trail junction. The dark area near the top is a mat of low-grade peat. Below it is the light gray clay with a few plant roots and carbonaceous remnants in it, and near the bottom the clay grades into a stonier, more ferruginous layer. Thickness of whole section about 30 inches.

(15)

Euxenite

NATURE'S STOREHOUSES

Areas where substantial deposits are found are called uranium districts. Considering the geochemical behavior of uranium, scientists recognize at least three general factors that determine the geology of a uranium district.

(1) The nature of the rocks in which the ore has been deposited.

(2) The sedimentary (rock) or structural (fracture) framework through which the solutions moved.

(3) The nature of the original mineralizing solutions. Many kinds of solutions, ranging from magmas to rainwater, containing a variety of metallic and nonmetallic elements, may carry uranium through rocks.

Types of Deposits

There are three important types of uranium deposits. The "sandstone-type" deposit, in which the ore trends horizontally or nearly so and is confined to a particular sandstone bed, or "petrified river", has already been described. The second is known as the "vein-type" or simply "vein" deposit. Veins tend to be vertical or rather steeply inclined and cut across sedimentary, igneous, and metamorphic rock formations. They are formed in fractures through which solutions either moved up from great depth or down from the surface. Most veins of uranium probably were formed from heated solutions that were squeezed upward into fractures under great pressure.

Occasionally, uranium also occurs in veins with more exotic elements, such as columbium, tantalum, and titanium, in minerals known as uranium multiple oxides. Davidite, a uranium titanate, has been mined in Australia from metamorphic rocks. The multiple oxides are resistant to weathering and often accumulate in stream beds known as "placer type" deposits. Among these an unusual multiple oxide called euxenite has been mined for uranium in Idaho stream sands. It is believed that the euxenite was weathered out of igneous rocks far upstream and concentrated in the sands by the action of the rushing waters, in the same manner that gold nuggets are deposited in streams. Al-

For general information it should be pointed out that most of the manganese in Hawaiian soils occurs as pyrolusite concretions *(25)*. These pyrolusite concretions have developed in certain soils as a product of weathering processes. The concretions are found in soils which have developed under climate having an alternating wet and dry season. The rainfall must be sufficient to cause rapid leaching of bases and thus provide conditions favorable for the development of kaolin clays. The alternating wet and dry conditions are necessary for the solution of the manganous ion, in which form it may be precipitated, on oxidation and dehydration, to form a concretion. The manganiferous concretions are developed in several ways. They are as follows: (1) Spherical types are developed where the manganese dioxide is precipitated around a small nuclei; (2) irregular and angular shapes occur where precipitation has taken place in soil pores or small openings in the soil; (3) aggregate types are developed where manganese dioxide is precipitated on the surface and in the pores of a soil aggregate; and (4) manganese dioxide is precipitated on the surface of roots to form tubular-shaped concretions. All of these concretions have a high content of manganese, but they also have a high content of sesquioxides and silica. Table 6 gives the MnO_2 content of typical concretions.

TABLE 6. THE AVERAGE CHEMICAL COMPOSITION OF DIFFERENT TYPES OF PYROLUSITE CONCRETIONS.

TYPE OF MANGANIFEROUS CONCRETION	AVERAGE CHEMICAL ANALYSIS				RANGE OF MnO_2 CONTENT
	SiO_2	Al_2O_3	Fe_2O_3	MnO_2	
Spherical	16.7	32.7	8.5	33.1	29.4–39.8
Tubular	13.6	28.6	14.7	27.0	23.1–31.4
Irregular	15.6	26.0	9.6	31.6	25.1–44.2

The MnO_2 content ranges from 23.1 to 44.2 per cent. Deposits which approach ore possibilities are found in small areas only. These are so small that they have no commercial possibilities at this time. However, these locations can be considered to be low-grade manganese deposits.

OTHER MINERAL POSSIBILITIES

There may be other mineral possibilities in Hawaii, some of which may be unknown to us today. Of those known but today insignificant in value, some may become valuable in future economic changes or other increased need for such mineral element. Appreciable amounts of nickel, chromium, vanadium, zirconium, and cobalt have been found, but none have been found in quantities approaching commercial possibilities under present day standards. Most of the soils of the islands contain about 0.1 per cent of columbium, a very scarce chemical element. The columbium content is too low to be considered a source unless it can be concentrated during the processing of another mineral.

INDUSTRIAL CLAYS

The parent rock of the Hawaiian Islands was formed from lavas having very little, if any, quartz. Under a warm tropical environment, the surface

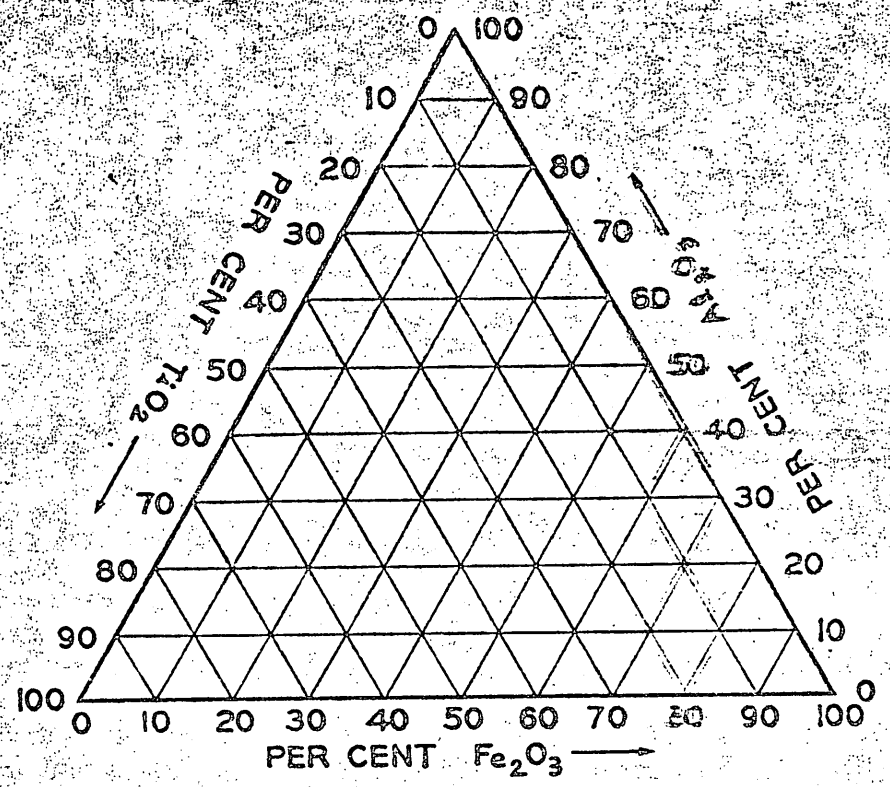


FIG. 1. Possible combinations of oxides in the end product of tropical weathering.

TITANIUM DEPOSITS

Hawaiian soils rich in titanium oxide were first described by McGeorge *(17)* in 1917. He reported soil analyses which showed a high titanium content. In his report, he pointed out that the average titanium oxide content of Hawaiian soils was found to be 5 per cent. He further pointed out that he had found soils containing more than 30 per cent. Kelley *et al.* *(15)* described two peculiar soils: one rich in manganese and the other rich in titanium.

In the middle 1930's, the U. S. Department of Agriculture made a soil survey of the Hawaiian Islands. The entry of this organization into the islands led to an interest in the chemical composition of the island soils. Hough and Byers *(10)* made a very complete study of the chemical and physical properties of seven Hawaiian soil profiles. Some of these profiles were soils having a very high titanium content. They reported that if the titanium-rich soils were dispersed, black minerals of a high specific gravity would settle out rapidly. These black minerals were identified by them as ilmenite and the magnetic iron oxide, magnetite.

In 1941, Hough *et al.* *(11)* published another comprehensive report on the chemical composition of Hawaiian soils. They proposed a hypothesis that the soil weathering occurring in Hawaiian soils was the same as that

*Reg. U.S. Pat. Off.

MODEL 117
"SPECIAL SCINTILLATOR"*

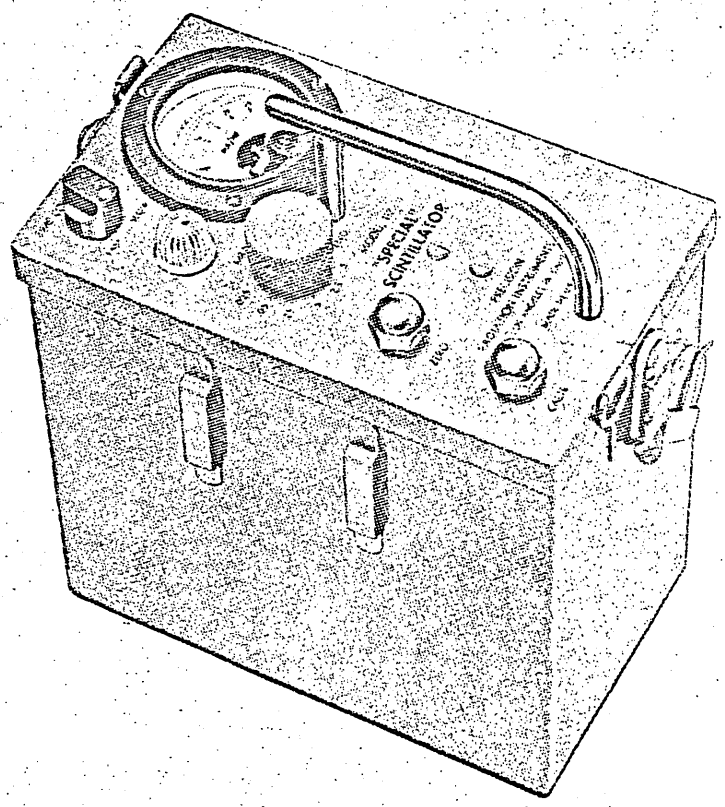
The Model 117 was designed especially for the prospector who wants the advantage of a scintillation counter at a moderate price. It has many times the sensitivity of any geiger counter but is not as sensitive as the Model 111. It is an ideal instrument for field prospecting because of its ruggedness, compactness, and light weight. It also has many uses in the laboratory and in industry. One of its industrial uses is as a portable liquid level indicator on large closed tanks. The liquid level in a closed tank can be determined by using a small radioactive source on one side of the tank and the 117 on the other side. The instrument and source are then raised and lowered simultaneously.

Depths at which a Scintillation counter will detect uranium deposits, range from a few feet to hundreds of feet, depending on whether the overburden is radioactive, the size and quality of the ore body, and other factors.

The detecting element used in the 117 is a 1" x ½" Thallium activated Sodium Iodide crystal coupled to an RCA 6199 photomultiplier tube. The tube and crystal assembly is enclosed within the instrument case and is magnetically shielded. Operating ranges of the Model 117 are .025, .05, .25, .5, 2.5, and 5 milliroentgens per hour. It has an accuracy of 5% on all ranges except the 5 MR/HR range.

The circuit is altitude independent to heights in excess of 15,000 feet. The Model 117 uses the newest type of circuit and is very stable in operation. It detects gamma rays as low as .01 M.E.V. The instrument has only two controls: the range switch and the time constant switch. It is just as simple to operate as a Geiger Counter and can be used by untrained persons.

The entire instrument is waterproofed and tropicalized. The photo tube and crystal are shock mounted. It can be carried either on the belt or by a shoulder strap as well as by the handle. Batteries are standard types and they can be replaced without tools. The battery supply consists of four flashlight batteries, two 45 volt radio type batteries and one 22½ volt hearing aid type battery. The cost of a complete set of batteries is [redacted] Battery life is well in excess of 100 hours continuous duty. A calibrated radium sample is supplied, making it possible to calibrate the instrument in the field. The price includes batteries, tubes, calibrated radium sample, shoulder strap and complete instructions.



SPECIFICATIONS

Ranges	.025, .05, .25, .5, 2.5 and 5 MR/HR
Sensitivity	Gamma
Size	4½" x 7¼" x 7"
Weight	6¾ lbs.
Shipping weight	10½ lbs.
Price complete	$299.50

PRI

World's largest manufacturers of portable radiation instruments

Bank Letter
July 1969

MME Form 40
(Revised Nov. 68)

Budget Bureau No. 42-R1368
Approval expires Dec. 1971

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

APPLICATION FOR FINANCIAL ASSISTANCE IN MINERALS EXPLORATION

Pursuant to Public Law 85—701 (72 Stat. 700; 30 U.S.C. 641)

NAME OF APPLICANT *(Full legal name and mailing address as they should appear on contract if one is executed.)*

Uranimum, Titanium Exploration & Development Corporation
3280 Round Top Drive, Honolulu, Hawaii 96822

APPLICANT DO NOT USE THIS BLOCK

DOCKET NUMBER

DATE RECEIVED

REGION

DIVISION CODE

BUSINESS ORGANIZATION *(Check one)*

INDIVIDUAL	
CORPORATION	X
PARTNERSHIP	
OTHER *(Specify)*	

STATE IN WHICH FIRM IS ORGANIZED
Oahu, Hawaii

LIST CORPORATE OFFICERS OR PARTNERS HERE, IF APPLICABLE

NAME	ADDRESS	TITLE
Arthur G. Gilman	2943 Kalakaua Ave.	President
William Crowder	4356 Punihi	Vice President, Sec.
William Petrine	3280 Round Top Dr.	Ex. Vice President & Gen. Manager
Dr. G. Donald Sherman	828 Onaha	Vice President & (Geogolist) Consultant

MINERAL(S) FOR WHICH YOU WISH TO EXPLORE
Uranium Ores and Rare Earths, Titanium

ESTIMATED COST OF PROJECT
Minimum $50,000.00

PROPERTY NAME	LOCATION COUNTY	STATE
State, Federal & Fee simple lands	Oahu Kauai Maui Molokai	Hawaii

GENERAL INSTRUCTIONS

Before filling out this application, please read the *OME Regulations for Obtaining Federal Assistance in Financing Explorations for Mineral Reserves* (30 CFR Chap. II). To assure prompt action, your application must provide all applicable material and information specified on the back of this application form. Avoid unnecessary correspondence and delays by submitting complete and accurate information. *Please submit two copies of this application and all accompanying papers* except as otherwise noted. Place your name and address on each sheet. Each item of information, maps, and reports required as a part of this application is described on the back of this form. Identify each attached statement by the item number to which it applies. If an item does not apply to your application, show the item number on your statement and after it write "not applicable." Maps or sketches should be used to supplement narrative descriptions of the property location and boundaries in item 2, existing mine workings and geology in item 3, and the proposed exploration work in item 5. When this information is not too complex, all of it may be shown on one map or sketch. All documents and other attachments submitted as a part of this application, except those in item 3(g) which you mark to be returned, become the property of the Government and will not be returned to the applicant. Send true copies, *not originals*, of leases, contracts, and other documents which are an essential part of your business records. *File this application with the Department of the Interior, U.S. Geological Survey, Office of Minerals Exploration, Washington, D. C., 20242, or with the nearest OME Field Office.*

CERTIFICATION

The undersigned, whether as an individual, corporate officer, partner, or otherwise, both in his own behalf and acting for the applicant, certifies that the information set forth in this form and accompanying papers is correct and complete, to the best of his knowledge and belief, and that he would not ordinarily undertake the proposed exploration under current conditions and circumstances at his sole expense.

January 8, 1970
DATED

Uranium, Titanium Exploration & Development Corp.
BY *(Signature)*

William Petrine, Ex. Vice President, Treas.
Gen. Manager
TITLE

William Petrine

A wilfully false statement or certification to any Department or Agency of the United States Government is a criminal offense.
U. S. Code, Title 18, Sec. 1001.

Financial Eligibility:

(a) Submit evidence of efforts made within 90 days preceding the filing of this application to obtain credit from your bank of account and at least one other banking institution or other private source of credit. Such evidence shall include (1) true copies of your letters to credit sources which show date of loan request, amount and terms requested, and proposed use of loan funds and (2) true copies of replies from credit sources. If the loan was offered under terms which you consider unreasonable, state why you consider them so.

(b) List names and addresses of affiliated, parent, or controlling companies or organizations and state extent and nature of their interest.

(c) State how you propose to furnish your share of the cost of the exploration work.

2. Applicant's Rights in Land:

(a) State your interest in the land and mineral rights, whether owner, lessee, purchaser under contract, or other. If you are not the owner, submit one true copy of the lease, contract, or other document (with address of owner) under which you control the property. Describe all liens, mortgages, or other encumbrances on the land and state book and page number and official place where recorded.

(b) State the legal description (section, township, and range; metes and bounds; patent number of claims) of the land upon which you wish to explore and all adjacent land which you own or control. Describe any part of the land or workings which should not be subject to Government royalty and liens. If the land consists of unpatented claims, state book and page number for each recorded location notice, including amended locations, and official place where recorded. State all the names by which you know the property.

(c) For all land or mineral rights encumbered or not owned, submit five copies of Lien and Subordination Agreements signed by owner on OME Form 52. If the agreements cannot be obtained, state reasons and whether you can furnish a performance bond.

3. Physical Description:

(a) Describe in detail and illustrate with maps or sketches all mining or exploration operations which you know have been or are being conducted upon the land. Include existing mine workings and all production facilities.

(b) State your interest, if any, in operations described in (a)

(c) State, if you know, the past and current production, supporting your statement with copies of settlement sheets, mine records, or published data if available.

(d) Describe known ore reserves, giving quantities and grades.

(e) Describe by narrative and maps or sketches the geologic features of the property, including ore minerals, geologic formations if known, and type of deposit (vein, bedded, etc.).

(f) If you have sampled the area you propose to explore, show where the samples were taken, describe sampling methods used, and provide copies of assay certificates. State your reasons for expecting to find ore.

(g) Send with your application at least *two* copies of all geologic or engineering reports, assay maps, or technologic information which you have, indicating whether you require their return.

4. Accessibility of Property:

(a) To aid the OME representative who may examine the property state name, address, and telephone number of person who will meet him; give directions for reaching the property; and describe accessibility of property and of any mine workings.

(b) Name the shipping and supply points and state the distances to the property.

5. Exploration Work:

(a) Describe fully the proposed exploration work giving individual footages and sizes of openings *for each item of work.* Use narrative, maps, plans, and sections as necessary. Show location of the proposed work as related to geologic features such as veins, ore-bearing beds, contacts of rock formations, etc. Show also the relation of the proposed work to any existing mine workings and to *land boundaries* or to the closest identifiable corner.

(b) If an access road must be built, show the proposed location on the property map and state the length, type and construction methods proposed.

(c) If an OME contract is executed, state how soon thereafter work would be started and finished. State your anticipated average daily or monthly rate of progress for each type of work.

6. Experience:

State your operating experience and background to conduct this exploration work and also that of the person who will supervise the work.

7. Estimate of Costs:

Furnish detailed estimates of the necessary costs for time and materials *for each item of the work proposed in 5(a)* under the headings listed below with a total for each heading and the estimated total cost of the work. Costs for any work to be performed by an independent contractor should be listed separately under category (a) below. Costs for any work that is not to be performed by an independent contractor should be listed under categories (b) through (g).

(a) Independent contracts. State the total cost of any proposed independent contract for all or any part of the work, and the number of units and the unit cost for each type of work, such as per foot of drilling, per foot of drifting, per hour of bulldozer operations, or per cubic yard of material moved. Cost estimates should be supported by bids from three contractors if possible. (*Note*—If none of the work is to be contracted, write "none" after this item.)

(b) Personal services. The cost of supervision, engineering and geological services, outside consultants, and labor should be itemized by numbers and classes of employees; rates of wages, salaries or fees; and periods of employment. State whether these services are available.

(c) Operating materials and supplies. List items of material and supplies giving quantity and price of each. Include under this heading power, water, and fuel, and units of equipment and tools costing less than $50 each.

(d) Operating equipment. List items of equipment and tools costing $50 or more per unit. Give specifications and indicate how each item is to be acquired—i. e., rented, purchased or provided by the applicant. If rented or purchased, state the estimated rental or purchase price. If furnished by the applicant, state condition and present fair market value.

(e) Initial rehabilitation and repairs. Describe the type and the cost of *initial* rehabilitation or repair of existing buildings, fixtures, installations (exclusive of mine workings), and movable operating equipment now owned by the applicant which will be used in the exploration work.

(f) New buildings, fixtures, installations. Describe each building, fixed improvement, and installation to be purchased, constructed, or installed for the exploration work, stating specifications and cost including labor, materials, and supervision.

(g) Miscellaneous. Describe the type and estimate the cost of repairs and maintenance of the operating equipment listed in 7(d). Do not repeat initial repairs listed in 7(e). Show also the costs of analytical work, accounting, workmen's compensation and employees' liability insurance, payroll taxes, and other required costs that do not fall within the previous categories. [*Note*—The Government will not contribute to costs incurred before the date of the contract, or to costs of or incident to: (1) acquiring, using, or possessing land and any existing improvements, facilities, buildings, installations, and appurtenances, or the depreciation and depletion thereof; (2) general overhead, corporate management, interest and taxes (other than payroll and sales taxes); (3) insurance (other than employees' liability insurance); and (4) damages to persons or property (other than authorized repair to or replacement of equipment or other property used in the work).]

MME Form 40
(Revised Nov. 68)

Budget Bureau No. 42-R1368
Approval expires Dec. 1971

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

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3280 Round Top Drive, Honolulu, Hawaii 96822

APPLICANT DO NOT USE THIS BLOCK

DOCKET NUMBER

DATE RECEIVED

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BUSINESS ORGANIZATION *(Check one)*

- INDIVIDUAL [ ]
- CORPORATION [X]
- PARTNERSHIP [ ]
- OTHER *(Specify)* [ ]

STATE IN WHICH FIRM IS ORGANIZED: Hawaii

LIST CORPORATE OFFICERS OR PARTNERS HERE, IF APPLICABLE

NAME	ADDRESS	TITLE
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William Crowder,	4356 Punihi	Vice President, Sect.
William Petrine,	3280 Round Top Drive	Exect. Vice President & General Manager.
Dr. G. Donald Sherman,	828 Onaha St.	Vice President & (Geogolist) Consulant.

MINERAL(S) FOR WHICH YOU WISH TO EXPLORE: Uranium ores and Rare Earths, Titanium

ESTIMATED COST OF PROJECT: Minimum $50,000.00

PROPERTY NAME: State, Federal & Fee Simple lands

LOCATION

COUNTY	STATE
Honolulu	Hawaii
Kauai,	
Maui	
Molokai	

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Uranium, Titanium Exploration & Development Corporation

January 8, 1970
DATED

William Petrine, Exct. Vice President & Gen. Manager
BY *(Signature)*

PROD
TITLE

William Petrine

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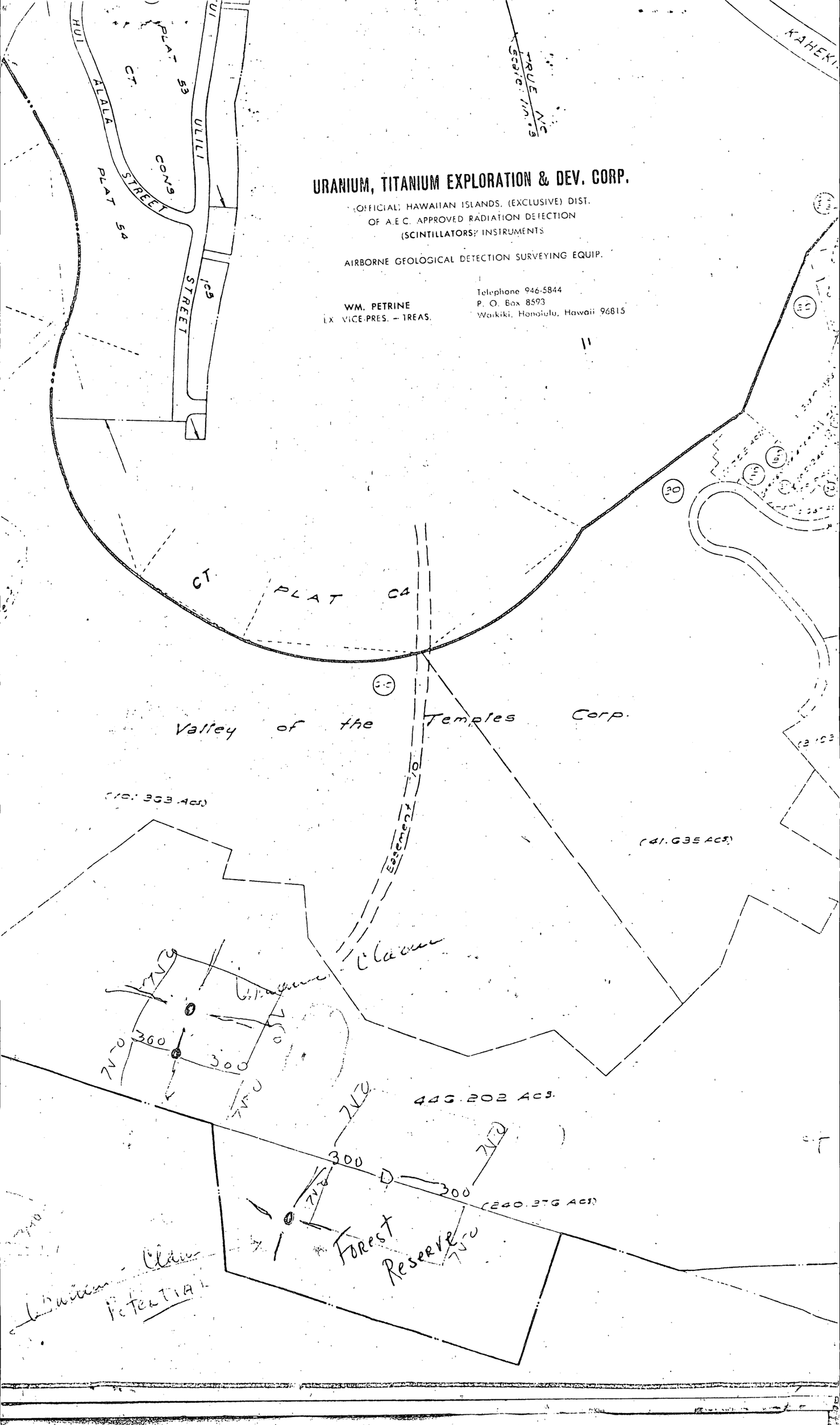
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Claim
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300
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(240.376 ACS)
Forest Reserve
Uranium - Claim
POTENTIAL

often occurs as continuous, deep deposits. The depth of these deposits ranges from 1 to 15 feet, with the average occurrence being less than 2 feet. The distribution of the soils rich in titanium oxide and the titaniferous clays is shown in the following map of the islands (figure 2). It is difficult to give a reasonable, accurate estimate of the tonnage of soil containing titanium oxide in each of these classes, because of the irregularity of the occurrence of the titaniferous-ferruginous laterite. The composition of Hawaiian soils having a high titanium oxide content is given in table 2.

TABLE 2. THE TYPICAL CHEMICAL COMPOSITION OF TITANIUM OXIDE DEPOSITS IN THE HAWAIIAN ISLANDS.

LOCATION OF DEPOSIT	OXIDE CONTENT IN PER CENT			
	SiO_2	Al_2O_3	Fe_2O_3	TiO_2
Waimea Canyon, Kauai	3.3	8.1	58.0	21.0
Waihee Point, Maui	18.1	9.6	48.7	10.7
Haiku, Maui	14.0	13.2	48.1	18.9
Waimea Canyon, Kauai	12.5	7.8	58.0	14.4
Waimea Canyon, Kauai	3.8	9.9	47.5	25.0
Kilauea, Kauai	3.6	19.7	45.0	8.5
Anahola, Kauai	28.5	25.8	9.9	24.4
Anahola, Kauai	25.5	21.8	19.9	20.0
Lanai City, Lanai	12.1	16.2	45.0	10.8
Near Meyers Lake, Molokai	13.8	7.2	56.6	15.2
Hawi, Hawaii	14.2	16.2	46.8	19.5
Waikolu, Molokai	25.0	11.8	27.4	8.4
Waimea Canyon, Kauai	3.9	5.8	60.8	26.0
Lower Forest Reserve, Molokai	7.8	3.6	60.4	24.0
Waimea Canyon, Kauai	7.4	12.8	60.2	16.4
Koolau Mountains, Oahu	39.0	29.6	9.9	17.6
Koloa Junction, Kauai	28.0	22.8	9.4	12.6
Lower Waimea Canyon, Kauai	1.8	2.8	58.8	34.9

DESCRIPTION OF TITANIFEROUS DEPOSITS

Titaniferous-ferruginous laterite. This type is always found on slopes where the existing climate has definite, alternating wet and dry seasons. Such a climate is conducive to rapid chemical weathering under conditions favoring the alternating reduction and oxidation conditions. In general, these areas occur just below the wet, tropical forest where weathering conditions favor the solution of iron and titanium through their reduction. Certain conditions are apparently necessary before titanium oxide can accumulate in these deposits, and they are as follows:

1. Conditions favoring intense chemical weathering under both reducing and oxidizing conditions. (Under such conditions titanium is released from its normally weathering-resistant minerals and will become soluble in the acid, and probably very reducing, environment.)
2. Conditions favoring the movement of titanium in the percolating water to an area of accumulation. (This hypothesis would have the dissolved titanium moving in the near-surface percolating waters which would carry the titanium to a dryer and more oxidizing environment, where it would be deposited.)

OME Form 7
(2/63)

OFFICIAL FILE COPY

Date	Surname	Code
1/12/70	Emerick	120
		120
		220

January 12, 1970

Memorandum

To: The File

From: Harold Kirkemo
Chief, Office of Minerals Exploration

Subject: OME-6828 (Uranium-Rare Earths-Titanium)
Uranium, Titanium Exploration and
Development Corporation
Oahu, Kauai, Molokai, Maui, Hawaii

The Applicant has not replied to our letter of December 7, 1970. Accordingly, the subject docket is transferred to the inactive file and the application considered as having been withdrawn.

Harold Kirkemo

Harold Kirkemo

cc: Director's File
Mineral Resources File
OME Docket
OME Reading File
Mr. Emerick
130
OME Region II

WLEmerick/bsl 1/12/70

MME Form 7
(2/63)

OFFICIAL FILE COPY

Date	Surname	Code
12/7/70	Emerick	120E
		120
12/7	cal	220
		120M

AIRMAIL

Uranium, Titanium Exploration and
Development Corporation
3280 Round Top Drive
Honolulu, Hawaii 96822

DEC 7 1970

Re: OME-6828 (Uranium, Rare Earths, Titanium)
Uranium, Titanium Exploration and
Development Corporation
Oahu, Kauai, Molokai, Maui, Hawaii

Gentlemen:

On October 27, 1970, we wrote you suggesting that you withdraw your application pending results of additional work on your part to outline more specific targets of exploration. Will you please inform us of your plans regarding your application. If you have decided not to pursue it further, will you please so inform us.

If we do not receive a reply from you within 30 days from the date of this letter, we will assume that you are no longer interested in your application and we shall consider it as having been withdrawn.

Sincerely yours,

Harold Kirkemo (gla)

Harold Kirkemo
Chief, Office of
Minerals Exploration

cc: Director's Reading File
Mineral Resources
OME docket
OME Reading File
OME Region II
Mr. Emerick

WL Emerick/gla 12-7-70

MME Form 7
(2/63)

OFFICIAL FILE COPY

Date	Surname	Code
10/27/70	Emerick	120E
		120
10/27	Cac	220
		120M

AIRMAIL

OCT 27 1970

Uranium, Titanium Exploration and
Development Corporation
3280 Round Top Drive
Honolulu, Hawaii 96822

Re: OME-6828 (Uranium, Rare Earths, Titanium)
Uranium, Titanium Exploration and
Development Corporation
Oahu, Kauai, Molokai, Maui, Hawaii

Gentlemen:

Our review of your application for financial assistance indicates that the work proposed is more in the nature of prospecting than exploration. Such work and the staking of additional claims does not qualify for assistance under the OME program. Accordingly, we suggest that you withdraw the application.

Exploration under the OME program is limited to or must be directed to testing specific exploration targets which have been located by previous work. The program excludes participating in work to locate these targets or to obtain geologic and assay information to plan a program to explore them.

Should your continued prospecting and sampling program outline more specific targets than your application shows, we shall be pleased to consider a new proposal. You may reopen the application at a later date by refering to this OME docket number, and furnishing the information pertinent to a new proposal. This information should include new letters to and from two banks dated within 90 days of filing the new material, evidence of your rights to the land, a clear statement of the plan and method of exploration proposed, and a detailed estimate of costs.

The 102 cancelled checks submitted with your application were noted in our review, and are being returned to you under separate cover.

Please advise us regarding the suggested withdrawal of your application.

Sincerely yours,

Harold Kirkemo (gla)

Harold Kirkemo
Chief, Office of
Minerals Exploration

cc: Director's Reading file
Mineral Resources
OME docket
OME Reading file
OME Region II
Mr. Kirkemo

HKirkemo/gla 10-27-70

October 19, 1970

Uranium, Titanium Exploration
& Development Corporation
3280 Round Top Drive
Honolulu, Hawaii 96822

Subject: OME - 6828

Gentlemen:

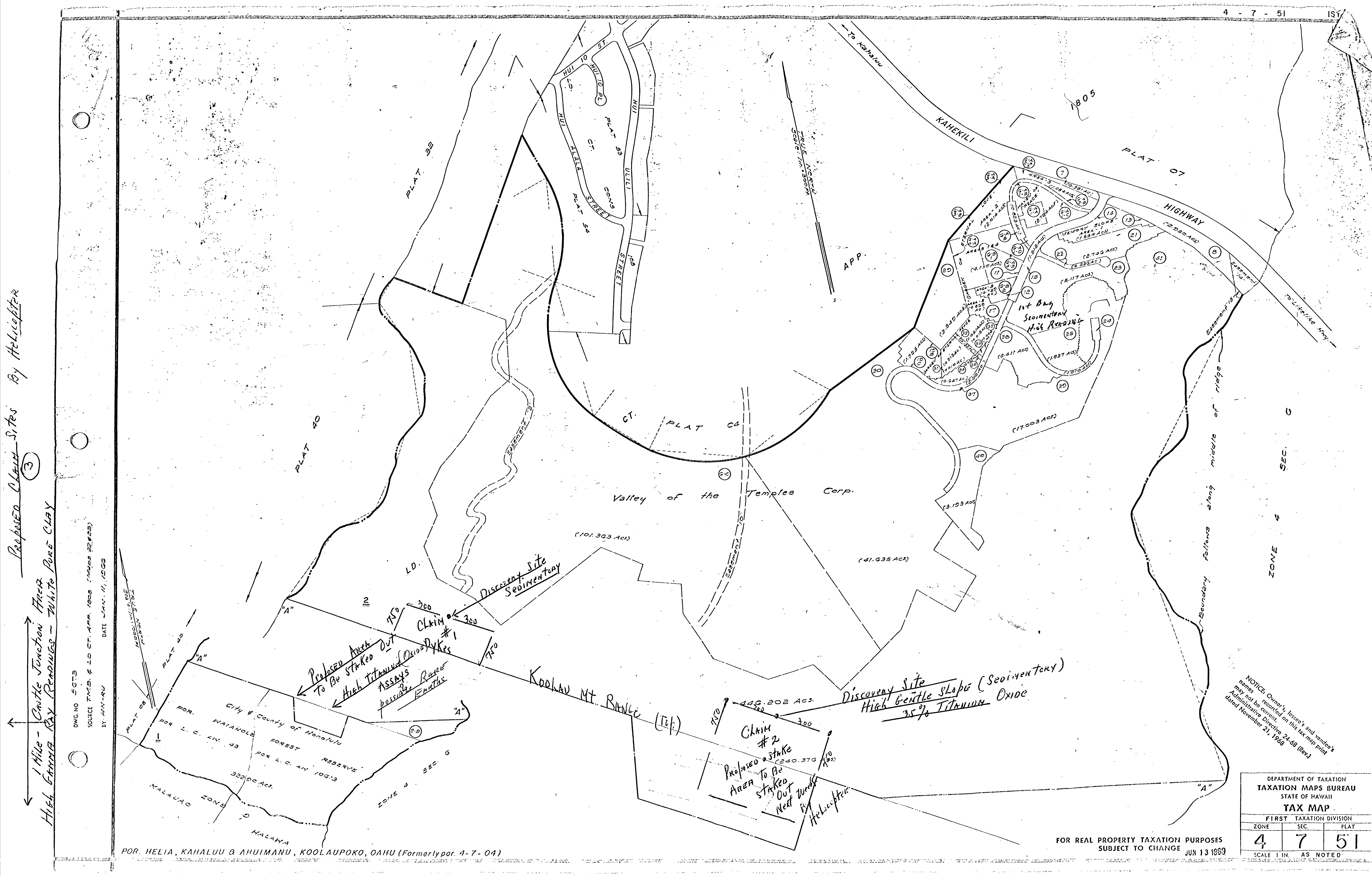
Your application for exploration assistance, dated January 8, 1970, submitted to our office at Washington, D. C., has been assigned Docket No. OME-6828.

Please identify all future correspondence relating to your application by this docket number.

Sincerely yours,

Harold Kirkemo
Chief, Office of
Minerals Exploration

Copy to 2-11 with copy
of [illegible] map


4 - 7 - 51 IST
Proposed Claim Sites (3) By Helicopter
1 Mile - Castle Junction Area
High Gamma Ray Readings - White Pore Clay
DWG. NO 5673
SOURCE T.M.B. & LD CT. APP. 1805 (Maps 22 & 23)
BY HN-RU
DATE JAN. 11, 1966
To Kahaluu
KAHEKILI HIGHWAY
PLAT 07
1805
To Likelike Hwy.
HUI IO ST.
HUI IO PL.
HUI ALALA STREET
ULILI STREET
PLAT 53
PLAT 54
LD. CT. CONS. 105
PLAT 32
PLAT 40
PLAT 08
TRUE NORTH Scale: 1 in. = 300 ft.
APP.
CT. PLAT 64
Valley of the Temples Corp.
(101.363 Acs.)
(41.635 Acs.)
(17.003 Acs.)
(3.193 Acs.)
Easement "2"
Easement "10"
Easement "13"
Easement "14"
ETERNAL LOVE
HAVEN OF PEACE
MEMORY SLOPE AREA - 1 (1.554 Acs.)
GARDEN OF ETERNAL PEACE
1st Bag Sedimentary High Reading
Boundary follows along middle of ridge
ZONE 4 SEC. 6
LD.
"A"
2
1
Discovery Site Sedimentary
CLAIM #1
300
750
Dykes
Proposed Area To Be Staked Out
High Titanium (Oxide) Assays possible Rare Earths
KOOLAU MT. RANGE (TOP)
446.202 Acs.
CLAIM #2
Proposed Stake
(240.376 Acs.)
Proposed Area To Be Staked Out Next Week By Helicopter
Discovery Site High Gentle Slope (Sedimentary) 35% Titanium Oxide
POR. City & County of Honolulu WAIAHOLE FOREST RESERVE
POR L. C. AW. 43
POR L. C. AW. 10613
322.96 Acs.
KALAUAO ZONE 9
HALAWA
ZONE 4 SEC. 6
NOTICE: Owner's, lessee's and vendee's names recorded on this tax map print may not be current. Administrative Directive 24-68 (Rev.) dated November 21, 1968
POR. HEEIA, KAHALUU & AHUIMANU, KOOLAUPOKO, OAHU (Formerly por. 4-7-04)
FOR REAL PROPERTY TAXATION PURPOSES
SUBJECT TO CHANGE JUN 13 1969
DEPARTMENT OF TAXATION
TAXATION MAPS BUREAU
STATE OF HAWAII
TAX MAP
FIRST TAXATION DIVISION
ZONE 4 SEC. 7 PLAT 51
SCALE 1 IN. AS NOTED