MANHATTAN DISTRICT HISTORY
BOOK VII - FEED MATERIALS, SPECIAL PROCUREMENT AND GEOGRAPHICAL EXPLORATION

VOLUME 2 - GEOGRAPHICAL EXPLORATION

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MANHATTAN DISTRICT HISTORY

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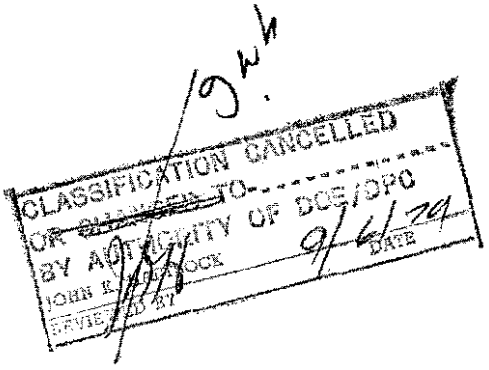

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FOREWORD

This second volume of Book VII of the Manhattan District Histo covers the geographical exploration carried on under the direction o the District, from its inception in the spring of 1943 until 31 Dece 1946. It describes the general methods and procedures by which this exploration was prosecuted, both in the library, bibliographically, in the field, physically, and how far its major purpose was effected the determination of the world's resources of the ores from which th principal food materials were obtained. The results of the explorat were recorded in a multiplicity of reports, brief summaries of which pear at the end of this volume, in Appendix B; other appendices cont maps and charts (Appendix A) and a list of referenced documents (App C).

Volume I of Book VII covers "Food Materials and Special Procur ment".

November 1947.

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MANHATTAN DISTRICT HISTORY

BOOK VII, FEED MATERIALS, SPECIAL PROCUREMENT AND GEOGRAPHICAL EXPLORATI

VOLUME 2, GEOGRAPHICAL EXPLORATION

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SUMMARY

1. General. - The Murray Hill Area was established, with Maj. Paul L. Gravin as Area Engineer, on 15 June 1943, for the major purpose of geographical exploration for, and later development of, the basic raw materials on which the entire Manhattan Project was dependent. E termination and evaluation of the world's resources of uranium ores w first undertaken, and the program was later expanded to include also thorium ores.

A contract, No. W-7405 eng-78, effective 12 May 1943, was made Union Mines Development Corporation, a subsidiary of Union Carbide an Carbon Corporation, for carrying out the work. The contract provided that all costs should be reimbursed by the Government, with no fixed or profit to the contractor.

The organization of Union Mines Development Corporation, with offices at 30 East 42nd Street, New York City, reached a peak of profes al and administrative personnel in 1944. It was gradually reduced d during 1945, and early in 1946 all activities were curtailed and the company was directed to start bringing the project to a close. At t end of the year this had nearly been accomplished.

The Contractor's operations were performed in four divisions: the bibliographic search division, the field exploration division, t exploration research division, and the metallurgical research divisi

The Bibliographic Search entailed the examination of all avail literature and the preparation of reports on all recorded occurrence

of uranium ores. About 67,000 volumes were examined, more than half foreign languages; 56 geological reports were completed, dealing with known and possible occurrences of uranium and thorium ores in more th 50 countries.

The Field Exploration Division sent out field parties of geolog and mining engineers who made examinations in more than 20 foreign co and in 36 states in this country. The results of these explorations recorded in reports, about 45 of which dealt with the carnotite ores the Colorado Plateau Region alone.

The Exploration Research Division dealt with the development of information and methods for field exploration, in two principal field research as to the applicability of geophysical methods of prospectin and mineralogical research.

The geophysical research was concerned with the development of: improved portable models of Geiger-Muller counters for field use; pro cedures for the use of these counters for quantitative or semi-quanti assaying; laboratory counters for accurate quantitative assays; and a active methods of locating and measuring ore reserves. An outstandin result of this research was the production of an extremely practical Geiger-Muller counter of light weight, rugged construction and small size - an accomplishment in which the Union Mines' geophysicists, the U. S. Geological Survey and the Canadian Government all took part.

The mineralogical research operated first in the research labor tories of the Union Carbide and Carbon Corporation at Niagara Falls, N. Y., and, later, in a laboratory established at the New York office

This work resulted in: the development of a device for measuring the maximum sensitivity of the bead test, which was the standard chemical method of testing for the presence of uranium; the recommendation that lithium fluoride be used instead of sodium fluoride as a flux in the test; and the determination of various other useful facts in connection with uranium-bearing and other similar ores. This Division made a co lation of all previous data and considerable new data on uranium mine alogy, and prepared a complete report on the investigation of the opt properties of uranium and thorium, and a manual on the mineralogy of uranium ores. In December 1943 the Contractor arranged for all chemi assays for the desired oxide to be made thereafter in the laboratories of the Linde Air Products Co., at Tonawanda, N. Y.

The Metallurgical Research Division devoted its efforts first t the development of suitable processes for concentrating carnotite ore from the Colorado Plateau Region, but before their contract was finis they had done work on nearly every type of uranium ore occurring thro out the world. Although this work may be considered as preliminary i it promises to be very useful in connection with future studies. The Division made a working agreement with the Denver Equipment Co., Denv Colo., whereby the research investigations were carried on in that company's laboratories, with the use of the company's facilities and many of its personnel.

The combined results of the field reconnaissance and the litera ture search have indicated that the productive possibilities of variou countries may be generally classified as listed below.

For Uranium

Excellent: Belgian Congo

Good : Canada, United States, Sweden

Fair : Czechoslovakia, Portugal, Union of South Africa

Poor : Madagascar, Australia, Brazil, England

Unknown : Russia (where potential possibilities could be gr
Bulgaria

For Thorium

Excellent: Brazil, India

Fair : Netherlands East Indies, Malaya, Siam, United Stat
Korea

All other countries appear to have very poor production possibi
ties.

b. Acquisition of Land. - Shortly after the contract with Und
Mines Development Corporation had been made, it became apparent that
acquisition of land by the Contractor in the interest of the Governm
should be authorized, and the contract was accordingly amended by Sup
plement No. 2, dated 13 August 1943, to make provision for such acqui
sition. Four properties in the Colorado Plateau Region were acquired
for the Government at a cost of about $276,000. They were (a) Germa
and Belcher Claims, (b) Curran and Wade Leases, (c) North Continent Mi
Inc., Property, and (d) Gateway Alloys Property. An option was obtai
on another property in this Region, the Kirk, Nilda, and Jeanette Cla
but the results of further examination were disappointing and therefo
the option was relinquished. Some claims, referred to as Ventures, I

Claims, in the Great Bear Lake Area, Northwest Territories, Canada, a acquired by Ventures, Ltd., for the account of Union Mines Development Corporation, under the terms of a proposed agreement which was to be a subcontract for a general reconnaissance survey. When the Canadian Government, on 15 September 1943, issued orders reserving to the Gov all radio-active substances henceforth produced in the Yukon Territo and the Northwest Territories of Canada, and indicated that it prefe red to prosecute its own exploration program, all arrangements betwe Union Mines and Ventures were terminated and, under authorization of Manhattan District, the Contractor directed Ventures, Ltd., to assign to the Canadian Government the mining claims which were being held fo the account of the Contractor.

3. Administration. - The total expenditures by the Contracto on the entire project amounted to approximately $2,409,000, made up a follows:

Bibliographical Search		$240,000
Field Exploration		
Foreign	$266,000	
Domestic	427,000	963,000
Land and Property		276,000
Research		129,000
Administration and Overhead		799,000
Total		$2,409,000

Lt. Col. Paul L. Guerin served as Area Engineer, Murray Hill Are from its inception in June 1943 until March 1946. He was succeeded by

Lt. Col. A. W. Oberbeck, who served as Area Engineer for about one month, until the Murray Hill Area was absorbed by the Manhattan Area Madison Square April 1946. Other officers who served in the Murray Hill Area were: Lt. Col. Gordon B. Page, Major Hubert D. Kaiser, Captain G. P. Thomp and 1st Lt. Robert D. Hininger.

The principal civilian personnel were: Geologists George C. Selfridge and George H. Bain; Mining Engineer Frank J. Belina (Chief the Grand Junction, Colo., Sub office); and Auditor Elmer C. Smith.

The peak number of the employees of Union Mines, 129, in July 1 was classifiable as: 61 field professional; 39 office professional; and 29 administrative and clerical.

The Murray Hill Area was rated as highly classified throughout the project, and every effort was used to maintain protective securit at all times and in all places. Particular efforts were directed tow concealing the real purpose of Union Mines and the exact material in which it was interested. The facts that the parent company, Union Carbide and Carbon Corporation, was the world's largest user of cobal and that it was also a large user of tantalum, vanadium and other materials, served as useful "blinds" in maintaining the desired con- cealment. Particular care was exercised in connection with the field geologists; when they were sent out of the country they were not perm ted to take with them any maps, data, or technical equipment which mi indicate their connection with the District or the Army, and all poss compromising material was forwarded in diplomatic pouch to the U. S. Military Attache nearest the destination.

Union Mines, and its parent company, Union Carbide and Carbon

Corporation, provided for the employees ample health and welfare ser including medical facilities, insurance, and savings and retirement plans. Medical-aid and hospitalization plans were also available locally.

MANHATTAN DISTRICT HISTORY

BOOK VII, FEED MATERIALS, SPECIAL PROCUREMENT AND GEOGRAPHICAL EXPLORATION
Volume 2, Geographical Exploration

SECTION 1 - GENERAL

1-1. Establishment of Murray Hill Area.

a. First Area Engineer. - For the major purposes of geographical exploration for, and later development of, the basic raw materials on which the entire Manhattan Project was dependent, the Murray Hill Area was established on 15 June 1943, with the assignment on that date of Major Paul L. Guarin, as Area Engineer. This action followed the signing of Letter Contract No. W-7405 eng-78 (available in District classified files) on 11 May 1943 by Colonel K. D. Nichols, the Contracting Officer, and the acceptance thereof for the Contractor, Union Mines Development Corporation, by its president, Mr. J. R. Van Fleet, on 24 May 1943. This corporation was a subsidiary of Union Carbide and Carbon Corporation, and was organized for carrying out this work.

b. Contract. - Under the date of 17 April 1944 and effective as of 11 May 1943, a final contract (available in District classified files) was executed by both parties, superseding the letter contract.

c. Features of contract. - In accordance with the contract, work on the project was performed by Union Mines Development Corporation with the entire cost reimbursible by the Government, and with no fixed fee or profit to the Contractor.

d. Security. - Union Mines, in the prosecution of its work,

made every effort to conceal its real purpose and particularly the exact material in which it was interested. All of the Contractor's employees were investigated and cleared from a protective security standpoint, and every effort was made to safeguard all classified material.

1-2. Establishment of Union Mines Development Corp. - In June 1943 Union Mines Development Corporation rented office space on the 18th floor of 50 E. 42nd Street, New York City, installed a skeleton staff, and began the recruiting of personnel. Field exploration and bibliographical research had begun by July 15, and at the end of that month a staff of 40 full-time employees was engaged on the project. By the middle of 1944 the Contractor's organization had reached its peak of 129 professional and administrative personnel. Under the organization developed, legal counsel and control accounting for the project were established in these respective departments of the parent company, the Union Carbide and Carbon Corporation. All other administrative functions, as well as the executive and technical functions, of the organization were established in the Union Mines Development Corporation. See Appendix A-7, Organization Chart, Union Mines Development Corporation. The organization was very gradually reduced in size during 1945 primarily because of a reduction in foreign exploration activities. In early 1946 all activities were curtailed and Union Mines was directed to begin to bring the project to a close. No further foreign exploration was in progress after 1 January 1946. Domestic exploration was discontinued in September, 1946, and by the end of the year, the organization was reduced to about 10 administrative personnel and 26 professional employees who were engaged in completing biblio-

graphical and mineralogical research work and preparing final reports. (Active work was discontinued completely on 31 January 1947 and the contract was allowed to expire on 30 April 1947.)

1-3. Description of Project. - The project assigned the Murray Hill Area was officially described as an exploration and development program to determine and evaluate the entire world's resources of uranium ores (later expanded to include thorium ores); also, to make recommendations for the acquisition of the strongest possible control of the production and disposal of such new resources as might be accessible and were considered to have commercial value, and to make recommendations for suitable methods of exploitation of such resources as were found. A major first aim of the project was to find as quickly as possible where, if anywhere in the world, any new large concentrations of the desired ores might be located; consequently little time was wasted on the investigation of minor traces, once the absence of rich or commercially productive fields had been determined; only roughly approximate estimates were made, during the first surveys, of the extent of the minor ore occurrences.

Operations on the project by the Contractor were segregated into four divisions, namely, the bibliographic search division, the field exploration division, the exploration research division, and the metallurgical research division. This segregation was used in the preparation of the monthly progress reports on the project that were submitted during the year to higher authority by the Area Engineer. An important additional function of Union Mines was acquisition of mineral land in the

United States for the Government.

1-4. Bibliographic Search.

a. Bibliographical reports relative to recorded occurrences of uranium ores were prepared by the Contractor. Primarily, the reports served a two-fold function; first, they provided a basis for the early appraisal of the relative importance of the various countries so far as the objectives of the project were concerned and, second, they contained invaluable information for the examining engineers dispatched by the Contractor, with the approval of the Area Engineer, to various countries. Approximately twenty-eight employees of the Contractor were engaged on searching literature bearing on the objectives of the project. Most of these employees had geological training, and, as a group, they were able to translate accurately practically all of the foreign languages in which pertinent information had been recorded. A total of about 67,000 volumes were examined, more than 50 percent of which were foreign language publications. New literature sources of information were constantly disclosed in the course of the search.

The bibliographic search division used recognized bibliographies of geological, mineralogical, mining, etc. publications. (Bibliography of the Geological Society of America, Annotated Bibliography of Economic Geology, U. S. Geological Survey Bibliographies, etc.) In addition, all back issues of all such publications which were available in the New York Public Library, the N. Y. Engineering Society Library, the Geographical Society Library, the Library of Congress, and various University libraries were checked.

b. Fifty-six geological reports were completed by the division, directed toward a better understanding of known and possible uranium and thorium occurrences in more than 50 countries. These reports covered in general those countries that either appeared to have the best possibilities for the discovery of commercial deposits of uranium or thorium or were within the sphere of influence of the United States. They are on file in the Office of New York Directed Operations and the Office of Special Projects, Washington, D. C. All the reports were considered preliminary reports, under the reasoning that not until the mission of the division had been completed would it be assumed that the possibilities had been exhausted for uncovering additional pertinent information relative to each and every country. In addition, special translations of pertinent articles were prepared at the request of the Contracting Officer for the use of the Murray Hill Area Staff. Details of the reports completed by the division are presented in Appendix B-1. The status of bibliographical search, at the conclusion of the project, is shown graphically and geographically on a map in Appendix A-1, "World Bibliographic Research - as of 31 December 1946".

c. The bibliographical search of Union Minas has made available to the Manhattan District a very nearly complete file of references and abstracts concerning occurrences of uranium and thorium throughout the world as well as a sizable library of reports prepared by the Bibliographic Unit covering the geology of parts of the world known to be or believed to be possible sources of uranium (App. B-1). The work of the bibliographical unit was used extensively as a basis for estimates

and recommendations by the technical staff of the Manhattan District relative to the world supply and distribution of uranium and thorium.

1-5. Field Exploration Division.

a. By November 1943 the Contractor had recruited 62 experienced geologists and mining engineers; this professional field exploration force advanced to 67 by the end of the year, with about 80 percent of the personnel in the field at all times. Approximately two-thirds of the force, comprising about 8 separate field parties of from one to four men each was engaged in field work in the Colorado Plateau Region, mapping and evaluating the carnotite ore-bearing areas, with headquarters at Grand Junction, Colorado; the remainder was engaged in field work either in other sections of the United States or in foreign countries, comprising parties of from one to three men, with their headquarters at the New York, N. Y., offices of the Contractor. (App. A-2.)

Field exploration parties, for reasons of security, performed their assigned tasks in a manner typical of large mining corporation exploration activities. After assimilating all information available in the bibliographic search division on possible interesting mineral occurrences in a given country, the general geology of the area, the pertinent mining laws, the principal mineral industries, etc., the party chiefs made arrangements through the Carbon and Carbide Corporation or Carbide Carbon through their own contacts, to meet influential geologists, engineers, and mining company officials in the country to be visited. Upon arrival, examination of critical areas was arranged by these contacts under the pretense of examination for tungsten, molybdenum, vanadium, or other

allied metals.

b. During the course of its operations, Union Mines furnished reports on exploration work in more than 20 foreign countries. Reports were prepared based on the results of the field studies in each of the foreign countries in which examinations were made and on each of the occurrences examined in the 36 states (including the Colorado Plateau Region) which were visited. Approximately 45 detailed reports including maps, stratigraphic descriptions, and ore calculations and measurements were prepared covering the entire carnotite area of the Colorado Plateau Region. (App. A-3, A-4, B-2, B-3.)

c. Union Mines foreign exploration program was the least thorough and most incomplete of the various projects under the contract inasmuch as this work was the first to be curtailed by decision of the District Engineer; the last field party to be authorized by the District Engineer departed the United States in the fall of 1945. However, as a result of its very preliminary and cursory examinations throughout the world, facts were obtained leading to an improved knowledge of the world-wide distribution and occurrence of uranium on which Manhattan District geologists and consultants could base preliminary estimates and prepare recommendations for further and more detailed exploration work to be performed by the area's own geologists, or other personnel. Subsequently, the area's geologists visited Sweden, Peru, Brazil, Uruguay and South Africa, and reports of these investigations are listed in Appendix B-2. The domestic exploration program was considerably more thorough than the foreign exploration program. Particularly in the Colorado Plateau Region,

Union Mines final report (App. B-3: 103) coordinating all of the individual area reports in that region represents a detailed initial appraisal of the resources and the possibilities for production in the Region. This, in conjunction with the information available from the U.S. Geological Survey and Bureau of Mines, formed a good basis for such further detailed surface and subsurface exploration work, development, and exploitation as the Atomic Energy Commission might desire. In addition, as a result of its exploration program in the Colorado Plateau region, Union Mines acquired for the Government four separate properties each comprising a large number of patented and/or unpatented mining claims which were believed to represent the best of the known ore deposits in the Plateau Region then available for sale, and were also believed to be important purchases for strategic reasons. These properties were acquired for the Government at a cost of approximately $276,000.

1-6. Exploration Research Division.

a. Investigations of the Exploration Research Division were centered in two fields, namely, research as to the applicability of geophysical methods of prospecting, and mineralogical research. Both fields of endeavor had as their objective the development of new information that would be of value to the exploration field forces in their search for and examination of uranium or thorium occurrences.

b. Research as to the applicability of geophysical methods of prospecting was begun in June 1943 and proceeded as follows:

(1) In August Mr. Henry Faul, a geophysicist on the staff of the Contractor, prepared a report entitled "Opinions and

recommendations regarding future geophysical work on radioactive deposits." During the same month, the Contractor completed arrangements whereby the services of Dr. Clark Goodman, a geophysicist on the faculty of the Massachusetts Institute of Technology, was retained on a consulting basis, and in September Dr. Goodman prepared a report entitled "Radioactive methods of prospecting for carnotite ores"; this report included a discussion of the various types of geophysical instruments and their respective applicability, availability, and cost. Neither of these two reports was formally submitted by the Contractor to the Area Engineer inasmuch as the information contained therein was later consolidated in a final comprehensive report entitled "Development of Portable Geiger-Muller Instruments for Field Exploration", 23 October 1945 (App. B-4: 7).

(2) In October, following completion of necessary arrangements by the Contractor, an investigation was made in the electronic laboratories of the General Electric Company, at Schenectady, N. Y., of the possible application of radar and electronics to the detection and evaluation of uranium occurrences. As a result of this investigation, the conclusion was reached that radar and electronics were not susceptible to such an application.

(3) In January, Mr. Warren D. Mateer, a geologist on the staff of the Contractor, undertook the design of an improved light-weight Geiger-Mueller counter for field use. Dr. Goodman joined Mr. Mateer on this work in March, and when Mr. Mateer was given a field assignment in May, Mr. Faul joined Dr. Goodman on the work.

(4) In April, the objectives of the geophysical research program were determined to be as follows:

(a) The design and manufacture of improved portable models of Geiger-Muller counters for field use.

(b) The development of procedure whereby the portable counters could be used by field men for quantitative or semi-quantitative assaying.

(c) The development and manufacture of several laboratory counters, with automatic recording devices, capable of providing accurate quantitative assays, which would eventually supplant, partly or wholly, assaying by chemical methods.

(d) Research looking toward the application of radioactive methods to locate and delimit ore reserves, with initial efforts confined to applications in the carnotite area of the Colorado Plateau Region. The first step in this research was to be an attempt to develop a method of obtaining information from an area wider than the diameter of a drill hole.

(e) The geophysical research work of Union Mines resulted in the development and manufacture of a type of Geiger-Muller counter which is extremely practical for the use of field geologists in the examination and evaluation of uranium or supposed uranium occurrences. The value of these counters lies in their light weight, rugged construction and small size. Cooperation between the Union Mines' geophysicists, the U. S. Geological Survey and the Canadian Government resulted in the development of better machines for this work by all

three agencies. In addition, Union Mines developed a portable drill hole counter for use in logging drill holes primarily designed for use in the Colorado Plateau Region, which may be of some value in future ore reserve determination work in that Region. A considerable amount of research was also done on the use of the laboratory Geiger-Muller counter developed by the Chicago Metallurgical Laboratory for the quantitative assaying of uranium and thorium samples. This work was directed toward calibration of the machine for assaying and the study of equilibrium, temperature, volume and weight factors.

d. Mineralogical research was begun in October 1943 and proceeded as follows:

(1) The initial investigation, which was made in the research laboratories of the Union Carbide and Carbon Corporation, at Niagara Falls, N. Y., had as its objective the qualitative and quantitative interpretation of the bead test for uranium. The investigation was completed in December with the following results:

(a) The development of a device for measuring the maximum sensitivity of the bead test.

(b) The recommendation that lithium fluoride be used as a flux in the bead test rather than sodium fluoride.

In general terms, the bead test for uranium consists of the following principal procedures: pulverize suspected uranium bearing material with mortar and pestle; mix pulverized material with several times as much lithium fluoride; heat to white heat a loop of platinum wire approximately 1/8" in diameter; place wire loop in prepared mixture;

completely fuse mixture on loop with blowpipe and alcohol or gas flame. The presence of uranium is indicated by yellow fluorescence of the cold bead under ultraviolet light, and the intensity of the color is a measure of the quantity of uranium present.

(2) In December the Contractor completed arrangements whereby all chemical assays for the desired oxide would thereafter be made in the laboratories of the Linde Air Products Co., at Tonawanda, N. Y.

(3) In February the Contractor established a mineralogical research laboratory at its New York, N. Y., offices, with Mr. D'Arcy George, a mineralogist, formerly with E. J. Lavino & Co., in charge. By the end of the year the laboratory was completely equipped, the equipment including two microscopes with accessories and necessary chemical apparatus and reagents, for microscopic and chemical examination of ores and minerals of all types. In the course of the year the laboratory examined a large number of ore and mineral samples submitted by the field exploration division, prepared pertinent instructions and information bulletins and assembled a museum collection of uranium ores for the use of the field exploration staff, and analyzed metallurgical products submitted by the metallurgical research division. The following facts were established as a result of the mineralogical research program:

(a) The bead test was proved to be reliable in indicating the presence of uranium in an ore or mineral down to a minimum of about 0.01 percent of the U_3O_8; it is not reliable down to a minimum grade of 0.001 percent of U_3O_8, as had previously been supposed.

(b) Tungsten in ores and minerals will fluoresce and may be mistaken for uranium under certain conditions.

(c) Ultraviolet light is of limited usefulness in prospecting for uranium minerals inasmuch as few of the desired minerals are naturally fluorescent and only one of these - autunite - is common.

(d) Nonfluorescent uranium minerals can be made to fluoresce by spraying them with dilute acid.

(e) Carnotite is the only appreciable source and probably the only source of uranium in carnotite ores.

(f) The grade of carnotite flotation concentrate is largely limited by the excessive amount of calcite that is floated with the carnotite and associated vanadium minerals.

(g) The work of Union Mines mineralogists has resulted in a compilation of all previous data on uranium mineralogy in addition to a considerable amount of new data resulting from studies in conjunction with the work of the field geologists and metallurgists and represents a firm base for further mineralogical studies.

(h) A complete report on the investigation of the optical properties of uranium and thorium and the mineralogy of uranium ores was prepared (App. B-4: 4).

1-7. Metallurgical Research Division.

a. Investigations of the Metallurgical Research Division in the beginning were devoted to the development of suitable processes for concentrating carnotite ores from the Colorado Plateau Region. By

the close of 1943, preliminary testing of the Uravan type of ore had been completed and the preliminary testing of the other types of ore from the region was in progress. A research investigation, directed toward the development of suitable processes for obtaining pitchblende concentrate from Jamestown, Colorado, fluorite ores, was completed in 1944. (App. B-5: 5.) In addition, toward the end of the contract, work was done on nearly every type of uranium ore occurring throughout the world. The metallurgical research staff comprised two of Union Mines' engineers and a varying number of Denver Equipment Company laboratory personnel as required. (Reports of all studies are listed in Appendix B-5) The metallurgical research work by Union Mines should be considered as of a somewhat preliminary nature but the results of this work may prove to be of some help in future studies of beneficiation and metallurgical processes for uranium ores.

b. The division was activated in September 1943 with the appointment of Mr. R. W. Handley, formerly metallurgist and director of research for Union Miniere du Haut Katanga, as chief of the division. Mr. Carl W. Sawyer, formerly metallurgist for the United States Vanadium Corporation, was employed on 12 December to assist Mr. Handley. Work of the division proceeded as follows:

(1) By 18 October a working agreement had been reached with the Denver Equipment Co., Denver, Colo., whereby the research investigations of the division would be made in the laboratories of that company, which had complete facilities for the accomplishment of the investigations contemplated. Moreover, the company's laboratories were

relatively near the Colorado Plateau Region, and the agreement provided that all the investigations would be under the direct supervision and control of Union Mines personnel.

(2) The working agreement with Denver Equipment was replaced on 1 November by a contract which included provisions to the effect that Union Mines had permission to use all the batch laboratory facilities that Denver Equipment maintained for ore treatment studies; that any new equipment needed would be obtained on request of Union Mines and at its expense; that as many of Denver Equipment's staff of trained technicians as could be spared would be assigned to the work, but Union Mines could accept or reject the services of such personnel as it deemed advisable; and that Union Mines could assign its own employees to the work if it so desired. The contract also expressed assurance that the necessity for secrecy would be respected, and that all patentable developments would be entirely the property of Union Mines.

(3) Arrangements were made by Union Mines with W. E. Burlingame, an assayer in Denver, Colo., for the chemical analysis of test products, as required by the division.

(4) Actual ore-testing investigations in the laboratories of Denver Equipment were begun on 9 November.

(5) Four separate reports on the development of concentration methods for carnotite ores were prepared by the division and submitted by Union Mines. (App. B-5: 1, 2, 3, 4.)

(6) Laboratory tests on the Uravan type of ore were completed on 17 June.

(7) In 1944 a preliminary report on the development of suitable processes for concentrating carnotite ores from the Colorado Plateau Region was submitted by the Contractor. Concentration tests were made on heavy concentrates from the Witwatersrand, Union of South Africa, and on other products submitted by field engineers, results of which are given in reports listed in Appendix B-5. In the instance of the Witwatersrand it was indicated that concentration of uranium was feasible.

(8) In early 1945 concentration tests began on ores from the Urgeirica and Rebaleiro mines in Portugal, Shinkolobwe Mine (Belgian Congo), and from the White Signal District, (New Mexico.) Results of these investigations completed in early 1946 are described in reports listed in Appendix B-5.

1-8. General Summary of Worldwide Uranium and Thorium Resources. The productive possibilities of the various countries, as indicated by the results of field reconnaissance and exploration in the countries and literature search, are presented below:

a. Uranium

Country	Uranium Production Possibilities	Remarks
Belgian Congo	Excellent	High-grade ore (over 2% U_3O_8). World's most important producer. Represents 80% or more of the entire world's high grade resources.

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Uranium Production Possibilities

Country		Remarks
Canada	Good	High-grade ore (over 0.50% U_3O_8). About 10% of world production. Potential possibilities believed to be great.
United States	Good	Medium grade ore (½ of 1 percent). About 5% of world's production. Potential possibilities believed to be largest source of carnotite ore.
Czechoslovakia	Fair	High-grade ore (over 0.50% U_3O_8). Few hundred tons production. Potential possibilities believed to be only fair.
Russia	?	Medium grade ore. Few hundred tons production. Potential possibilities could be great.
Portugal	Fair	Medium-grade ore. Small production. Potential possibilities believed to be fair.

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Country	Uranium Production Possibilities	Remarks
Madagascar	Poor	Medium-grade ore. Very small past production. Potential possibilities believed to be poor.
Union of South Africa	Fair	Moderate byproduction from gold mining may be possible.
Australia	Poor	Fairly low-grade ore. Extremely small past production. Potential possibilities believed to be poor.
Bulgaria	?	No production. Potential possibilities unknown.
Sweden	Good	Very low-grade ore. No reported production, but potential possibilities believed to be fairly good.
Brasil	Poor	Medium-grade pegmatite ore. No production. Potential possibilities believed to be poor.
England	Poor	Medium-grade ore. Moderate past production. Reserves appear to be depleted. Potential possibilities believed to be poor.

b. Thorium

Country	Thorium Production Possibilities	Remarks
Brasil	Excellent	May have 200,000 tons potential monazite production (5% ThO_2)

Country	Thorium Production Possibilities	Remarks
India	Excellent	About the same potential production as Brazil but monazite contains 8-10% ThO_2.
Netherlands East Indies, Malaya, Siam	Fair	Possible moderate monazite by-production from tin placer operations.
U. S., Korea	Fair	Possible small monazite by-production from gold placers.

All other countries appear to have very poor production possibilities. Occurrences and showings of uranium and thorium minerals were reported in many of these other countries, but they appear to be largely of mineralogical and scientific interest only and with no commercial productive possibilities.

1-9. Appraisal of Results of Field Reconnaissance and Exploration. The following table presents a general appraisal of the results of the reconnaissance and exploration in the principal countries visited. Others are listed in the appendices.

Country	Remarks
Canada. Great Bear Lake area and pegmatite areas of Ontario and Quebec were reconnoitered.	The undeveloped possibilities of uranium in the Great Bear Lake area are sufficiently attractive to justify extensive exploration work. Possibilities of other parts of the Northwest Territories are unknown. Uranium-bearing pegmatites of Ontario

Country	Remarks
	and Quebec have little possibility for the development of a commercial supply of ore. Further detailed investigation is believed to be justified.
United States. Reconnaissance survey of the low-grade carnotite-producing region in western United States and general nationwide reconnaissance.	The carnotite ore occurs in small isolated and scattered deposits in sedimentary beds, and the unknown deposits are hidden under overburden ranging from a few feet to several hundred feet thick. Extensive core drilling will be required to develop positive reserves. Reserves are estimated at 7,000,000 tons of about 0.16% U_3O_8. Extremely low-grade phosphate and shale deposits were found, of doubtful significance. No other interesting finds.
Brazil. Reconnaissance areas and monazite sand deposits.	Uranium possibilities seem to be confined to small by-product production from pegmatite quarries which are worked for semi-precious gems, mica, feldspar, and tantalum. Brazil is a principal source of thorium derived from its monazite sands along the beaches.
Argentina. Reconnaissance of pegmatites and asphaltites.	These offer little or no commercial productive possibilities.
Chile. Reconnaissance of	Several uranium occurrences were found and

Country	Remarks
lode mining area.	examined, but they had no commercial productive possibilities.
Peru. Reconnaissance of lode mining area.	Nothing significant was found.
Mexico. Comprehensive reconnaissance and examination of mining properties.	A few small uranium occurrences were found, but commercial and productive prospects are very unlikely.
Alaska. Reconnaissance of placer area.	This is a potential small source of uranium and thorium in placer deposits.
Greenland. Reconnaissance of pegmatite areas.	A few uranium occurrences were noted, but prospects are very unattractive.
Australia and New Zealand. Reconnaissance of Olary and Radium Hill areas and beach placers.	No commercial uranium production is believed possible, and only very small thorium production.
Portugal and Spain. Uranium area of Portugal, pegmatites and lode mines of Spain.	Possibly 300 tons U_3O_8 could be produced in Portugal, and nothing from Spain.
Union of South Africa and Madagascar. Reconnaissance of gold producing area of the Union and pegmatite area of Madagascar.	Small amounts of uranium are found in gold areas in the Union and in the oxidized uranium deposits in Madagascar. Production is unlikely.

SECTION 2 - ACQUISITION OF LAND

2-1. Contractual Features.

a. Shortly after execution of the letter contract, it became apparent that acquisition of land by the Contractor in the interest of the Government should be authorized. Accordingly, the letter contract was amended by Supplement No. 2 thereto dated 13 August 1943 (App. C-1).

b. Because of agreements for operation in foreign countries, acquisition of mineral property rights by the Contractor for the account of the Government, as provided for in Supplement No. 2 to the letter contract, was restricted, in a letter dated 11 April 1944 from the Area Engineer to Mr. Van Fleet, to the acquisition of such rights within the United States and its possessions (App. C-2).

c. Provisions of the final contract relative to the acquisition of land were approved by the Secretary of War (App. C-3), according to a letter dated 1 July 1944 originating in the Washington Liaison office.

2-2. Value of Land Ownership. - Geological exploration in connection with the search for valuable mineral deposits is undertaken to obtain new information relative to such deposits. The information so obtained, whether obtained by a large mining company expending its own funds or by a Government agency utilizing public funds, is in itself valuable and remains valuable so long as it is either unknown by others or is suitably protected through acquisition of control or ownership of the land involved. In the instance of this project, such control or ownership of land in the United States was essential to protect suitably

the Government's interest. Without such protection, the possibility would exist that land containing valuable mineral deposits discovered under the project might be acquired by others who could quite conceivably be undesirable interests to hold such land. Moreover, if other interests were permitted to acquire such land, they would then be in a position to sell the land to the Government at a premium without having expended any of their own funds todisclose that the land was valuable.

2-3. Land Deals.

a. German and Belcher Claims. - Purchase of the tax titles to the German (Survey 494) and Belcher (Survey 7076) U.S. patented mining claims situated 600 yards north of the Kirk claim on Quarts Hill near Central City, Colorado, on 13 October 1943, by the Contractor, was confirmed in a letter dated 31 December 1943 (App. C-4) from Mr. William A. White, Sr., Administrative Director, Union Mines Development Corporation, to the Area Engineer.

b. Ventures, Ltd., Claims.

(1) Negotiations were completed 26 July 1943 by the Contractor to subcontract the survey of the Great Bear Lake Area, Northwest Territories, Canada, to Ventures, Ltd. In accordance with the terms of the proposed subcontract a general reconnaissance survey was made by Ventures, Ltd., during the period 2 August 1943 to 16 September 1943, preliminary to full scale prospecting, reconnaissance, and detailed exploration operations to be begun in the summer of 1944. As proposed, the entire program was to be undertaken on the basis of actual cost completely reimbursible with no cash fee. A specific list of properties in the area then owned by Ventures, or in which Ventures was then interested

in acquiring ownership, would be excluded from the deal. All other properties in the area acquired by Ventures during the period covered by its contract with Union Mines Development Corporation were to be for the account of Union Mines. Consideration was to be a ten percent royalty (free of development and production costs) on all minerals produced from properties acquired for Union Mines' account and prior right to obtain lease from Union Mines. Union Mines agreed to keep titles to mineral properties in good standing but retained right to re-assign to Ventures at any time at Union Mines sole option.

(2) On 15 September 1943, the Canadian Government issued orders reserving to the Crown all radio-active substances hence-forth produced in the Yukon Territory and the Northwest Territories of Canada (App. C-5). The Canadian Government also indicated its preference to control the ownership of such resources and to prosecute a comprehensive exploration program at its own expense. This plan envisioned a complete interchange of information on the program and the Canadian Government indicated its willingness to discuss with the United States Government ways and means of producing and disposing of the desired resources for the mutual benefit. Accordingly, the Contractor was directed to terminate all arrangements previously made with Ventures (although no written con-tract had yet been signed) and to bring all work in connection therewith to the earliest possible conclusion. A written agreement covering the termination of this work was made 18 August 1944 between the Contractor and Ventures with promise for complete reimbursement to Ventures for all actual costs incurred plus a cash fee of reasonable amount as consideration

for its services because of the sudden required termination. On 19 October 1944 the Contractor forwarded its check in the amount of $50,000 due and payable to Ventures, in accordance with this agreement, formally bringing to a close all agreements and arrangements between Union Mines and Ventures.

(3) The Canadian Government was informed by the Contracting Officer of authority granted to the Contractor to direct Ventures, Ltd., to assign to the Canadian Government the 75 mining claims which were staked in the Northwest Territories by Ventures, Ltd., for the Contractor, in a letter dated 17 October 1944 (App. C-5) from the District Engineer to the Minister, Department of Munitions and Supply.

(4) Concurrence with the agreements and conditions stated therein was signified by the signature of The Minister affixed to one copy of the letter on 27 October 1944 and returned to the District Engineer.

c. Curran and Wade Leases, Two-thirds Interest.

(1) Curran Brothers and Wade, a partnership, was the successful bidder, in August 1943, for a prospecting permit on a tract of land containing roughly 168 square miles of the Navajo Indian Reservation, northeastern Arizona, which was selected after widespread prospecting. Three months were allowed by law for further prospecting this restricted area, at the end of which time, according to Government regulations, a lease on a selected 960 acres could be obtained. Further details are contained in the following paragraph of a letter dated 10 January 1944 (App. C-6 (c)) from Mr. Ridgway to the Area Engineer:

1 - "At the time of the granting of the lease to Curran Brothers & Wade, a down payment was made with $4063 due within the time provided in the written notice of bids for said lease. Just before the payment was due, Curran Brothers and Wade approached the U. S. Vanadium Corporation for financial help in consummating the lease agreement with the Indian office. Accordingly, an agreement was reached between the U. S. Vanadium Corporation and Curran Brothers & Wade, whereby the U. S. Vanadium Corporation advanced the $4063, and assumed other minor obligations in connection with the lease, and Curran Brothers & Wade turned over an undivided two-thirds interest in the lease to the U. S. Vanadium Corporation. With certain stated exceptions each party to the agreement was allowed to select its own properties for retention."

(2) An agreement was made by the Contractor with United States Vanadium Corporation for the purchase of its two-thirds interest in the Wade and Curran lease (640 acres) for the Government's account on an actual cost basis without profit to either United States Vanadium Corporation or Curran Brothers and Wade.

d. Curran and Wade Lease, One-third Interest.

(1) In March 1944, the Contractor opened negotiations with Curran Brothers and Wade with a view of purchasing for the Government's account Curran Brothers and Wade's remaining one-third share (320 acres) of the total lease, an agreement for the purchase of the other two-thirds of the lease for the Government's account having already been concluded with U. S. Vanadium Corporation. A summary of the deal for the one-third share is given in a letter dated 15 March 1944 (App. C-6 (d)) from the Area Engineer to the District Engineer.

In this letter it was stated that if Wade & Curran's share could be bought for, say $10,000, the cost of the entire lease (960 acres) would then total $16,000 or about $16.50 per acre, which was considered a cheap price for unusually good mineral lands of this character.

On 17 April 1944, upon the payment of $3500, an option to purchase the remaining one-third interest in the lease was granted Union Mines by Curran Brothers and Wade, in accordance with agreement reached on 12 April 1944 (App. C-6 (e)). Formal approval of the assignment of all interest in the lease to Union Mines was given by the Assistant Secretary of the Interior on 31 October 1944 (App. C-6 (f)).

e. Kirk, Hilda, and Jeanette Claims.

(1) Under the date of 16 August 1944, an agreement was executed by the Contractor with the owner of the Kirk, Hilda and Jeanette patented mining claims located on the south slope of Quarts Hill, Illinois Central Mining District, near Central City, Gilpin County, Colorado. The terms and conditions were as follows (App. C-7): (1) The Contractor had a 2-1/2 year lease on the property with first six months rental free, $5,000 yearly rental payable in advance thereafter, and agreed to pay 10 percent basis royalty on minerals produced and consumed for experimental purposes and (2) the Contractor had the option to purchase the property in fee at any time during the term of the lease by paying $50,000 less any prior payments made for rentals and royalties.

(2) As a result of dewatering and sampling of the Kirk mine on the property, which was very disappointing, the option

was not exercised and was relinquished in January 1945.

f. North Continent Mines, Inc., Property.

(1) Details of the proposed land-purchase program in the Colorado Plateau Region are contained in a secret teletype message dated 27 June 1944 from the District Engineer to Major General L. R. Groves (App. C-8 (a)).

(2) The holdings of North Continent Mines, Inc. were located in the Egnar-Slick Rock district, Dolores County, southwestern Colorado. This district was considered by Dr. Fischer, U. S. Geological Survey, and by the Contractor, to be the most promising in the entire Colorado Plateau Region. The Contractor estimated that 4,625,000 tons, of the 10,936,000 tons of ore estimated for the entire region, were contained in the Egnar-Slick Rock district. The North Continent Mines, Inc., property was considered outstanding in the district. A recommendation for the purchase of the property was contained in a letter dated 5 August 1944 (App. C-8 (b)) from Mr. Blair Burwell to the Area Engineer.

(3) Negotiations for the purchase of the North Continent Mines, Inc., holdings were concluded, payment was made, and title to the property was acquired by Union Mines on 24 February 1945. The total cost was approximately $224,000.

g. Gateway Alloys Property.

(1) Union Mines Development Corp. took title to 42 claims of the Molybdenum Corporation, known as the Calamity Group, located on Calamity Mesa near Gateway, Colorado, by a Trustee's Deed of Conveyance dated 10 August 1945 (App. C-9). The total cost of acquiring the claims was approximately $40,000. Acquisition was accomplished

through the Trustees in Bankruptcy of Gateway Alloys Co., who had previously taken over the holdings from Molybdenum Corp.

(2) Considerable drilling was done in 1943 by the U. S. Bureau of Mines which showed proven reserves of 3,358 tons of ore. Production from the property prior to acquisition by Union Mines was 20-25,000 tons. The property was considered next in importance of available lands to North Continent property from the standpoint of possible additional ore reserves.

SECTION 3 - ADMINISTRATION

3-1. Expenditures. - Expenditures by the Contractor on the P totaled approximately $2,409,000. (App. A-8.) The Union Mines Deve ment Corporation program under the contract was originally estimated continue until 31 December 1947 and to cost $10,000,000. However, a the program developed, it became apparent that the various phases of the work being carried on by the contractor could be more satisfacto prosecuted by other contractors, other agencies of the Government, o by the Manhattan District itself. Therefore, a policy of gradually restricting the activities of the Contractor was begun by the Contra ing Officer. This first affected the foreign field exploration prog and later resulted in cancellation of Union Mines' plans for an exte drilling and underground exploration program in the Colorado Plateau Region. Finally, a move toward complete termination of the contract was begun early in 1946, resulting in effective termination of the co as of 31 December 1946, with cessation at that time of all activities with the exception of administrative and clerical work pertinent to t closing of the contract. Expenditures were segregated, in the syste accounts established by the Contractor beginning with the month of M 1944, under five headings, as shown below:

Account		Expenditures	Percent of Tota
Bibliographical search		$240,000	10
Field exploration			
Foreign	$288,000		
Domestic	$677,000	$965,000	40
Land and property		$276,000	11

Account	Expenditures	Percent of T
Research	$129,000	6
Administration and overhead	$799,000	33
Total	$2,409,000	100

3-2. Personnel.

a. The number of personnel in the Murray Hill Area of following the assignment of Major Paul L. Guarin as Area Engineer on 15 June 1943, was increased gradually as activities under the project expanded. The functions and organization of the staff as of 1 Janua 1946 are shown in Appendix A-3, and as of 1 April 1946 in Appendix A The principal personnel who served, during the period from 15 June 19 until the Murray Hill Area was absorbed by the Madison Square Area 1 April 1946, were the following:

(1) Military Personnel.

(a) Lt. Col. Paul L. Guarin, Area Engineer, 1 June 1943 to March 1946.

(b) Lt. Col. A. W. Oberbeck, Assistant Area E January 1946 to March 1946; Area Engineer, March 1946 until April 19

(c) Lt. Col. Gordon B. Page, Assistant Area E March 1946 to April 1946.

(d) Major Hubert D. Kaiser, Deputy Area Engin 3 April 1944 to March 1946; Executive Officer, March 1946 to April 1

(e) Capt. G. P. Thompson, Assistant, from Sep 1945 to April 1946.

(f) 1st. Lt. Robert D. Hininger, Assistant, 3 May 1944 to April 1946.

(2) Civilian Personnel.

(a) George C. Selfridge, Geologist; headed Technical Review and Inspection Branch from August 1943 to October 19 Consultant from October 1945 to April 1946.

(b) George W. Bain, Geologist; reported for du 15 September 1944; headed Technical Review and Inspection Branch from October 1945 to April 1946.

(c) Frank J. Bolina, Mining Engineer; Chief of Grand Junction, Colo., Suboffice, from September 1944 to April 1946.

(d) Elmer C. Smith, Auditor, from 18 February to April 1946.

When the Murray Hill Area was absorbed by the Madison Sq Area, in April 1946, all its personnel were transferred to the latter Area.

b. The number of personnel employed by Union Mines inc rapidly during the latter half of 1943. With the month of January 19 however, the Union Mines force began to level off, having then reache total of 119. In July of 1944 the peak of 129 employees was reached. (App. A-2.)

Table 4 - Distribution of employees, Union Mines Development Corporation

Classification		Number
Field professional:		
	Men	61
	Women	-
Office professional:		
	Men	16
	Women	23

Classification	Number
Administrative and clerical:	
Men	12
Women	17
Total	129

An organisation chart of the Corporation, as of 15 October 1945, is s in Appendix A-7.

3-3. Protective Security.

a. The Murray Hill Area was rated as a highly classifi area throughout the project. Protective security was maintained in accordance with the provisions of Army Regulations 380-5 and 380-10 a pertinent bulletins, circular letters, memorandums, and letters issue by the War Department, Manhattan Engineer District, and Madison Squar Area. In the interest of protective security, close contact was main ed by the commissioned personnel of the Murray Hill Area office with representatives of the New York Branch Office, Intelligence and Secur Division, Manhattan Engineer District. (See Book I, Vol. 14.)

b. Offices of the Murray Hill Area: The offices oc- cupied 5 rooms of a portion of the 17th floor of a 25-story office building at 50 E. 42nd Street, together with the Union Mines Develops Company. For security purposes it was considered the same facility, guards, disposal of classified waste, etc., were the same. Fire prot and continuity of production were not factors at this location. The Murray Hill Area administered Engineer Contract No. W 7405 eng-78 wit the Union Mines Development Corporation from that location.

c. Offices of Union Mines: Union Mines occupied the

entire 18th floor and a portion of 17th floor of 50 E. 42nd Street. classified information was kept in locked metal files. All personnel were investigated by the contractor and were subject to clearance und MED requirements.

d. General. - Union Mines, in the prosecution of its w made every effort to conceal its real purpose and particularly the ex material in which it was interested. All of the Contractor's employe were investigated and cleared from a protective security standpoint, every effort was made to safeguard all classified material.

Union Carbide and Carbon Corporation was the world's lar user of cobalt, deposits of which are often found in conjunction with deposits of uranium ore. The same applied to tantalum, vanadium and other materials of which UCC was a large user, and for which they wou logically be prospecting. This was an excellent "blind" security-wis for this project. Field men of Union Mines were carefully cautioned t conceal relationship of the Engineers or the Army to this work. When field geologists were sent out of the country they were forbidden to take with them any maps, data, equipment or other means which might indicate their connection with the District or with the Army. All suc material (geiger counters, identification, etc.) was forwarded in dipl matic pouch to nearest U. S. Military Attache. All correspondence was handled in similar fashion. If it was necessary for a field man to hi native labor or facilities to perform stripping or other operations, t cost was paid out of personal funds of the field man, for which he was later reimbursed. All possible checks, through diplomatic and militar attache channels, were made on alien personnel performing any such wor

in foreign countries, to prevent information leaks.

3-4. Health and Welfare.

a. Union Carbide and Carbon Corporation, the parent organization of Union Mines, maintained a Medical Department in a new office building, the facilities of which were available to all employees of Union Mines. These included the services of a trained nurse on duty throughout each business day and those of a physician on duty the afternoon of each business day. Every Union Mines employee who was absent because of illness reported to the department for examination prior to resuming his duties; new employees who were discharged from the Armed Services for physical disability were examined by the department prior to assuming their duties; any employee given an assignment to a foreign country was examined physically by the department prior to his departure and given any serum injections required; all guards reported annually to the department for a physical examination.

b. Compensation insurance, applicable to accidents and occupational disease incurred in the performance of duties, was carried by Union Mines for every employee in accordance with the legislative requirements of the State of New York.

c. Various welfare plans were available to but optional with employees; these included a group insurance plan (comprises life insurance, total and permanent disability benefits, and health and accident insurance), a savings plan, and a retirement plan. A medical-plan and a hospitalization plan were available locally, and payroll deductions were made on an employee's request for payment to the agency issuing these plans.

APPENDIX A. - MAPS AND CHARTS

A-1 World Bibliographic Research, as of 31 December 1946.

A-2 Murray Hill Area - Project S-37 - Analysis of Employment, June 1943 to December 1946

A-3 World Field Reconnaissance and/or Exploration, as of 31 Decembe 1946

A-4 United States - Field Reconnaissance and/or Exploration, as of 31 December 1946.

A-5 Organization Chart, Murray Hill Area, 1 Jan. 1946

A-6 Organization Chart, Murray Hill Area, 1 April 1946

A-7 Organization Chart, Union Mines Development Corp., 15 October 1945

A-8 Monthly Expenditures, Cumulative, by the Contractor, to 31 December 1946

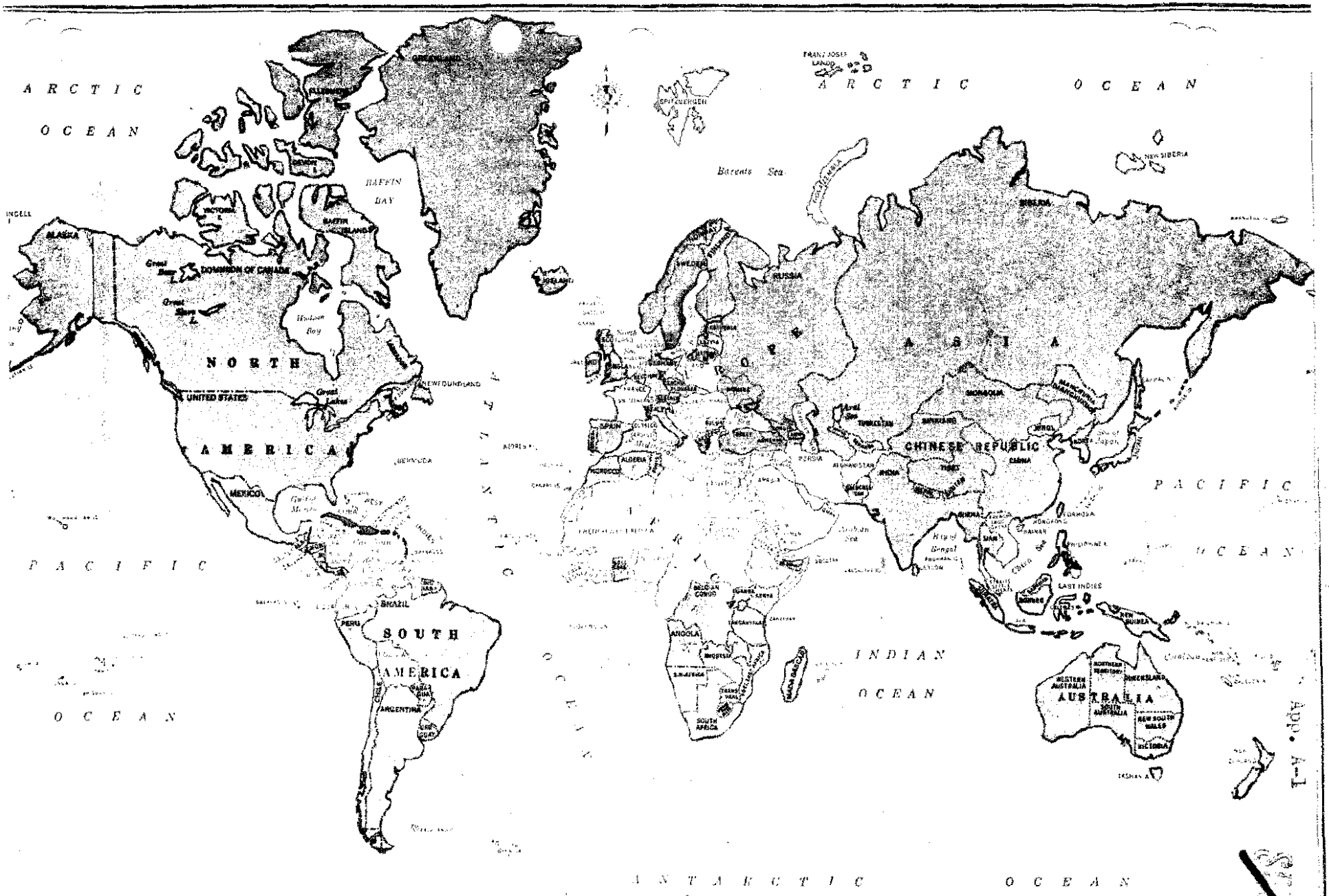


FIG. - WORLD BIBLIOGRAPHIC SEARCH - as of 31 December 1946.

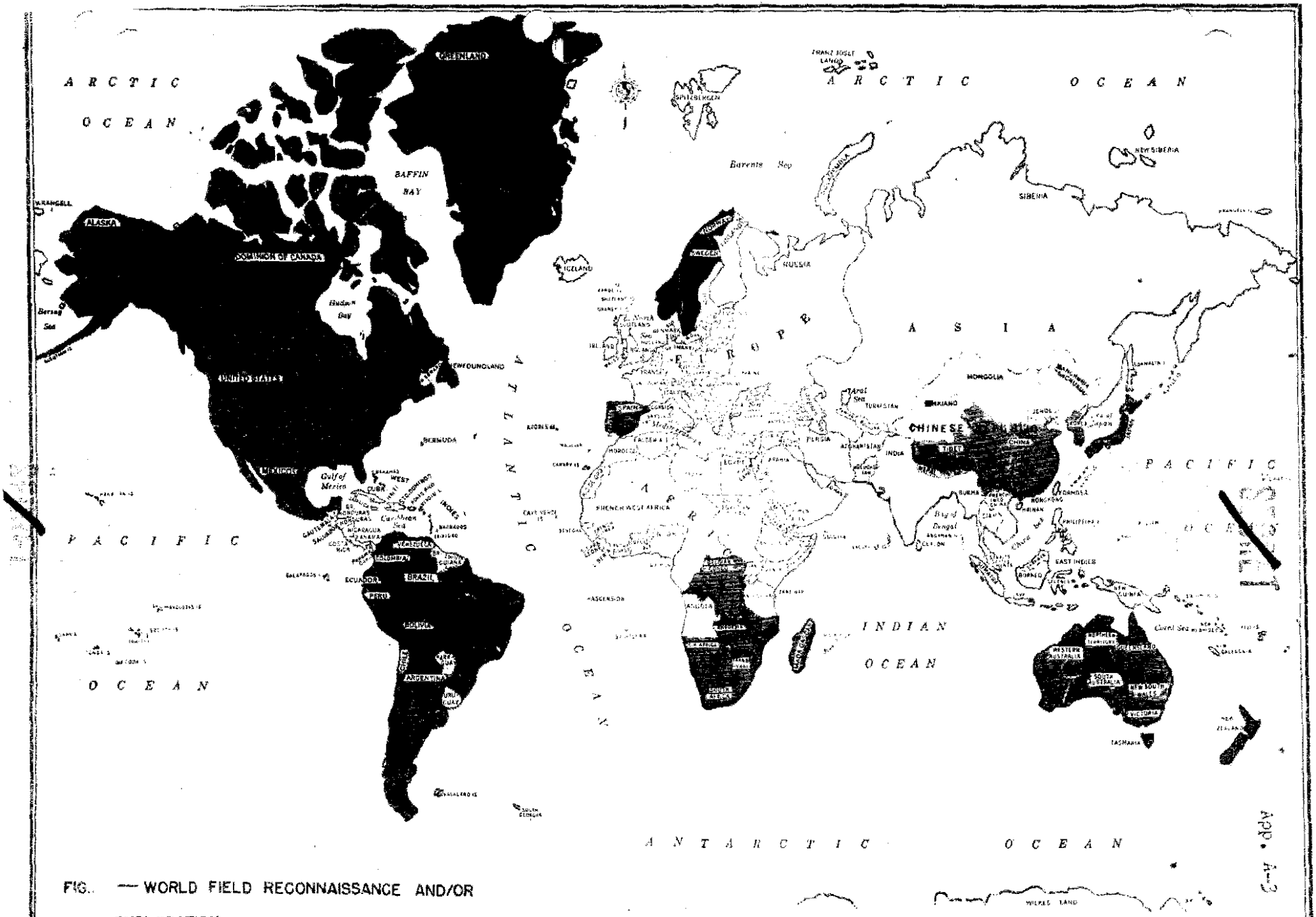


FIG. — WORLD FIELD RECONNAISSANCE AND/OR EXPLORATION

Shaded Areas represent countries in which Field Reconnaissance and/or Exploration had been performed as of 31 December 1946.

App. A-3

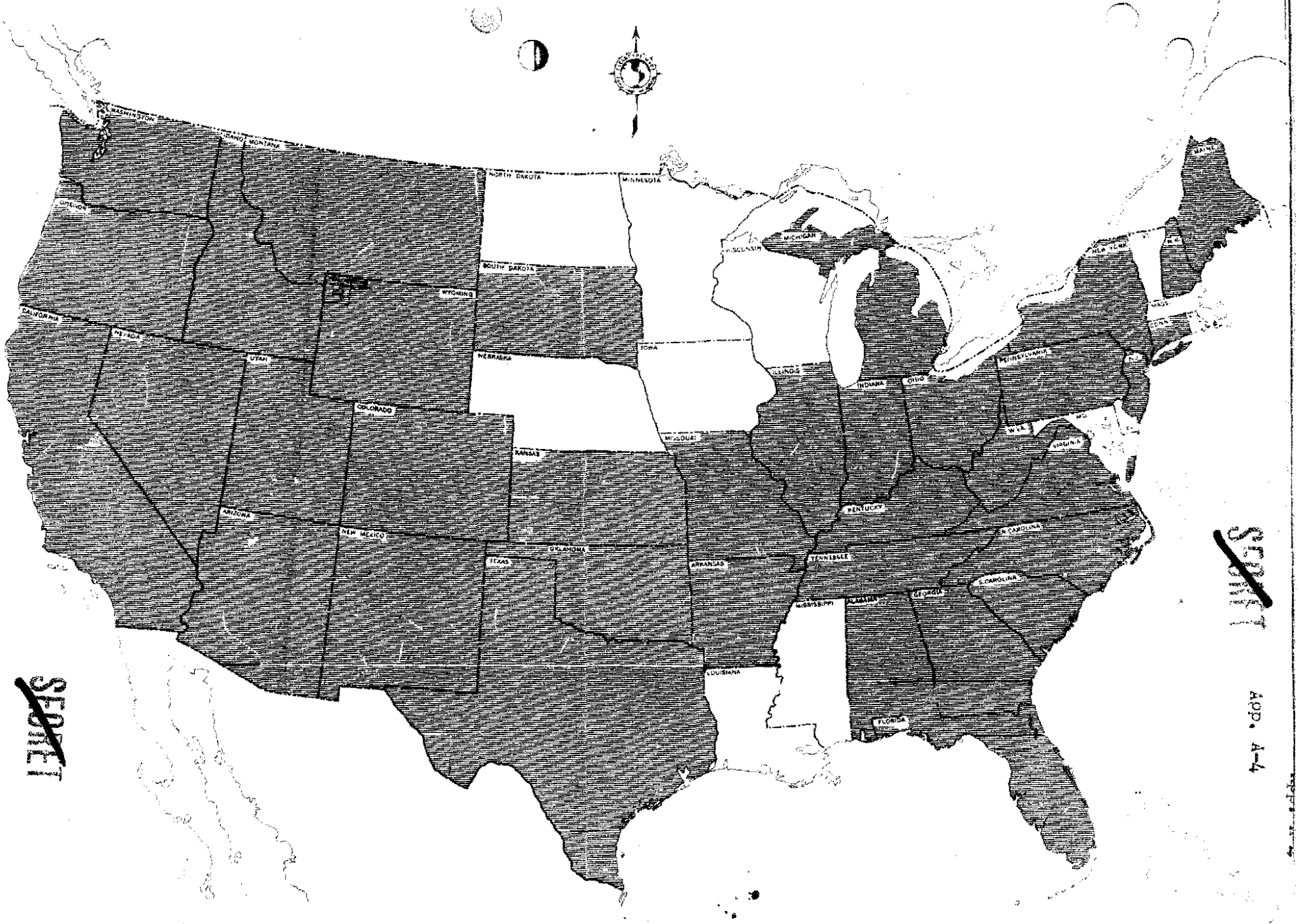


FIG. —UNITED STATES—FIELD RECONNAISSANCE AND/OR EXPLORATION

Shaded Areas represent states in which Field Reconnaissance and/or Exploration had been performed as of 31 December 1966.

WAR DEPARTMENT

CORPS OF ENGINEERS, U.S. ARMY

PERSONNEL	
OFFICE	
ENL	
P	
S P	
C A F	
C P C	
MISCL.	
VAC.	
TOTAL	3

[illegible]

[illegible]

T[ECHNICAL] REVI[EW AND FIELD] INSPECTI[ON]

[Mr]. George W. Bain, P-6, Chief
[Mr]. George [illegible], Asst.*
1 Clerk-Stenographer [illegible]

1. Physically inspects field work performed by the Contractor, as required and directed by the Area Engineer.

2. Reviews, appraises, and correlates all reports submitted by the Contractor, covering work accomplished under the [illegible].

3. Reviews currently the individual interim reports submitted by the Contractor's field and research personnel on jobs in progress.

4. Provides technical advice [illegible] the Area Engineer, [illegible].

* Part time; Cont. W-[illegible]-153 [illegible].

R. I. Keiser, Major, C.E., Chief
G. P. Thompson, Capt., C.E.
R. D. Nininger, 1st Lt., C.E.
1 Clerk-Stenographer [illegible]

[illegible] and maintains [illegible]

[illegible]

11. Provides for and maintains protective security.
12. Performs functions pertaining to labor relations.
13. Handles all Area matters pertaining to patents.

[illegible]

R. C. Smith, CAF-9, Chief
1 Clerk-Stenographer CAF-4

1. [illegible] Government auditing functions and handles all other fiscal matters. Serves as liaison with Contractor on all fiscal matters.
2. Handles mail and records.
3. Maintains property accounts.
4. Handles [illegible] features of [illegible] for railway travel.
5. [illegible] procurement priorities.
6. [illegible] administrative supervision of civilian personnel.
7. Handles all matters pertaining to [illegible].
8. Prepares miscellaneous administrative reports required [illegible] and maintains administrative records.
9. [illegible] program.

[illegible], COLO.

[illegible]

1. Physically inspects field work performed by Contractor in the Colorado Plateau Region.
2. Reviews, appraises, and correlates all reports, programs, and recommendations submitted by Contractor covering work in the Colorado Plateau Region.
3. Reviews and advises Area Engineer on Contractor's proposals to acquire mineral rights in the Colorado Plateau Region.
4. Serves as liaison with Contractor's field organization in the Colorado Plateau Region.

* Attached to Colorado Area for administrative supervision only.

ORGANIZATION CHART
MANHATTAN DISTRICT

UNIT [illegible] Area

SUBMITTED [illegible] DATE [illegible] '46

RECOMMENDED [illegible] DATE

APPROVED [signature] DATE [illegible] '46

SHEET NO. 1 OF 1 SHEETS

WAR DEPARTMENT

CORPS OF ENGINEERS, U S ARMY

PERSONNEL	
OFFICERS	5
COL	
P	2
E P	
C A P	5
C P C	
MISCL	
VAC	
TOTAL	12

AREA ENGINEER

A. W. OBERBECK, Lt. Col., C.E.

1 Clerk-Stenographer CAF-5

[illegible]

[illegible] HAGY, Lt. Col., C.E.

EXECUTIVE OFFICER

H. D. Keiser, Major, C.E.

TECHNICAL BRANCH

Dr. George W. Bain, P-6, Chief
J. P. Thompson, Capt., C.E.
R. D. Minlinger, 1st Lt., C.E.
Dr. George C. Selfridge *

1. Physically inspects field work performed by the Contractor, as required and directed by the Area Engineer.

2. Reviews, appraises, and correlates all reports submitted by the Contractor, covering work accomplished under the contract.

3. Reviews currently the individual interim reports submitted by the Contractor's field and research personnel on jobs in progress.

4. Provides technical advise to the Area Engineer, as required.

* Part time; Cont. W-44-153) eng-6.

GRAND JUNCTION, COLO.

Frank J. Bolina, P-5, Chief

1. Physically inspects field work performed by Contractor in the Colorado Plateau Region.

2. Reviews, appraises, and correlates all reports, programs, and recommendations submitted by Contractor covering work in the Colorado Plateau Region.

3. Reviews and advises Area Engineer on Contractor's proposals to acquire mineral rights in the Colorado Plateau Region.

4. Serves as liaison with Contractor's field organization in the Colorado Plateau Region.

ADMINISTRATIVE BRANCH

R. C. Smith, CAF-9, Chief
3 Clerk-Stenographers, CAF-4

1. Performs Government auditing functions and handles all other fiscal matters. Serves as liaison with Contractor on all fiscal matters.
2. Handles mail and records.
3. Maintains property accounts.
4. Handles clerical features of official travel by personnel and obtains space for railway travel.
5. Provides for and maintains protective security.
6. Exercises administrative supervision of civilian personnel.
7. Handles all matters pertaining to safety and labor relations.
8. Prepares miscellaneous administrative reports required by higher authority and maintains administrative records.

Legend

— — — Administrative supervision only.

ORGANIZATION CHART
MANHATTAN DISTRICT

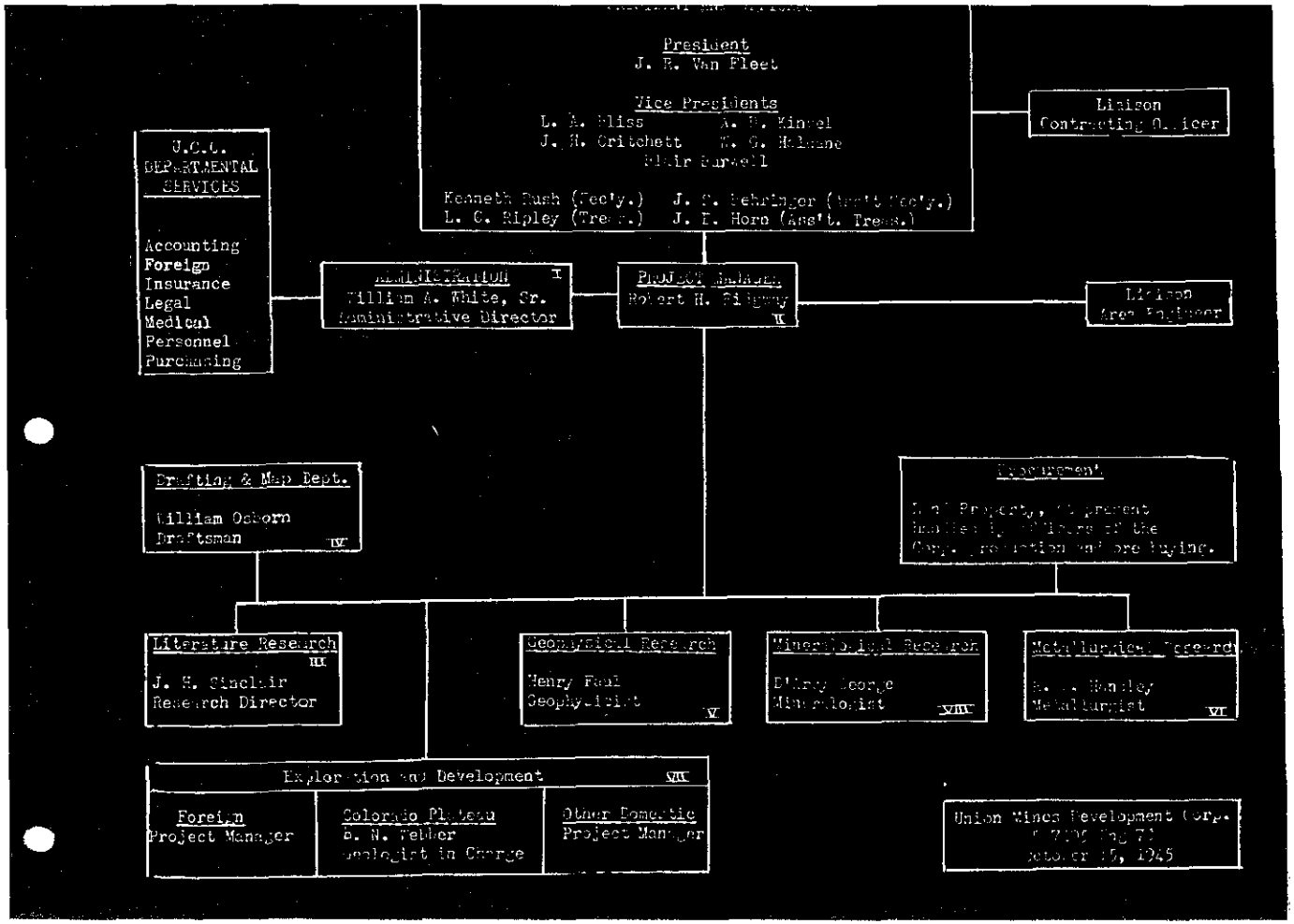
UNIT Murray Hill Area

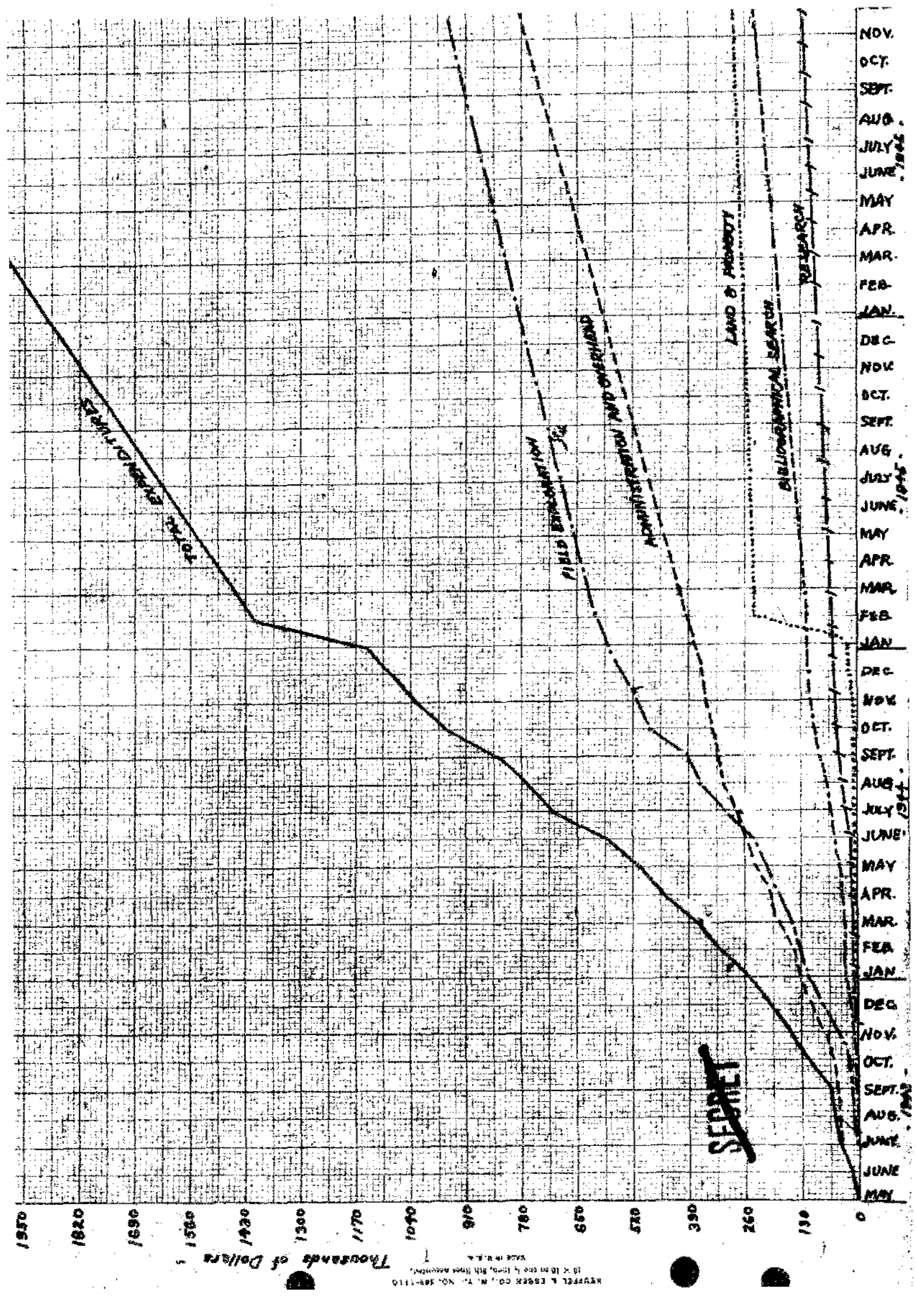
SUBMITTED [signature] DATE 1 Apr. '46

RECOMMENDED DATE

APPROVED [signature] DATE 2 [illegible]

SHEET NO. 1 OF 1 SHEETS


President
J. R. Van Fleet
Vice Presidents
L. A. Bliss
A. F. Kinzel
J. H. Critchett
W. G. McKeane
Blair Burwell
Kenneth Bush (Sec'y.)
J. S. Behringer (Asst. Sec'y.)
L. C. Ripley (Treas.)
J. E. Horn (Asst. Treas.)
Liaison
Contracting Officer
U.C.C.
DEPARTMENTAL
SERVICES
Accounting
Foreign
Insurance
Legal
Medical
Personnel
Purchasing
ADMINISTRATION
William A. White, Sr.
Administrative Director
PROJECT MANAGER
Robert H. Pilgrim
Liaison
Area Engineer
Drafting & Map Dept.
William Osborn
Draftsman
Procurement
Literature Research
J. H. Sinclair
Research Director
Geophysical Research
Henry Faul
Geophysicist
Mineralogical Research
Dilsey George
Mineralogist
Metallurgical Research
E. . Wamsley
Metallurgist
Exploration and Development
Foreign
Project Manager
Colorado Plateau
E. N. Tether
Geologist in Charge
Other Domestic
Project Manager
Union Mines Development Corp.
October 15, 1945



TOTAL EXPENDITURES
FIELD EXPLORATION
ADMINISTRATION AND OVERHEAD
LAND & PROPERTY
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780
910
1040
1170
1300
1430
1560
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Thousands of Dollars

APPENDIX B. - SUMMARIES OF REPORTS

B-1 Bibliographical Reports

a1 to a49. Union Mines Development Corporation

b1 to b8. Murray Hill Area

B-2 Foreign Exploration Reports

1 to 43. (Union Mines Development Corp., 1-32; Murray Hill Area 33-44)

B-3 United States Exploration Reports

1 to 59. (Colorado Plateau - General, 58, 59; Individual Areas, listed only, (1) to (44)

B-4 Exploration Research Reports

1 to 13

B-5 Metallurgical Research Reports

1 to 24

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BIBLIOGRAPHICAL REPORTS

(Figures in parentheses are the serial numbers of the Summaries which follow)

a. UNION MINES DEVELOPMENT CORPORATION

1. (1) Africa (South of the Equator) and Madagascar, Preliminary Bibliographical Report on S-37 Occurrences in. October 19, 1943.

2. (37) Alaska, Preliminary Bibliographical Report on S-37 Occurrences in. June, 1944.

3. (2) Algeria and Tunisia, Preliminary Report on SOM and TOM in. November 28, 1945.

4. (3) Angola, Preliminary Report on Possibilities for SOM and TOM in. March 28, 1946.

5. (44) Argentina, Preliminary Bibliographical Report on S-37 Resources in. December, 1943.

6. (16) Australia, Preliminary Bibliographical Report on S-37 Occurrences in. October 25, 1943.

7. (17) Australia, Preliminary Bibliographical Report on S-37 Occurrences in. Supplement No. 1. May 24, 1944.

8. (4) Belgian Congo and Data on the Shinkolobwe Mine, Preliminary Bibliographical Report on S-37 Occurrences in the. July 19, 1943. (See Report No. 1 also)

9. (45) Brasil, Preliminary Bibliographical Report of Occurrences of S-37 in. July, 1943.

10. (19) Bulgaria, Preliminary Report on SOM in. November 15, 1943.
Burma (See Report No. 25)

11. (38) California and Oregon, Possibilities of SOM Occurrences in. April 6, 1944.

12. (39) Canada, Preliminary Bibliographical Report on S-37 Occurrences in. August, 1944.

Cape Province, Union of South Africa (See Report No. 1)

13. (40) Central America, Preliminary Bibliographical Report on S-37 Occurrences in. May 29, 1944.

Ceylon (See Report No. 25)

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14. (46) Chile, Report on S-37 Resources of. April 24, 1944.

15. (8) China, Preliminary Bibliographical Report on SCM in. April,

16. (9) China (Eastern), Report on Possibilities for Uranium in. April, 1946.

17. (20) Czechoslovakia, Report on SCM Deposits of Joachimsthal. October, 1943. (See Report No. 21, also).

18. (47) Dutch Guiana, Preliminary Report on Possibilities for SCM in August 17, 1944.

19. (21) England, Preliminary Bibliographical Report on Occurrences of S-37 in. January, 1944.

20. (22) Finland, Preliminary Bibliographical Report on SCM in. June 1945.

21. (23) Germany and Czechoslovakia, S-37 Deposits in. August, 1946.

22. (24) Greece, Bibliographical Report on S-37 and T-37 Possibilities in. October 18, 1945.

23. (42) Greenland, Bibliographical Report on S-37 Occurrences in. January 20, 1944.

24. (43) Iceland, Preliminary Bibliographical Report on SCM in. July 1945.

25. (10) India, Ceylon, Burma, and Tibet, Preliminary Bibliographical Report on S-37 Occurrences in. February 7, 1944.

26. (25) Italy, Preliminary Bibliographical Report on S-37 Occurrence in. February 29, 1944.

27. (11) Japan, Preliminary Bibliographical Report on S-37 Occurrence December, 1944.

Kenya (See Report No. 1)

28. (12) Korea, Possibilities for Uranium in. July, 1946.

Madagascar (See Report No. 1).

29. (41) Mexico, Preliminary Report on S-37 in. September, 1943.

30. (5) Morocco, Preliminary Bibliographical Report on SCM in. June 30, 1945.

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31. (6) Mozambique, Possibilities for SCM and TCM in. January 15, 1

32. (13) Netherlands East Indies and Southeast Asia, Thorium in the. March 30, 1945.

33. (18) New Zealand, Preliminary Bibliographical Report on S-37 Reso of. June 9, 1944.

34. (26) Norway, Preliminary Bibliographical Report on SCM in. June 1945.

Oregon (See Report No. 11).

Paraguay (See Report No. 44).

35. (48) Peru, Preliminary Bibliographical Report on SCM in. June, 1

36. (14) Philippine Islands, SCM and TCM Possibilities in the. July,

37. (27) Portugal, Preliminary Bibliographical Report on S-37 Occurren in, and Production Data. September, 1943.

38. (28) Portugal, Bibliographical Report on SCM in. October 31, 194

Shinkolobwe Mine, Belgian Congo (See Report No. 8).

Southwest Africa (See Report No. 1).

39. (29) Spain, Preliminary Bibliographical Report on S-37 Occurrences July 14, 1944.

Swaziland (See Report No. 1).

40. (30) Sweden, Preliminary Bibliographical Report on S-37 Occurrence in. September, 1943.

41. (7) Tanganyika Territory, Possibilities for SCM and TCM in. February 1, 1946. (See Report No. 1, also).

42. (15) Thailand, SCM and TCM Possibilities in. November, 1945.

Tibet (See Report No. 25).

Transvaal (See Report No. 1).

Tunisia (See Report No. 3).

43. (31) Turkey, Bibliographical Report on SCM in. March 20, 1945.

Uganda (See Report No. 1).

44. (49) Uruguay and Paraguay, Preliminary Report on the Possibilit for SCM and TCM in. August 24, 1945.

45. (32) U.S.S.R., Preliminary Bibliographical Report on S-37 Occurr in. October 20, 1943.

46. (33) U.S.S.R., Preliminary Bibliographical Report on S-37 Occurr in. Supplement No. 1. April 28, 1944.

47. (34) U.S.S.R., Bibliographical Report on the Ukhta Oil Region, U A.S.S.R. October 30, 1945.

48. (35) U.S.S.R., Bibliography of References on. May 25, 1945.

49. (36) U.S.S.R. Scientists, Biographical Data on. March 7, 1946.

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b. MURRAY HILL AREA

1. (1) Angola, Report of S-37 Prospects in. G. W. Bain, May 15, 194

2. (3) Czechoslovakia, Review of Production and Reserves Statistics, Joachimsthal Mines. G. C. Selfridge, April 20, 1944.

3. (4) /Czechoslovakia/ The Erzgebirge - Bohemia Area. G. W. Bain, December 3, 1946.

4. (2) Korea, Thorium and Uranium Resources of. G. W. Bain, Novembe 1946.

5. (5) Distribution Pattern of Primary S-37. G. W. Bain, Nov. 9, 19

6. (6) Exploration for S-37. G. W. Bain, Nov. 15, 1944.

7. (7) Review of S-37 Placer Deposits and Proposed Exploration Metho by Use of Placer Minerals. G. W. Bain, Feb. 22, 1945.

8. (8) Preliminary Report on SCH-Bearing Hydrocarbons. G. W. Bain, April 14, 1945.

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BIBLIOGRAPHICAL REPORTS
UNION MINES DEVELOPMENT CORPORATION
AFRICA

1. (1) Preliminary Bibliographical Report on S-37 Occurrences in Afri (South of the Equator) and Madagascar. October 19, 1943.

The report covered Africa, south of the Equator, except for Gold Coast Colony, British Somaliland, Angola, and Bechuanaland. In Belgi Congo the treatment of ore from the Shinkolobwe Mine was said to have produced about 510 g. of radium up to 1939, so it probably contained at least 1850 m. tons of uranium. Reserves were estimated at 4700 m. tons of uranium. In Madagascar the occurrences were centered around Antsirabe basin. Production of about 160 m. tons of hand-sorted beta euxenite ore and autunite-uranocircite concentrates had been reported from Madagascar. In the Union of South Africa, uranium minerals were reported from pegmatites in Gordonia, Kenhardt, and Namaqualand, all i Cape Province. In Swaziland minor occurrences of monazite and allied materials were reported from the tin gravels of Embabaan but were not commercially important. In Transvaal, a uranium mineral of the pitch-blende type was reported from Messina Mine in 1926 but no further data appeared in later literature. In Kenya an unsubstantiated report was made of a pitchblende discovery in Nyeri-Nanuki in the Loldaiga Hills about 30 miles from Nanyuki. In Southwest Africa carnotite may be pre with the vanadium deposits in the Otavi Mountains but there is no sup-porting evidence so far. In Tanganyika, Krusch, in 1937, reported uraninite crystals in pegmatite on the east slope of Lukwangule in the Uluguru Mountains, Morogoro district, in mica deposits and in 1923

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pitchblende had been reported in pegmatite veins. Neither deposit was developed. In Uganda, the literature mentions occurrences of monazite xenotime, and tantalite but no specific radium minerals.

3. (2) Preliminary Report on SOM and TOM in Algeria and Tunisia. November 28, 1945.

Uranium traces were reported in a specimen of vanadinite, which occurs in small amounts in the lead-zinc deposit at Djebba, Tunisia. Very small amounts of uranium and thorium were present in precipitate from a slightly radioactive phosphate deposit at Bordj-Kadir, Algeria Monazite is found in titaniferous sands near Cap Kelah. The reviewer believes there may be some carnotite in the Permo-Triassic formation and that phosphate zone of the Eocene formation might carry uranium phosphate containing up to 0.03% U_3O_8.

4. (3) Preliminary Report on Possibilities for SOM and TOM in Angola. March 28, 1946.

Orthite (allanite) is the only mineral listed which contains even traces of uranium or thorium. It occurs in a rock slide in the Cunene River five kilometers above Montenegro Falls.

5. (4) Preliminary Bibliographical Report on S-37 Occurrences in the Belgian Congo and Data on the Shinkolobwe Mine. July 19, 1943.

The Shinkolobwe Mine of Haut Katanga in Belgian Congo is one of the world's chief uranium producers. About 2400 m. tons had been ship

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for radium production up to around 1940. The ore reserves are estim at 130,000 m. tons of ore carrying 5550 m. tons of U_3O_8 or 4700 m. t of uranium.

30. (5) Preliminary Bibliographical Report on SOM in Morocco. Janua 30, 1945.

Two very indefinite literature references reported pitchblende deposits in valleys between Fez and Tangier and a small crystal of a in a sample of compact manganiferous iron ore from Emerschen near Tasmrabits in Beni Said near the seashore. There may be some uranium associated with cobalt deposits at El Graara and Bou Azzer in veins i the pre-Cambrian formations of the Anti-Atlas Mountains although none has been reported so far. Monazite may occur in ilmenite-bearing bea sands near the mouth of the Oum er Rbia and in beach sands along the Moroccan Meseta. Phosphate beds between Casablanca and the Little At Mountains may be potential hosts to low grade uranium minerals over a wide area.

31. (6) Possibilities for SOM and TOM in Mozambique. January 15, 194

Occurrences of uranium minerals in Mozambique carrying significa amounts of uranium are located in the coastal areas in the circumscri of Nampula, eastern Ribaue, Alto Molocue, Erati, and Mocoje. In the columbite-tantalite occurrence at Muiane Mine, Alto Molocue, the rese are estimated as 2000 tons of mineral containing 62 m. tons UO_3 and 5 m. tons ThO_2. Monazite is present in alluvial deposits along rivers i Alto Molocue, in the sands of Komati River, and in several other beach and delta deposits. It may also occur in black sands of the

Zambesi and Ruvuma deltas.

41. (7) Possibilities for SCM and TCM in Tanganyika Territory. Feb. 1946.

Occurrences of uranium minerals like uraninite, samarskite, etc. and their weathering products are limited to the Ulugura and Usambara Mountains in pegmatite dikes. Monazite, thorite, and allanite are widely distributed. Monazite with a low thorium content may occur in black sands at the mouth of the Ruvuma and Malandu rivers. Monazite may be present with a significant thorium content in the beaches and coastal plain deposits and in the known deposits in the Karroo sedim

ASIA

15. (8) Preliminary Bibliographical Report on SCM in China. April, 1945.

There are no genuine occurrences of uranium reported in the lite ture for the central provinces of China. Euxenite is reported from t Hai-ch'eng district of southern Manchuria. An occurrence of specular hematite in Liao-yang Prefecture was noted as being faintly radioacti due to traces of uranium and thorium. The report also mentions radi active bismuthinite at Yao-k'ang-hsien in Hunan province and occurres of cobalt, et., with which uranium might be associated though unrepor as yet.

UNION MINES DEVELOPMENT CORPORATION

16. (9) Report on Possibilities for Uranium in Eastern China. April, 1946.

No definite uranium occurrences are reported from eastern China. In Manchuria there are occurrences, probably authentic, in euxenite and radioactive columbo-tantalite near Hai-ch'eng, radioactive hematite near Liao-ling, and an unidentified radioactive mineral near Hsiao-li. The alleged radioactive occurrence at Halhin-holumarahan in northern Manchuria still remains to be proven. Monazite is reported in the alluvial deposits of Liaoning, Hopeh, Kwantung, Kirin (0.03% monazite) and Heilingkiang (0.4-1.1%). It may also be present in the graphite deposits of Shantung, which are in the same zone as the radioactive graphite deposits of Korea.

25. (10) Preliminary Bibliographical Report on S-37 Occurrences in India, Ceylon, Burma, and Tibet. February 7, 1944.

In India, pitchblende was recovered to the extent of 672 lbs. in Abraki Pahar mica mine in Gaya District, Bihar province, between 1913-1915. Uranium minerals have also been found in India at Pichili mine 3 mi. N of Dilwa RR station in Gaya District, at Sumrgi-Dhalbhum in Singhbhum province, at Lopso Hill in Singhbhum, at Singhbhum copper mines, at Sankara mica mine, Gridalur, Nellore District, where 82,136 lbs. of samarskite were produced between 1910-1923, at Vaiyampatti in Trichinopoly District, at Pusulapad mica mine 2 mi. NW of Sankara, at

the abandoned Kondandarama mica mine near Parlappalli village, Nellor District, in the alluvium of the valley of the Kistna (Krishna) river and at four locations in Madras State, namely, Tovala taluk, Erania taluk, Thadagay Hill, and Tadikaren Konam. In Ceylon thorianite occu at Kondrugala in the bed of a small stream, Kuda-Pandi-oya, and near Gampola in pegmatite in the Ambalawa estate. A small piece of samars was reported from Tavoy, Burma. Uraninite crystals were found in gra from the right bank of the Tsangpo or Brahmaputra river above the Cha ferry in the provinces of Tsang and U in Tibet.

27. (11) Preliminary Bibliographical Report on S-37 Occurrences in Japan. December, 1944.

All Japanese occurrences of uranium minerals were in pegmatites or in shallow, low-grade alluvial deposits washed from pegmatite outc Small amounts of uraninite occur in Abukuma block pegmatites. Uraniu minerals are also present in the alluvials at Nagi and on the Southe Inner or Sea of Japan block in Kyushu, southern Honshu, and Shikoku. Three mines at Iimori, Besshi, and Eboshi with cobalt mineralization may be possible sources of uranium although none has been reported fr them yet.

28. (12) Possibilities for Uranium in Korea. July, 1946.

Although there are no reported developed resources of uranium ore in Korea, there are reported occurrences of torbernite in pegmatite at Ginkoku Mine near Sakushu in Heian Koku; uranium minerals of the refractory group in alluvial gold operations at Ryusei and Kojo in

Chusein Nan Kinman in Kokei and Kaigetsu in Keiki; monazite carrying 0.1-0.5% uranium in all the alluvial gold sands, the proportions bein lower in southern than in northern Korea; and miscellaneous pegmatite occurrences. The best potential sources of uranium seem to be monazi in auriferous alluvium and possible pitchblende veins associated with cobalt areas of Keisho Hoku located on the edge of a massif.

32. (13) Thorium in the Netherlands East Indies and Southeast Asia, G. W. Bain, March 30, 1945.

Three types of occurrences of thorium-bearing minerals are recog in this area, bedrock occurrences, residual and alluvial deposits. ThO_2 content in various mineral samples ranges from 3.40-9.41%. Exhaustion of the rich detrital tin deposits in Malaya and the Netherla East Indies is diverting exploration to the lower grade deposits. Normal annual output of monazite might be expected to reach 2000 long tons in Malaya, 1000 tons in the Netherlands East Indies and 4 tons i the Unfederated Malay States.

36. (14) SOM and TOM Possibilities in the Philippine Islands. July,

Monazite is present in alluvial gold deposits in Southern Luzon (there are radioactive black sands at Nueva Ecija and Camarines Norte Both artesian and ordinary groundwater contained considerable radon. specific uranium occurrences were reported.

UNION MINES DEVELOPMENT CORPORATION

42. (15) SOM and TOM Possibilities in Thailand. November, 1945.

Monazite is reported from placer tin ores at Tenimh harbor. Of potential uranium and thorium deposits would be in alluvials derived by stream action from gneiss, granite, and other crystalline rock as on Kra Isthmus and northeastern Thailand, and in placer deposits wor for cassiterite and gold. Further investigations for uranium and th in Thailand would probably give favorable results.

AUSTRALIA AND NEW ZEALAND

6. (16) Preliminary Bibliographical Report on S-37 Occurrences in Australia. October 25, 1943.

Two districts at Radium Hill and Mount Painter in S. Australia produced small quantities of uranium concentrates. Uranium minerals also occur at Moonta and Cleve in S. Australia, Cooglegong and Nodgi in W. Australia, and Cook District in Queensland. Pegmatites at Normanville, S. Australia, contain thorium, possibly accompanied by uranium too.

7. (17) Preliminary Bibliographical Report on S-37 Occurrences in Australia. Supplement No. 1. May 24, 1944.

This report is an elaboration of the previous one and gives more detail regarding the areas listed above. In addition, traces of carn were reported from a section of the Hundred of Minbrie, S. Australia.

33. (13) Preliminary Bibliographical Report on S-37 Resources of New Zealand. June 9, 1944.

Carnotite at an unnamed location was reported in two literature references in New Zealand in 1914. Thorium was reported as widely distributed in streams of Reefton subdivision, Westport and North Westland Divisions, and monazite occurrences were numerous but small in quantity. The vanadiferous and titaniferous ironsands at Patea on the north coast of North Island near Plymouth, the Taranaki iron sand with 0.08 - 0.1 vanadium, the vanadium-bearing coal at Wharekiranpunga, and the phosphate deposits of New Zealand may all be of interest as possible uranium sources although no content has been reported from them.

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BIBLIOGRAPHICAL REPORTS - 10

UNION MINES DEVELOPMENT CORPORATION

EUROPE

10. (19) Preliminary Report on SOM in Bulgaria. November 15, 1943.

The two known occurrences of uranium minerals are the autunite and torbernite (with possibly pitchblende too) occurrence at Goten as the autunite crystals in pegmatite at Strechla. Neither deposit had worked at the time the report was written. Reserves are unknown but believed to be small.

17. (20) Report on SOM Deposits of Joachimstal, Czechoslovakia. Octo 1943.

Valuable pitchblende deposits in veins in the schists were worke extensively. Silver is mined there and other mineral associations include uraninite, cobalt-nickel-silver, native bismuth, and tin. Pitchblende from here was used by Curies in the discovery of radium. The estimated reserves are 852 m. tons of uranium. The annual produc is about 14.2 m. tons of uranium.

19. (21) Preliminary Bibliographical Report on Occurrences of S-37 in England. January, 1944.

Uranium minerals, including pitchblende and its derivatives, aut torbernite, Nippeite, and ochre, occur in the tin and copper mining districts of Cornwall and Devonshire. Recorded production from 1856- totalled about 2410 s. tons of uranium minerals with an approximate U_3O_8 content of 5%.

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20. (22) Preliminary Bibliographic Report on SOM in Finland. June, 1

No definite uranium occurrences were listed in literature on Finland but there may be some possibilities in the deposits at Suojar which resemble the shungite of Shunga, U.S.S.R.; the high radioactivi of Rapakivi granites possibly caused by uranium and thorium; gadolini in pegmatites of Kimito Island; strongly radioactive gadolinite at Kangasala; and the accessory wiikite, monazite, euxenite, and orthite in pegmatites of Impilahti. No field work was recommended.

21. (23) S-37 Deposits in Germany and Czechoslovakia. August, 1946.

Occurrences of uranium minerals are numerous and widespread particularly in the border area of the Bohemian uplift but, except fo the Joachimsthal district, are small and irregular. The chief uraniu locations in Germany and Czechoslovakia are: the Erzgebirge and Riesengebirge, Schneeberg district, the Fichtelgebirge, the Bavarian Forest, Wolsendorf in Upper Palatinate, Black Forest, Harz Mountain-Mansfeld area, Kaiserwaldgebirge, Schlaggenwald-Schonfeld area, and Joachimsthal. Data for making an accurate estimate of production and reserves are lacking. "Based on past performance, however, and the record of Joachimsthal production, it would appear that maximum annual production including, say, 50 tons from Joachimsthal, would not exceed 75 tons of 50% U_3O_8 concentrates and probably would be considerably le Within Germany proper, production probably would not exceed 20 tons a

even under an accelerated mining program."

22. (24) Bibliographical Report on S-37 and T-37 Possibilities in Gr October 18, 1945.

Only one reference, dated 1875, suggested the possible presence 1.5% uranium oxide in the lead slags of the Laurion District. Other areas which might contain limited deposits are: pegmatites associat with granites of Naxos and other Cyclades Islands; silver veins of M and Thasos; alluvial sands and pegmatites of Thrace and Macedonia; and asphaltites in Nummulitic limestone in northern Aegean Sea area. In view of the limited possibilities no special field examination of the was recommended except as an incidental side-trip connected with exam nation of an adjacent area.

26. (25) Preliminary Bibliographical Report on S-37 Occurrences in It February 29, 1944.

No known deposits of uranium minerals in Italy warranted investi despite the presence of many radioactive mineral springs. At Lurisia U_3O_8 occurred in autunite. At Colico and Dervio, Lake Como, uranium minerals occur with beryl, apatite, and zircon. Delorenzite occurs a Craveggia, zeunerite occurs in small amounts at Monte Cristo Island, and some pitchblende and torbernite were found in pegmatite dikes.

34. (26) Preliminary Bibliographical Report on SOM in Norway. June 2 1945.

UNION MINES DEVELOPMENT CORPORATION

The principal uranium minerals' areas listed in southeastern Norway include southern Norway to the Mase, Western Norway, and North Norway. The uranium minerals occur primarily in banded magmatic pegmatites with only microlite in the hydrothermal type. In the hundreds of localities listed none were known to have yielded more than a few hundred pounds of U_3O_8. Only 3-15 tons U_3O_8 could be extracted annu The reviewer mentions Lofoten Islands' black sands as a possible sou of monazite and uranothorianite.

37. (27) Preliminary Bibliographical Report on S-37 Occurrences in Portugal and Production Data. September, 1943.

Uranium ores, frequently associated with tin and tungsten deposi are widely distributed in Beira State in north-central Portugal, prim ly around Guarda, Viseu, Castelo Branco, and Nelas, the latter being site of the most recent activity. The Urgeirica Mine had been the ch producer in recent years, with an output of uranium ores between 1911 and 1937 amounting to 17,140 m. tons and an estimated radium content crude ores produced between 1908 and 1937 of about 22.2 grams (or, th retically, 65 m. tons of uranium metal since no specific record of th uranium content of the ores was given).

38. (28) Bibliographical Report on SOM in Portugal. October 31, 1944.

Of 120 uranium concessions granted, 17 produced some ore and most of the concessions and all the producers were in the Viseu, Guarda, s

Castelo Branco districts. Minerals occur primarily in narrow fissure veins in granites of Carboniferous age but in outlying areas the vei: are in metamorphic rock. Three principal producers are Urgeiriea Mi: near Nelas, 9088 m. tons of ore, Reboleiro and Vales mines near Tran: 12 m. tons, and at Dondada the Rosmaninha mine, 1932 m. tons, and Co: mine, 607 m. tons. They produced 11627 m. tons of ore or 5/8ths of Portugal's output before 1938. The reviewer's estimated reserves ar: Urgeiriea, 67.75 m. tons U_3O_8; Trancoso, 54.30 m. tons U_3O_8; and a questionable quantity from the Guarda-Castelo Branco district.

39. (29) Preliminary Bibliographical Report on S-37 Occurrences in Sp July 14, 1944.

Uranium has been mined or discovered at 27 localities in Spain, primarily in the Meseta. Little information is available on tonnage or average grade of the deposits. The largest and only production ca from the Flor de El Espinar mine in Segovia Province, when 12.9 tons ore, presumably containing chalcolite, are reported in a paper writte in 1910.

40. (30) Preliminary Bibliographical Report on S-37 Occurrences in Sweden. September, 1943.

Uranium occurs in Sweden in at least two forms, namely, in kolm, a sparsely distributed constituent of the Cambrian "alum schist", and in pegmatites. The kolm is found in the area between and northeast o Lakes Varnern and Vattern in Vastergotland and Narke provinces, and i the iron mines of Dannemora, Hallefors, and Norberg, and has received

much study for its commercial possibilties but no industrial work h been done on it as yet. Pegmatites occur in Tryserums (pitchblende Digelakar near Grano (cleveite), Varutrask (uraninite and pitchblen and Mohl near Kongelf (nohlite and blomstrandite) but the occurrenc have received only scientific attention.

43. (31) Bibliographic Report on SOM in Turkey. March 20, 1945.

The only uranium occurrence was recorded for Turkey in 1848 as pitchblende located somewhere around Adrianople. There is no confir in later literature. The reviewer suggested the beach sands adjacen to the uranium-thorium bearing sands of Batum, U.S.S.R. or the alluv in streams near the Batum boundary as possible sources. He said the carnotite may also be present in Turkey although none had been dis- covered to date.

45. (32) Preliminary Bibliographical Report on S-37 Occurrences in U.S.S.R. October 20, 1943.

The chief Russian source of uranium is the Tyuya-Muyun deposit in Ferghana district, Turkestan, for which 2.3 grams metallic radium were recovered between 1904 and 1914 and of which the reserves were estimated in 1922 as 15-20 grams metallic radium and 60 m. tons of uranium in low grade tyuya-muyunite ore. Other occurrences listed i clude pegmatites of Northern Karelia; lead-vanadium ore deposits in Suleytan-Say, Kazakistan; contact zone deposit between crystalline r

and limestone in Minusinsk district; V and U in copper-bearing sandstone in Perm, Urals; pegmatite dikes in Sludanky region and the west section, Trans-Baikal; uraninite occurrences of the Altai Mountains; in salt water of oil wells in Pecherasky, Timan, Ukhta region; veins i quarts diorites in Taborsharskaya region; deposit in granodiorite wal rock of large vein of Tokmak area; ore deposits in Naili Su River reg deposit resembling U. S. carnotite ores in Caucasus district; radioac waters in Pyatigorsk district; carnotite-type minerals of South Fergh district and pitchblende in Karamazar Mountains; radium in oil refine in Baku; bituminous shales in Petrograd district; vein deposits in Ka region.

46. (33) Preliminary Bibliographical Report on U-37 Occurrences in U.S.S.R. Supplement No. 1. April 28, 1944.

U.S.S.R. has at least six promising areas for uranium deposits but no information is available on the magnitude and grade of ore reserves. The occurrences include: Tuyya-Muyun (vanadium, radium, and tuyamunite); Alai Mountains (uraninite); Kara-Mazar district (uraniu minerals at Tabashar and Sarymakhly mines and micas at Kan-i-mansoor) Samarkand district (Tyuyamunite at Azalyk); Lake Baikal; section in vicinity of Abakan, Khakassak Autonomous Territory. In addition, the are euxenite and wiikite in Ukrainian crystalline belt, fergusonite i northern Caucasus on the upper Terek River near the mouth of the Zno Daghestan A.S.S.R., and carnotite around Kirovabad. Pegmatites on

eastern flank of Urals have euxenite and samarskite and those along t
west coast of the White Sea and Kandalaksha Inlet in Northern Karelia
contain uraconite, uranophane, and crystalline uraninite.

47. (34) Bibliographical Report on the Ukhta Oil Region, Komi A.S.S.R
U.S.S.R. October 30, 1945.

The oil field waters of this area were reported to contain radiu
and mesothorium but no uranium or thorium, according to literature
available for examination when the report was compiled. State Well N
had the highest radium content of all the wells in the area, namely,
$7.4 - 7.6 \times 10^{-9}$ g. radium element per liter. The reviewer states th
in articles by Onkovskaya written in 1942 (but not seen by the researc
staff), water from Kazarmaya No. 1 at Ukhta contained 3.7×10^{-7} g.
uranium per liter or only fifty times as much uranium as radium so th
the uranium output would be inconsequential. He also believes that t
shales near the salt water horizon may have an unusually high uranium
content, possibly up to 0.03% U_3O_8.

48. (35) Bibliography of References on U.S.S.R. May 25, 1945.

This report consists of two parts: a list of the full titles
and volume numbers of periodical Russian literature examined by the
research staff to that date and a bibliography of references dealing
with the U.S.S.R., issued between 1932 and 1944, and mostly written i
Russian.

49. (36) Biographical Data on U.S.S.R. Scientists. March 7, 1946.

This report contains the names and brief biographical sketches (where available) of Russian scientists who had written articles on subjects of interest in the research work and for whom references w available in the research files.

NORTH AMERICA

2. (37) Preliminary Bibliographical Report on S-37 Occurrences in Alaska. June, 1944.

No reports of specific uranium occurrences were found in the literature but monazite, aeschynite, and allanite occur in gold pla deposits and the lode deposits may be favorable for uranium minerals

11. (38) Possibilities of SCM Occurrences in California and Oregon. April 6, 1944.

In California, the occurrence of a few hundred pounds of pitch- blende at Benland is the only promising uranium occurrence. In addi uraconite and uraninite occur at Rathgeb mine, San Andreas, Calavera County, and there are occurrences of allanite in five counties, mona in eight counties and, in 29 counties, placer deposits which are not thought to be a suitable type for uranium mineralization. In Oregon, torbernite occurrence at Baker City was reported in 1904 while the re of a radium occurrence at Fields, Harney County, is probably just a

promotion story.

12. (39) Preliminary Bibliographical Report on S-37 Occurrences in Ca August, 1944.

The chief uranium occurrences in Canada are at Great Bear Lake in the Northwest Territories. The Eldorado Mine there produced 53.30 g. radium and 254 tons of uranium compounds up to 1937, and, by the e of 1944, probably would have produced about 694 g. radium and 2,625 t of uranium compounds containing about 1,920 tons uranium element. Th B.E.A.R. mine in the same area produced about 3½ tons of concentrated uranium ore before operations were suspended in 1938-39. Uraniferous minerals are also found in British Columbia, Saskatchewan, Manitoba, Ontario, and Quebec but there has been no production from these local

13. (40) Preliminary Bibliographical Report on S-37 Occurrences in Ce America. May 29, 1944.

There are no uranium occurrences reported for the countries of Central America. Investigation of old mines might reveal some uraniu minerals but, to date, they are unreported in the literature.

29. (41) Preliminary Report on S-37 in Mexico. September, 1943.

The most interesting possibility for uranium in Mexico seems to the uraninite in the gold placers at Placeres de Guadalupe in the sta of Chihuahua although the report gives no figures on the uranium cont

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A lead vanadate ore at Saqui Grande, Sonora, carries 6% V_2O_5, 15% Pb and 0.14% U_3O_8. There are unverified reports of pitchblende occurre at an unnamed location, from which a Canadian concern supposedly was making purchases, and from a spot 250 mi. S of and slightly E of Nog

23. (42) Bibliographical Report on S-37 Occurrences in Greenland. January 20, 1944.

References in the literature list 49 occurrences of uranium min in Greenland, chiefly allanite and similar minerals with low uranium content. Thus the deposits seem to be of mineralogical interest onl

24. (43) Preliminary Bibliographical Report on SOM in Iceland. July 1945.

There are no uranium occurrences reported from Iceland and the geological and mineralogical conditions do not seem favorable for the future discovery of such occurrences.

SOUTH AMERICA

5. (44) Preliminary Bibliographical Report on S-37 Resources in Arge December, 1943.

Uranium occurrences in Argentina are limited primarily to the granite and pegmatites in the mountain area between San Luis and Cord and on the west slope of the Sierra de Famatina, 500 km NW of Cordob in the foothills of the Andes, where uranium was associated with sil

cobalt-nickel deposits. There has been no uranium production and lit is known about any of the deposits.

9. (45) Preliminary Bibliographical Report of Occurrences of S-37 in Brazil. July, 1943.

Uraniferous minerals of various types occur in the Brazilian peg tite dikes extending from near the Minas Geraes-Sao Paulo border on t south to the states of Parahyba, Rio Grande do Norte, and Ceara on th north. There is no record of uranium production in the report but th area has been worked extensively for its beryl and other associated minerals and has been subjected to geological study by the Brazilian government.

14. (46) Report on S-37 Resources of Chile. April 24, 1944.

The only uranium deposits noted for Chile are an unlocated pitch blende occurrence in the extreme northern part, from which small ship were made to England during World War I; a note on the extraction of uranium minerals "on a small scale" at Paihuano (Paiguano), Elqui Dep Coquimbo Province; a tungsten mineral with a 6.20% U_3O_8 content at La Serena in Coquimbo Province; samarskite associated with mica deposits the same area; and the radium deposits near Valler. Little is known a any of these deposits and none of them seems very promising. Study of the cobalt occurrences and asphaltites might prove more favorable.

18. (47) Preliminary Report on Possibilities for SOM in Dutch Guiana August 17, 1944.

A report of pitchblende near the border of Dutch Guiana and Bra appeared in a 1934 English publication but no further information wa found. The area does not seem very favorable as a possible future p ducer of uranium.

35. (48) Preliminary Bibliographical Report on SOM in Peru. June, 1

Pitchblende, in amounts too small to be economically important, occurs in pegmatite dikes on Nevada Coropuna near Pampacolca Castill Province, Arequipa. No other uranium occurrences are reported but p sible favorable sources might be the cobalt-silver mineralization in deposits in La Mar and Cuzco provinces, the asphaltite deposits, and gold or gold-tin placers.

44. (49) Preliminary Bibliographical Report on the Possibilities for SOM and TOM in Uruguay and Paraguay. August 24, 1945.

There are no uranium occurrences reported in the literature on these two areas. The reviewer cites the presence of monazite on the Rio de la Plata but no details are available regarding it. The bismu veins in the two countries may be of interest although no uranium content has been reported in them. In general, both countries seem t be very unfavorable as possible sources of uranium minerals.

BIBLIOGRAPHICAL REPORTS - 23

MURRAY HILL AREA

AFRICA

1. (1) Report of S-37 Prospects in Angola, G. W. Bain, May 15, 1945.

The favorable Mine Series host rocks which extend from the Belg Congo outcrop in a 100 mile zone in Angola. Although uranium depos are not known, conditions in this zone are favorable for their occur in quantity. Asphaltites are known in the Cretaceous strata of Cuan Basin and may contain uranium. Coastal plain rocks are favorable to formation of carnotite deposits. Any contemplated exploration for ur deposits should proceed on a geological rather than an engineering ba

ASIA

4. (2) Thorium and Uranium Resources of Korea, G. W. Bain, November 1 1946.

Uranium from Korea in more than specimen amounts is known only in refractory minerals. Thorium-bearing monazite, however, is a univ constituent of the alluvial gold gravels, and some beach sands. The alluvials have slightly over 9100 tons of monazite, containing about 640 tons of ThO_2, in explored deposits. Resources of beach alluvials (possessing about 1% monazite content) amount to 4350 tons of sand eq lent to slightly more than 300 tons of ThO_2. Total amount of known reserves of U_3O_8 in Korea, exclusive of that in monazite, is about 25 tons. Uranium in monazite of proven deposits is estimated at slightly over 35 tons of U_3O_8.

EUROPE

2. (3) Review of Production and Reserves Statistics, Joachimsthal Mir Czechoslovakia, G. C. Selfridge, April 20, 1944.

After reviewing past production and reserve statistics, Dr. Sell arrived at the following conclusion - maximum reserves of U_3O_8 as of January 1, 1937, were about 296 metric tons. Probably the mines have been stripped of the better ore above the lowest workings, and the be mineralization has bottomed on the upper levels at some places and do not extend much further downward from the lowest levels at others.

3. (4) The Erzgebirge-Bohemia Area, G. W. Bain, Dec. 3, 1946.

Joachimsthal, Czechoslovakia, has been the principal producer of pitchblende. Between 1850 and 1937 the yield was estimated at 450 me tons of U_3O_8 and 85 tons of U_3O_8 were produced between 1937 and 1944. A Joachimsthal estimate of 1945 anticipated ore reserves containing 1 metric tons of U_3O_8.

GENERAL

5. (5) Distribution Pattern of Primary S-37, G. W. Bain, Nov. 9, 1944.

The report summarizes characteristic relationships between major geologic structures and significant uranium producing regions of the primary type deposit. One of these is that uranium provinces are gen ly on or near the periphery of extensive areas of crystalline rocks po sessing some relief above the surrounding country. The report selects

for elimination from consideration a number of areas and those crite for regional favorability which have been found unsatisfactory and i specifies certain features which are non-critical or irrelevant. Po sible applications of this knowledge to exploration for uranium sup- plies and evaluation of the earth resources are discussed.

6. (6) Exploration for S-37, G. M. Bain, Nov. 15, 1944.

The unexplored and incompletely explored areas of the world are considered. Suitable methods of field study are suggested. Dr. Bai recommends field exploration in the following localities: East Green Guiana Shield, Brazilian Shield, Tibetan Shield, Ahaggar Massif, Nore Bulgaria, and New Guinea. The inadequate understanding of the sedim deposits is indicated and the need for some summary of the present knowledge is suggested.

7. (7) Review of S-37 Placer Deposits and Proposed Exploration Method by Use of Placer Minerals, G. M. Bain, Feb. 22, 1945.

The report discusses the origin and general characteristics of placer deposits, sampling methods and procedures, and economic and ex ploration value of placer studies. In addition there are regional st and data on specific deposits with uranium minerals. Deposits in California, Idaho, Witwatersrand, Tibet, Placer de Guadeloupe (Mexico Ceylon, India, Brazil, and Madagascar are discussed. Potential urani areas which are difficult to explore but seem amenable to exploration

placer examination technique include the Tibetan, Brazilian and Guia Shields, and the Peruvian Piedmont Pampas.

3. (S) Preliminary Report on SOM Bearing Hydrocarbons, G. W. Bain, April 14, 1945.

The report presents a summary of the data on the hydrocarbon occurrences of uranium. Subjects discussed include käls, asphaltite, pegmatite and vein hydrocarbons, black shale, and radioactive petrol and oil field waters. The amount of U_3O_8 occurring in hydrocarbon deposits of all sorts may exceed 300,000 tons. Possibly one-third of this amount or 100,000 tons occurring in the Swedish käls and the Argentine asphaltites, can be recovered now or in the future at costs not too far out of line with present values.

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Foreign Exploration Reports

(Figures in parentheses are the serial numbers of the Summaries which follow.)

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2. (21) Argentina, Supplement #1 to Report on Reconnaissance Survey for S-37 Occurrences in, Russell Gibson and D'Arcy George, April 23, 1945.

3. (22) Argentina, Report on Reconnaissance of Area of Solitaria Mine, La Rioja Province, John Worcester, Oct. 17, 1945

4. (5) Australia, Report on Field Examination for Occurrences of SCM in, C. H. Hall, July 23, 1945

5. (23) Bolivia, Reconnaissance of for SCM, John Worcester, March 12, 1945

6. (24) Brazil, Report on S-37 Resources in, E. H. Cooper, Jr., April 29, 1944

7. (25) Brazil, Supplement #1 to Report of Reconnaissance Survey of S-37 Resources in, R. H. Ridgway, June 27, 1945

8. (26) Chile, Report on Reconnaissance of S-37 in, John Worcester, July 27, 1944

9. (27) Chile, Report on Reconnaissance of w/Geiger-Muller Counter (Suppl. Reconnaissance of S-37 in), John Worcester, October 25, 1945

10. (4) China, (Western) Reconnaissance for Radioactive Minerals in, Russell Gibson and William Gruenerwald, June 1946

11. (28) Columbia, Preliminary Investigation of S-37 and T-37 in, John Worcester, Aug. 31, 1945

12. (29) Ecuador, Investigation of SCM and TCM Possibilities in, John Worcester, Sept. 24, 1945

13. (14) Greenland (Southern), Report on Reconnaissance Survey of, W. G. Valentine, Jan. 1945

14. (1) Madagascar, Reconnaissance Report - SCM and TCM in, W. G. Bourret, Oct. 16, 1945

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16. (17) Mexico, Report on Investigations for S-37 in, J. M. Hill, M 1944

17. (18) Mexico, Supplementary Report on SCM in, O. Cebos, July 1945

18. (19) Mexico,(Chihuahua, San Carlos Region) Report on Clark Quicks Mine, J. M. Hill, Aug. 21, 1945

19. (16) Mexico (Northern Part of Lower California), Report of Field Reconnaissance Survey, J. M. Hill and A. E. Carper, Feb. 194

20. (6) New Zealand, SCM and TCM in, C. H. Hall, June 11, 1945

21. (11) Northwest Territories, Investigation of Pitchblende Resources of. Report on Preliminary Field Work at Great Bear Lake and Hottah Lake, A. K. Muir, summer 1943

22. (13) Northwest Territories, Supplement #1 to investigation of S-3 Resources of, Report on Preliminary Field Work at Great Bear Lake and Hottah Lake, A. K. Muir, Dec. 27, 1944.

23. (12) Ontario and Quebec, Reconnaissance Report on SCM Mineral Occurrences of with Recommendations for Further Prospecting, W. D. Mateer, Nov. 1943

24. (30) Peru, Preliminary Report on Field Investigation for S-37 and Minerals in, R. I. Salberg, Dec. 3, 1945

25. (31) Peru, Reconnaissance for S-37 and T-37 in Peru, R. I. Salberg Dec. 11, 1945

26. (9) Portugal, SCM Resources of, E. N. Cooper, Jr., April 1946

27. (7) Portugal, Preliminary Memorandum Report on Investigation of the Urgeirica Mine, D. Baker, Feb. 20, 1945

28. (8) Portugal, Report on Examination of Urgeirica Mine, D. D. Baker March 1945

Quebec - see # 26

29. (10) Spain, Preliminary Report on Field Investigation For S-37 and T-37 Minerals in, E. N. Cooper, Nov. 15, 1945

30. (3) Union of South Africa, SCM Reconnaissance of Certain Localiti in, W. G. Bourret, July 1946

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31. (32) Venezuela, (Western), Report on Reconnaissance for SOM in Andes of, John Worcester, May 7, 1945

32. (2) Witwatersrand, Preliminary Examination of Occurrences of Uraninite in Gold Fields, W. G. Bourret, Jan. 1946

33. (33) Belgian Congo (and Rhodesia) Border, S-37 Deposits and Localization of SOM in Cobalt Ores, G. W. Bain, Dec. 28, 1944

34. (41) Brazil, Coastal Monazite Deposits of, R. D. Mininger, Jan. 3 1947

35. (34) Klerksdorp (and Orange Free State), Uranium Deposits in, G. Bain, April 9, 1946

36. (40) Mexico (Chihuahua), C. W. Clark Uranium Prospect, G. W. Bain Feb. 18, 1946

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37. (39) Northwest Territories (Eldorado Mine, Great Bear Lake) Repor on a Reconnaissance Examination of the, G. C. Selfridge, Feb 10, 1945

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38. (42) Peru, Hydrocarbon Deposits of, G. W. Bain, June 1947

39. (35) Rand (Far East), S-37 Possibilities in the, G. W. Bain, June 1945

40. (37) Rand (Far East), Uranium on the, G. W. Bain, March 27, 1946

41. (36) Rand (Far West), Uranium Resources of the Witwatersrand Secti of the, G. W. Bain, Feb. 14, 1946

42. (38) Sweden, Uranium Distribution in, G. W. Bain, Sept. 25, 1946

43. (43) Uruguay (Southern), Beach Examination for Monazite, R. D. Mininger, June 24, 1947

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FOREIGN EXPLORATION REPORTS

AFRICA

Madagascar

14. (1) Reconnaissance Report on SCM & TCM in Madagascar, Weston Bo W. D. Mateer, J. Frank West, October 16, 1945.

During the six month period between October 16, 1944, to March, 1945, a field party consisting of Mr. Weston Bourret, Mr. W. D. Mate and Mr. J. Frank West examined the uranium and thorium occurrences i Madagascar. Approximately 0.8-1.2 lbs. of uranium mineral concentrat can be recovered per ton of pegmatite mined, with total pegmatite re serves from autunite bearing sediments were estimated at 130.0 tons U_3O_8. The cost of recovering the above would range from $2.60 - $12. per lb. U_3O_8. It was recommended that future field work be discontin until such time as it was deemed advisable to obtain supplies at the above indicated prices.

/Main Review recommended further study of the autunite type deposit, the monazite beach sands and the alluvial gold workings/

Rand

32. (2) Preliminary Examination of Occurrences of Uraninite in Witwatersrand Gold Fields, W. Bourret, Jan. 1946.

Field work was carried out in Aug. and Sept., 1944, by Mr. Bourr during the time of waiting for a visa for Madagascar. The survey in- dicated that the Rand is one of the world's most important uranium areas. Uraninite occurs in highly concentrated mill products. An

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annual production (at present milling rates) of some 41 tons U_3O_8 is indicated. 34 tons of this amount are assigned to mines working Main Reef Leader ore. Some additional 40 tons per year could probably be obtained from the "all-cyanide" type mills working Main Reef Leader o if the plants had corduroy gravity circuits. It is recommended that detailed investigation be undertaken immediately. The recommended method of recovery of U_3O_8 concentrates is outlined.

/Main review: only 25% of the uranium is in uraninite while most is in a light hydrocarbon which cannot be recovered in the heavy concentrate. The uraninite is ten times more abundant than that indicated by Bourret. Total amount of U_3O_8 in both uraninite and hydrocarbon handled annually may be between 6,000 and 25,000 tons providing it ca be recovered./

Union of South Africa

30. (3) SGM Reconnaissance of Certain Localities in The Union of South Africa, Weston Bourret, July, 1946.

During the month of Sept. 1944, W. Bourret, N. D. Mateer, and J. F. West investigated three general areas in South Africa. The occurrence of polycrase and uraninite is very sporadic in the pegmatites of the Orange River area. About 700 lbs. of priorite containing about 2% U_3O_8, and a lesser amount of monazite are recoverable annually as by-products of tin mining from the Swaziland Tin Fields. Pegmatites of the Bushveld Complex contain minor amounts of bastnasite and fluorite which contain minor percentages of ThO_2. The Alexander Bay diamond beach sands were found to contain monazite. It is recommended that th Alexander Bay sands be studied; and that the pegmatite horizon of the

Bushveld Complex be mapped in detail if there is interest in recover ThO_2 from bastnasite and fluocerite.

ASIA

China

10. (4) Reconnaissance for Radioactive Minerals in Western China, Russell Gibson and William Gruenerwald, June, 1946.

Numerous types of mineral deposits, prospects, mines, tailings dumps and mineral collections were examined and information sought i Yunnan, Sikang, Szechwan, Hunan, Kansu, Shensi, Ch'ing-kai and H'ing provinces. No radioactive minerals were discovered in deposits exam by Mr. Gibson and Mr. Gruenerwald and there was no record found of production of radioactive minerals.

The authors felt that the area should not be finally rejected f in so vast an area there are possibilities of unexplored or incomple explored territories.

AUSTRALIA

4. (5) Report on Field Examination for Occurrences of SOM in Austral C. H. Hall, July 23, 1945.

During 1944, Mr. Clarence H. Hall spent 6½ months in Australia examining 42 deposits for possible sources of uranium. At two locali ities-Radium Hill and Mount Painter, uranium ore of grade exceeding) can be mined. At Radium Hill, 150 tons concentrate (about 1% U_3O_8) i

been mined and at Mount Painter approximately 54.25 tons assorted ore and concentrate (averaging 2.7% U_3O_8). These deposits can produce small amounts of U_3O_8 at extremely high cost. Future field work not recommended.

New Zealand

20. (6) Report of Field Examination for Occurrences of SCM and TCM in New Zealand, C. H. Hall, June 11, 1945.

Principal occurrences of uranium minerals were investigated by Clarence Hall on the west coast of South Island where alluvial deposi carry uranium and thorium. At Gillespie Beach highly concentrated he minerals carrying up to 10% uranium were reported but the extent of t uranothorianite is not yet determined.

Indicated reserves for the three properties-Addison's flat, Barrytown and Gillespie's Beach are calculated as 2,600,000 lbs. of U and 6,420,000 lbs. of ThO_2 in 7,600,000 cubic yards of material being worked for gold. Old tailings contain triple the above amounts.

EUROPE

Portugal

27. (7) Preliminary Memorandum Report on Investigation of Urgeirica M Portugal, David D. Baker, February 20, 1945.

During the months of December, 1944 and January, 1945, Mr. David D. Baker examined the Urgeirica Mine in Portugal. A rough estimate o ore reserves indicated a possible 2,000 tons of 0.5% uranium ore with the limits of known ore shoots. Ready assets on the surface of the

property included 30 tons of sorted 1½% ore, 20 tons of precipitates assaying 7.75% and 30 tons of precipitates running 34.4%. Total surf and underground material represents a possible content of approximate 25 tons of U_3O_8.

28. (8) Report on Examination of Urgeirica Mine, D. D. Baker, Mar. 2 1945.

Field examination was carried out during the months of Dec., 194 and Jan., 1945 by Mr. Baker assisted by Mr. E. N. Cooper, Jr. All accessible workings of Urgeirica mine were visited and studied, and samples were taken from the dump, tailings piles, and from the ore-bearing localities in the mine. Maps were brought up to date.

It is estimated that the lower levels of the mine contain some 3,000 tons of probable ore representing approximately 25 tons of uran Possible ore existing in stope fills and in unmined lenses of ore in old workings may contain about 17 tons of uranium. Surface reserves consist of chemical residues with 9.35 tons of easily recoverable uranium, in addition to some 10 tons of uranium in chemical plant tai Value of assured and probable reserves amounts to $178,620.

Hotel property belonging to Cia. Portuguesa de Radium, Ltda. is appraised at $63,700, land and buildings pertaining to the mine are appraised at $88,625. Holdings of the company have an apparent value $330,960.

26. (9) SOM Resources of Portugal, E. N. Cooper, Jr., April, 1946.

The uranium mineral deposits exclusive of the Urgeirica mine were

examined by Mr. Cooper. Numerous alluvial, pegmatite, and lode depos were visited. Individual mineral areas are described at some length the Appendix. Principle mining operations have been at Rosmaninha ar adjacent sections and at the Urgeirica mine. Cost for exploration ar development of the properties is estimated at $490,000. The only anticipated reserves of consequence are at Rosmaninha and Reboleira v have 442.5 tons of the total 481.5 tons inferred U_3O_8. Outside the Urgeirica mine, inferred ore is estimated at about 130,000 tons with average grade of 0.37% U_3O_8. Total costs are estimated at $1.28 to $ per lb. U_3O_8.

Main review: Total resources for Portugal are reassessed at about 1 tons U_3O_8 in ore of grade recoverable in concentrates at about $3.4 per lb. of contained oxide.

Spain

29. (10) Preliminary Report on Field Investigation for S-37 and T-37 Minerals in Spain, E. N. Cooper, November 15, 1945.

During trips to Spain in 1944 and 1945, Mr. E. N. Cooper carried on field work in the Guadarrama Mountains and in parts of Cordoba, Badajoz, Leon, Santander, Lerida and Salamanca Provinces. Scattered occurrences of uranium minerals were found but none in large quantity Monazite areas visited have possibilities for stepped up production. The G-M counter could not be used, therefore, additional work was rec mended for certain sections of the above provinces at such time as it could.

NORTH AMERICA

Canada

21. (11) Investigation of Pitchblende Resources of the NWT. Report o Preliminary Field Work at Great Bear Lake & Hottah Lake, A. M. Muir, Summer, 1943.

During August and September of 1943, investigation of the radio-active resources was started in the Echo Bay-Lindsley Bay, Great Bear Lake and the Hottah-Beaverlodge Lake areas by Frobisher Exploration Company, Limited, under the direction of Mr. Muir. Aerial and ground reconnaissance was carried on and exploration and mapping of the Uran group started. 166 claims were staked in the Echo Bay-Lindsley Bay district and 12 claims at Hunter Bay.

23. (12) Reconnaissance Report on SCM Mineral Occurrences of Ontario Quebec With Recommendations For Further Prospecting, W. D. Mateer, November, 1943.

Reconnaissance for uranium minerals was carried on during Septem and October, 1943 by Mr. Mateer in a large area of southern Ontario a Quebec. Several existing mines could be profitably worked for uraniu and their dumps are also possible sources for its recovery. It was r mended that further exploration should be made in this area.

22. (13) Supplement #1 to Investigation of S-37 Resources of The Nort Territories-Report on Preliminary Field Work At Great Bear Lake & Hottah Lake, A. M. Muir, December 27, 1944.

This supplementary report by Mr. Muir supplies additional inform on several claims prospected by Ventures, Ltd. during the N.W. T.

Exploration in 1943.

Greenland

13. (14) Report on Reconnaissance Survey for S-37 Occurrences in Southern Greenland, W. G. Valentine & J. C. Troelsen, January, 1945.

During the latter part of 1944, six districts (Sardleq, Narssaq, Eqalunguit, Godthaab, Qagsiarssuk, and Tugtutuarssuk) were visited by Mr. Valentine and Mr. Troelsen. About 3/4 of the pegmatite dikes investigated contained enough radioactive material to be readily detect by the G-M counter.

On the basis of G-M counter survey of Narssaq and Sardleq distri it is estimated that about 7 million tons of pegmatite material conta about 335 tons of U_3O_8, the average content being about 0.005% U_3O_8. Mr. Valentine, in a supplementary letter, states that his grade figur should be divided by 3 to obtain the correct figure since the chemical assay was found to be that much less than the field counter results which were used to compute the above figures. The pegmatite dikes of southwestern Greenland are not practicable sources of uranium. No additional field work was recommended.

Mexico

15. (15) Preliminary Report on S-37 in Mexico, A. I. Rodrigues, Jan. 1944.

The following areas were examined by Mr. Rodrigues: the gold-uranium occurrences of Placer de Guadalupe, the Archaean Complex of southwestern Mexico and the uranium occurrences of the Sonoqui Grande District, Sonora, Mexico. Uraninite could be recovered profitably as

by-product of gold mining in the Placer de Guadalupe district. Uran bearing minerals exist as rare mineral accessories in the Archaean rocks of southwestern Mexico. As regards the Suaqui Grande district no observed basis exists for concluding that any of the veins contai uranium ore.

19. (16) Report of Field Reconnaissance Survey of Northern Part of L California, Mexico, J. M. Hill and A. E. Carper, Feb. 1944.

The purpose of this trip by Mr. J. M. Hill and Mr. Carper to the northern part of Lower California, Mexico, during the first half of February was to determine whether the pegmatite area of San Diego Co California, extended into Mexico and to find out if uranium minerals were contained within the pegmatites. They found the composition of pegmatites to be quartz-orthoclase-tourmaline with a little biotite a not of the character indicating possible presence of uranium minerals The pegmatites decrease in number and size within 15 to 20 miles S. o the International Boundary. Many bead tests for possible uranium wer all negative. The ore specimen containing uranium, proven by bead te method, made up 0.01% of the dump in which it was found and could not considered as a possible source of uranium.

16. (17) Report on Investigations for S-37 in Mexico, J. M. Hill, Nov 1944.

For a period of 10 months, a group of 7 engineers made a study o 81 mining districts in 13 states of the Republic of Mexico. Although small quantities of uraninite, associated with gold have been produced

in Placer de Guadalupe, in the past, none was found at this investig
It is believed that a sufficient number of various types of ore occu
have been examined to warrant the conclusion that uranium does not o
in significant quantities in ore deposits of Mexico. No further fie
work for uranium should be carried out.

17. (18) Supplementary Report on SCM in Mexico, O. Cobos, July, 1945.

Reconnaissance in Mexico by Mr. Cobos consisted of 3 months fie
work. A few deposits in each of 6 states were visited, totaling 18
properties. Specimens of ores and mill products, museum specimens a
samples submitted by owners of mining prospects were given the stand
bead test but uranium was not noted in any specimen from any known l
ity. From Mr. Cobos' observations, it can be concluded that no
important source of uranium can be found in Mexico.

18. (19) Report on Clark Quicksilver Mine, San Carlos Region, Chihuah
Mexico, J. M. Hill, Aug. 21, 1945.

The area examined between May 26th and May 30th by Mr. Hill was
Clark Quicksilver property, 56 miles SE of Presidio, Texas, near San
Carlos, Chihuahua, Mexico. On this property some carnotite and pos-
sibly other vanadium minerals are associated with the low grade cinna
deposits which are found in clay-filled caverns in heavy bedded "Edwa
limestone. There are a number of prospect holes, open cuts, shafts a
tunnels over an elliptical area 2500 ft. long from east to west at wh
carnotite appears. Most of the samples assayed less than 0.1% U_3O_8.
The property is not expected to reveal any large ore bodies.

SOUTH AMERICA

Argentina

1. (20) Reconnaissance of Argentina for SOM Production Possibilities, Russell Gibson, November 30, 1944.

Mr. Russell Gibson spent 4 to 6 months of 1944 examining 22 gro of mines and prospects in central Argentina. Only 12 properties sho small traces of uranium. Columbite-tantalite containing up to 0.20% U_3O_8 was found in some pegmatites. Analyses of the ash of asphaltit samples showed about one ounce of U_3O_8 per ton of asphaltite. This not be considered an important source of uranium.

2. (21) Supplement #1 to "Report on Reconnaissance Survey for S-37 Occurrences in Argentina", Russell Gibson & D'Arcy George, April 23, 1945.

The average U_3O_8 content of 28 samples of Argentine asphaltites analysed is estimated at .0033 percent and the ash at 0.29 percent. The percentage of U_3O_8 in ash ranged from .02 - 1.35; the percentage U_3O_8 in asphalt x 10^2 ranged from .04 - 1.12.

3. (22) Report on The Reconnaissance of The Area of The Solitaria Mi La Rioja Province, Argentina. John Worcester, Oct. 17, 1945 (Supplementary Report of Reconnaissance of Argentina for SOM Production Possibilities).

Seventeen days were spent in the field by Mr. Worcester. Some radioactivity was found in the Estrella Mine. The Solitaria mine was found to have the largest amount of uranium. This is estimated at n more than 100 tons of plus 1% U_3O_8 ore.

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Bolivia

5. (23) Reconnaissance of Bolivia for SOM, John Worcester, March 12, 1945.

The mines of the Corata-Millipaya District, San Augustin pegmat district, Caxata-Luribay vanadium area and Potosi cobalt area of the lower Huanuni River were visited in the reconnaissance of Bolivia by John Worcester, assisted by R. I. Salberg. Ores and concentrates in the warehouses of ore buyers were checked over with the G-M counter i many cities and towns. Minerals containing very small quantities of uranium were identified in two districts. No significant amounts of uranium were found.

Brazil

6. (24) Report on S-37 Resources in Brazil, E. N. Cooper, Jr., April 1944.

The reconnaissance was made from Aug. 1943 - Jan. 1944 by a thre man field party including Mr. Cooper. The known uranium mineral oc- currences in Minas Gerais, the tantalite area of N.E. Brazil, and any other promising localities were examined. It is estimated that if op tions were resumed at the Divino de Uba pegmatite deposit, Minas Gera on a pre-war scale, a production of 900 lbs. a month of U oxide might expected. The tantalite pegmatites of N. E. Brazil contain a relativ low amount of uranium minerals. It was decided that the Divino de Ub mine was a matter for consideration after the war and that it was in- advisable to do any further field work in Brazil at the time.

7. (25) Supplement No. 1 to Report of The Reconnaissance Survey of S- Resources in Brazil, R. H. Ridgway, June 27, 1945.

SECRET

It was discovered that the presence of thorium and other rare earth minerals nullified the fluorescence of the bead in tests made on Brazilian monazite sand. Chemical tests showed 0.19% U_3O_8. Informat is given on the monazite deposits from data gathered by the literatu research staff. It was recommended that an engineer be sent to estim the tonnage of the monazite and that a metallurgical investigation be initiated on the recovery of uranium from monazite.

Chile

8. (26) Report on Reconnaissance of S-37 in Chile, John Worcester, July 27, 1944.

Mr. John Worcester spent a total of 124 days (43 days of active field work) in Chile. The extent of examination included 15 types of occurrences, 29 small mines, 3 major mining ventures and numerous pos sible incidental sources. Minor amounts of uranium were found at Miamia Mine (0.2 ozs or less samarskite per ton), Mina Grande (0.1% of U_3O_8 in 10 tons of ore) and Jaija Mine (estimated 0.05% uranium). commercial deposits of uranium were found nor are there any deposits known which could produce uranium minerals in any quantity in the fut even at very much higher price levels.

9. (27) Report on Reconnaissance of Chile with Geiger-Muller Counter, John Worcester, October 25, 1945.

The examination of mineral specimens, stockpiles, and sample ore rejects with a G-M counter led to the discovery of several previously unknown occurrences of uranium minerals in the Copiapo and Vegas del

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Flaco areas in Chile. Subsequent field work by Mr. John Worcester w the counter resulted in the conclusion that the occurrences were of commercial or strategic importance. A limited tonnage of 2-5 tons uranium might be recoverable at a cost of $50.00 to $100.00 per poun Recommended that further field work be discontinued.

/Main review recommends further examination of the cobalt areas./

Colombia

11. (28) Preliminary Investigation of S-37 and T-37 in Colombia, John Worcester, Aug. 31, 1945.

As the result of an 8 day visit by John Worcester to Colombia, uranium minerals have been obtained in specimen amounts from pegmatit near Pamplona, Santander Province. Although 4 areas have geologicall suitable host rocks for uranium minerals, the Pamplona pegmatites hav the only reported occurrences and here 50 man-days labor were rewarde with less than 5 kilograms of U_3O_8. Additional work in Colombia shou be held in abeyance, until more favorable countries have been examine

Ecuador

12. (29) Investigations of SCM & TCM Possibilities in Ecuador, John Worcester, September, 1945.

No deposits of uranium or thorium minerals are known in Ecuador. John Worcester spent eight days in the capital, Quito, testing sample and interviewing mining experts. There were no leads that would warr field trips to any other locations.

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Peru

24. (30) Preliminary Report on Field Investigation for S-37 and T-37 Minerals in Peru, R. I. Salberg & John Worcester, December 3, 1945.

25. (31) Reconnaissance for S-37 & T-37 in Peru, R. I. Salberg & John Worcester, December 11, 1945.

Mr. R. I. Salberg spent from February 1, through August 2, 1944 and Mr. John Worcester 3 months of 1944 in Peru studying future prod possibilities of uranium and thorium. During the course of the field work, 83 mining prospects located throughout the principal mining dis were examined. Four uranium mineral occurrences were found but none considered as having any production possibilities due to their scatte nature.

/Main review recommended more careful examination of the asphaltites, the cobalt associations and the alluvials./

Venezuela

31. (32) Report on A Reconnaissance for SCM in The Andes of Western Venezuela, John Worcester, May 7, 1945.

Ten days were spent by Mr. Worcester examining pegmatites in an area 150 miles long and 50 miles wide between Lagunillas and Trujillo The Capilla de Carmen and Berilio No. 1 Prospects contain uranium min as isolated specimens in pegmatites. The former contains about 0.000 U_3O_8, the latter 0.0001%; neither is of commercial value. Other clai were visited but no other occurrences of uranium minerals were noted. further field work was recommended for this area.

MURRAY HILL AREA

AFRICA

Belgian Congo

33. (33) The Congo-Rhodesia Border S-37 Deposits and Localisation of in Cobalt Ores, G. W. Bain, Dec. 28, 1944.

The Belgian Congo uranium mineral zone is just south of the prin overthrust faults of the Rhodesia-Congo are in an area of relatively simple folding and it lies between the lead zinc belt to the south an the copper belt to the north. The uranium at the Shinkolobwe Mine is only found in significant amounts associated with cobalt in a narrow zone in which continuous open fissures are developed.

Orange Free State

35. (34) Uranium Deposits at Klerksdorp and in Orange Free State, G. Bain, April 9, 1946.

Uranium is found associated with gold around Klerksdorp. Total amount in all the reefs is believed to be just over 325,000 tons U_3O_8 Content throughout the Klerksdorp-Orange Free State area appears to average about 0.10 percent U_3O_8 over 16.4 inches or 0.05% U_3O_8 over mining width of 30 inches minimum.

Rand

39. (35) S-37 Possibilities in the Far East Rand - Union of South Afri G. W. Bain, June 13, 1945.

A collection of gold reef specimens made on the Witwatersrand

during 1941 exhibited unusual radioactivity. Uraninite and hydrocarl had been recognised in them and a measurement of their radioactivity was made; the results showed high radioactivity.

Recoverable reserves are estimated in excess of 10,000 tons of U in developed and undeveloped areas on the Rand and in the Orange Free State.

42. (36) Uranium Resources of The Witwatersrand Section of the Far E Rand, G. W. Bain, Feb. 14, 1946.

The average grade of samples from the Klyvecruitsicht Mine may b taken as 0.20% U_3O_8. Developed ore is estimated to contain 1540 tons U_3O_8. Undeveloped, but structurally similar ground is believed to ha 15,000 tons of U_3O_8. Structurally and geologically similar areas of Far East Rand may have 33,000 tons additional U_3O_8. Detailed study i dicates that the U_3O_8 is associated with the carbon and that high val are in structural traps in the path of descending solutions.

43. (37) Uranium On The Far East Rand, George W. Bain, March 27, 1946

During 1945, Dr. Bain examined the East Daggafontein Mine, the Vogelstruisbult and Daggafontein Mines. Proven Resources in the Kimberley Reefs are estimated at 2775 tons contained U_3O_8. Probable resources are believed considerable. The Kimberley Contact Reef has tons of contained U_3O_8. The Main Reef Leader contains some U_3O_8 in o of .025% grade. The amount is estimated at 833 tons U_3O_8 per sq. mil of reef mined. Annual through-put at the mills is believed to contai 5400 tons U_3O_8.

EUROPE

Sweden

42. (38) Uranium Distribution in Sweden, G. W. Bain, Sept. 25, 1946.

Dr. Bain discusses the distribution of uranium in Sweden in the report. The alum shale deposits of southern Sweden have significant uranium in a formation about 10 meters thick, characterized by a fossil arthropod called Peltura. Other groups of strata have uranium but in amounts definitely lower than in this bed. The formation occurs in 6 areas; in three of these a significant amount of uranium is concentrated into a combustible hydrocarbon called kolm.

The areas of interest in Sweden are discussed in considerable detail. The most important areas are the Hunneberg, Kinnekulle, Billingsfalbygden, Narke, and Oster Gotland. Possible inferred reserves in these areas amount to 660,500 M. tons U_3O_8 in the kolm shale zone and 1,842,000 M. tons U_3O_8 in the alum shale zone.

NORTH AMERICA

Canada

37. (39) A Report On A Reconnaissance Examination of The Eldorado Mine Great Bear Lake, N.W.T., Canada, George Selfridge, Feb., 1945.

Two days were spent by Mr. Selfridge and Majors W. E. Kelley and P. L. Merritt, inspecting the mine. Reserves as of Jan. 1945 are estimated at 90,550 tons assaying 1.04% U_3O_8. Of this, 50,500 is available and remainder inferred. Producing 100 tons a day, the mine would last 2 or 3 years until new reserves were developed.

Mexico

36. (40) C. W. Clark Uranium Prospect, Chihuahua, Mexico, George W. I Feb. 18, 1946.

This study of the Clark prospect by Dr. Bain considered the orig of the deposit, areal distributions of conditions favorable to develo of similar deposits and maximum of U_3O_8 which could be left in the fa able areas. Only about 0.2 tons U_3O_8 is in rock containing over 0.2% and most ore averages approximately 0.075% U_3O_8. Between 8 and 16 to the maximum possible amount which may be expected in any grade down t 0.01% U_3O_8. No further work is recommended.

SOUTH AMERICA

Brazil

34. (41) Coastal Monazite Deposits of Brazil, Robert D. Mininger, Jan 30, 1947.

This report by Mr. Mininger covers the coastal sands between Mac state of Rio de Janeiro and Porto Seguro, Bahia. The richest deposit occur between Sao Joao da Barra in northern Rio de Janeiro and Comexa in southern Bahia. The highest average monazite content is 5% but lo concentrations up to 12% occur. Brazilian monazite averages about 5% ThO_2 and 0.20% U_3O_8. Monazite e Ilmenite Brasilera at Guarapary prod 2,000 tons of monazite annually. Total maximum recoverable monazite reserves are estimated at approximately 200,000 tons.

Peru

38. (42) Hydrocarbon Deposits of Peru, George W. Bain, June, 1947.

During August, 1946 hydrocarbon-bearing sediments were examined. a thin black bituminous shale there is 0.01% U_3O_8 and 0.5 to 0.75% V_2 In 5 million metric tons of asphaltite, there are less than 250 tons U_3O_8.

Uruguay

43. (43) Beach Examination For Monazite in Southern Uruguay, R. D. Mininger, June 24, 1947.

Beaches of southern Uruguay were examined by Mr. Mininger in May 1946 for possible occurrences of monazite. An aerial and surface reconnaissance was made. It is concluded that there is no significan monazite concentration on the beaches.

UNION MINES DEVELOPMENT CORP.

UNITED STATES EXPLORATION REPORTS

1. Alabama District, (East Central Part of), Southern Appalachian Area, Report of Reconnaissance Survey for S-37 in, W. G. Valentine, June 23, 1944.

2. Alaska, Preliminary Reconnaissance Survey of Placer Deposits in, J. M. Skidmore, Nov. 29, 1944.

3. Arizona (Except the Plateau Province), Report on SOM Investigations in, J. M. Hill, Feb. 28, 1946.

4. Arizona, Possibility of S-37 in Nine Mountain Ranges in the Vicinity of Tucson, M. M. Hill, Feb. 16, 1944.

Arizona, see No. 7

5. California (Northern), Report on Reconnaissance Survey of, A. F. Carper, Nov. 7, 1945.

6. California (Southern), Report on Examinations for SOM at Two Localities, A. F. Carper and B. Judd, May 1946.

7. California (Southern), Preliminary Reconnaissance Survey of Placer Deposits in, with Minor Work in Oregon and Arizona, J. M. Skidmore, Dec. 1944.

8. California, Inyo County, Possibilities for SOQ in the Wingate Pass Area, Death Valley, A. F. Carper, April 1945.

9. California, Riverside County, Field Reconnaissance Survey for S-37 in, A. F. Carper, May 26, 1944.

10. California, San Bernardino County, Reconnaissance for S-37 Minerals in the San Bernardino Mountains, A. F. Carper, Sept. 1945.

11. California, San Bernardino County, Northeast-Portion and Area Adjacent, Report on Reconnaissance Survey for S-37 in, A. F. Carper, May 27, 1944.

12. California, San Diego County, Reconnaissance Study of Pegmatite Deposits in, A. F. Carper, May 19, 1944.

13. Colorado (Eastern), Report of Preliminary Field Reconnaissance of Reported S-37 Occurrences in, C. B. Guillotte, Feb. 22, 1944.

14. Colorado, Clear Creek County, S-37 Occurrences in Grover Pegmatite Mine in North Beaver Brook, C. B. Guillotte, June 14, 1944.

U. S. EXPLORATION REPORTS (CONT'D)

15. Colorado, Gilpin County, SCM Deposits of, G. B. Guillotte, Feb. 28, 1944.

16. Colorado, Gilpin County, Unwatering & Sampling of Kirk Mine & Geology of Kirk Mine, J. M. Hill, & G. B. Guillotte, April 30, 1

17. Colorado, Gunnison County, Geology & Ore Deposits of Brown Derby Pegmatites, Box Canyon Mining District, G. B. Guillotte, June 8, 1945.

Colorado (see Nos. 56 & 57)

18. Colorado, Huerfano and Costilla Counties, Summary of Investigati Vanadium and Uranium Occurrence in Huerfano Park District, Raton Basin Area, J. F. Emerson, Nov. 1943.

19. Colorado, Park County, SCM Occurrences Near Garo, L. B. Riley, M 1946.

20. Georgia (Northern Part of), Report on Reconnaissance Survey of S Occurrences in the, W. C. Valentine, June 30, 1944.

21. Idaho, Preliminary Reconnaissance Survey of Placer Deposits in, J. H. Skidmore, March 16, 1944.

22. Idaho, Supplement No. 1 to "Preliminary Field Reconnaissance of Occurrences in Placer Deposits, R. H. Ridgway, Nov. 7, 1945.

23. Montana, Reconnaissance Survey, A. F. Carper, Oct. 31, 1945.

24. Nevada (Southeast), Examination of Alleged SCM Occurrences in, A Carper, May 1946.

25. Nevada, Reconnaissance of Placer and Opalite Deposits in, A. F. Carper, Nov. 21, 1945.

26. Nevada, Clark County, Report on Reconnaissance Survey of S-37 Oc rences in the Erie to Arden Area, J. M. Hill & A. F. Carper, May 1944.

27. Nevada, Clark County, SCM Occurrences in Yellow Pine or Goodspri District (Jean-Goodsprings Project), J. M. Hill, Nov. 15, 1944.

28. Nevada, Lincoln County, Report on Reconnaissance Survey for S-37 the Caliente-Pioche Area, A. F. Carper, May 25, 1944.

29. Nevada, Lyon County, Report on the Rink Copper and Gold Properti near Yerington, A. F. Carper, May 1946.

U. S. EXPLORATION REPORTS (CONT'D)

30. Nevada, Pershing County, Report on Reconnaissance Survey of Majt Hill, J. M. Hill, Feb. 18, 1946.

31. New England Region, Report of Field Examination and Appraisal of S-37 Resources of the, T. B. Holmes, G. W. Bourret, June 30, 194

32. New Jersey, Report of Field Examination for Occurrences of SOM n Netcong, W. C. Valentine, July 1945.

33. New Mexico, Examination for SOM in, J. M. Hill, Sept. 1945.

34. New Mexico, Petaca Area, Reconnaissance Study of Pegmatite Depos in the, C. H. Apsouri, March 1944.

35. New Mexico, White Signal, Black Hawk & San Lorenzo Districts & Swanson-Lauer Property, Reconnaissance of the, S. B. Keith, April 1944.

36. New Mexico, Grant County, White Signal & Associated Districts, S. B. Keith, July 14, 1945.

37. New York (Southeast), Reconnaissance Survey of Bedford Feldspar Quarries of, W. C. Valentine, July 24, 1945.

38. North Carolina, Bailey Springs & Union Grove District, Reconnaissance of SOM Possibilities in the, W. C. Valentine, June 26, 1944

39. North Carolina, Spruce Pine District, Reconnaissance Study of the Occurrences of SOM in the Pegmatite Veins of the, W. C. Valentine March 21, 1944.

40. North Carolina, Spruce Pine District, Supplementary Report on SOM Possibilities in the, W. C. Valentine, June 30, 1944.

41. North Carolina, Jackson and Henderson Counties, Reconnaissance Su of SOM Possibilities in, W. C. Valentine, July 27, 1945.

42. Oregon, Reconnaissance Survey of, A. F. Carper, Nov. 23, 1945.

Oregon, see No. 7

43. Pennsylvania (Eastern), Report on Reconnaissance Survey in, W. C. Valentine, July 27, 1945.

44. Pennsylvania, Chester County, Report on S-37 Minerals in, G. B. Guillotte, Aug. 21, 1944.

45. South Carolina, Reconnaissance Survey of SOM Possibilities in, W. Valentine, July 11, 1945.

U. S. EXPLORATION REPORTS (CONT'D)

46. South Dakota, Northern Black Hills, Mineral Area, J. F. West, Ma 20, 1944.

47. South Dakota, Southern Black Hills Mineral Area, J. F. West, Jun 1944.

48. Texas, Trans-Pecos Region, Reconnaissance Report on the, J. M. H Sept. 24, 1945.

49. Texas, Hudspeth County, Reconnaissance Report on Rossman SOM Pro B. N. Webber, March 25, 1946.

50. Utah (and Colorado), Uinta Basin, SOM in Hydrocarbons of the, G. Guillotte, June 29, 1944.

51. Utah (and Colorado), Uinta Basin, Supplement No. 1 to Report of Reconnaissance for S-37 Occurrences in the, R. H. Ridgway, June 1945.

52. Virginia, Amelia and Piney River Districts, Reconnaissance of SO Possibilities in, W. G. Valentine, June 20, 1944.

53. Virginia, Amherst County, Reconnaissance Survey in, W. G. Valenti July 12, 1945.

54. Washington, Reconnaissance Survey for S-37 Minerals in the State A. F. Carper, Nov. 23, 1945.

55. Wyoming, Lusk, Examination of Silver Cliff Mine, J. F. West, Apri 13, 1944.

56. Wyoming, Sweetwater County, Schroeckingerite Deposits at Lost Cre G. B. Guillotte, March 23, 1945.

Murray Hill Area

57. United States, S-37 and T-37 Resources of the, R. D. Hininger & P. L. Guarin, Oct. 30, 1945.

UNION MINES DEVELOPMENT CORP.
COLORADO PLATEAU REPORTS

General

58. (58) Geology & Ore Resources of Uranium-Vanadium Depositional Pro of Colo. Plateau Region - B. N. Webber, Jan. 1947

59. (57) Report on the Carnotite Ore Reserves of the Colorado Plateau Region - B. Burwell, May 1, 1944

The above general reports are based on the information given the following reports on individual areas (not summarized he

Individual Areas

(1) Abajo Mts. District, Green River Desert Area - S. K. Smyth, Feb.

(2) Beaver Creek Mesa Dist., Green River Desert Area, Utah - C.H. Me Jan. 1946

(3) B'Gla B'Toh Dist., Carrizo Uplift Area, Ariz. - A. H. Coleman, S 1944

(4) Blanding Dist., San Juan Basin Area, Utah - S. K. Smyth, Feb. 19

(5) Bull Canyon Dist., Dolores Plateau Area, Colo. - J. F. Emerson, 1945

(6) Calamity Dist., Uncompaghre Uplift Area, Colo. - O. H. Metzger, 1945

(7) Calamity Mesa Dist., Uncompahgre Uplift Area, Colo. - R. K. Kirk Feb. 1944

(8) Carpenter Ridge Dist., Dolores Plateau Area, Colo. - G. B. Mille Jan. 1946

(9) Ciaco Dist., Green River Desert Area, Utah - J. F. Emerson, Mar.

(10) Coal Creek Anticline Dist., White River Uplift Area, Utah - B. N. Webber, Feb. 1944

(11) Comb Ridge Fold Dist., San Juan Basin Area, Utah - V. R. Chamber March 1946

(12) Coyote Mesa Dist., Dolores Plateau Area, Colo. - H. R. Wardwell, April 1946

(13) Dolores River Dist., Dolores Plateau Area, Colo. - B. W. Van Voo Jr., Aug. 1945

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COLORADO PLATEAU REPORTS, Individual Areas (Cont'd)

(14) Eurida (Toh-A-Tin) Dist., Carrizo Uplift Area, Ariz. - April 194
E. H. Eakland, Jr.

(15) Grand Hogback Dist., White River Uplift Area, Colo. - B. N. Webb
Jan. 1944

(16) Granite Wash Dist., Henry Mts. Area, Utah - Coleman, Bryner & Hi
June 1945

(17) Green River Dist., San Rafael Swell Area, Utah - Webber & Van Ve
Jan. 1944

(18) Suppl. to Green River Dist., San Rafael Swell Area, Utah - Hill,
1945

(19) Gypsum Valley Dist., Dolores Plateau Area, Colo. - R. K. Kirkpat
April 1946

(20) Helium Dome Dist., San Rafael Swell Area, Utah - R. K. Kirkpatri
Feb. 1944

(21) Inter River Dist., Green River Desert Area, Utah - C. T. Smith,
June 1944

(22) Suppl. to Inter River Dist., Green River Area, Utah - Smith & Hi
Nov. 1945

(23) Lightner Creek Dist., San Juan Basin Area, Colo. - S. B. Keith,
Dec. 1945

(24) Little Rockies Dist., Henry Mts. Area, Utah - A. M. Mastrovich,
Sept. 1945

(25) McElmo Dist., San Juan Basin Area, Colo. - O. H. Metager, May 19

(26) Moab District, Green River Desert Area, Utah - H. R. Wardwell,
March 1946

(27) Monticello (Dry Valley) Dist., Green River Desert Area, Utah-Col
R. K. Kirkpatrick, Aug. 1944

(28) Navajo Reservation, Carrizo Uplift Area & Chuska Mts. Area, Ariz
B. N. Webber, Dec. 1943

(29) Nucla Dist., San Miguel Plateau Area, Colo. - L. P. Gaggini, Apr
1946

(30) Oak Ridge Fold Dist., White River Uplift Area, Colo. - B. N. Web
Nov. 1943

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COLORADO PLATEAU REPORTS, Individual Areas (Cont'd)

(31) Polar Mesa Camp (W. Gateway) Dist., Green River Desert Area, Uta Emerson & Smith, Oct. 1944

(32) Polar Mesa Dist., Green River Desert Area, Utah - J. F. Emerson, 1944

(33) Richardson Basin Dist., Green River Desert Area, Utah - F. M. Mu June 1945

(34) Rifle Mine Locality, Grand Hogback Dist., White River Uplift Are Colo., - C. T. Smith, April 1946

(35) San Miguel River Dist., San Miguel Plateau Area, Colo. - A. M. Mastrovich, April 1945

(36) Silver Reef District, S. W. Utah Area, Utah - C. T. Smith, Feb. 1

(37) Sleepy Cat Mt. Dist., White River Uplift Area, Colo. - Gruemerwal Richardson, Sept. 1945

(38) Slick Rock Dist., Dolores Plateau Area, Colo. - R. K. Kirkpatrick Feb. 1945

(39) Temple Mt. Dist., San Rafael Swell Area, Utah - F. M. Murphy, Sep 1944

(40) Trachyte Dist., Henry Mts. Area, Garfield & Wayne Counties, Utah A. M. Mastrovich, Dec. 1943

(41) Uravan Dist., San Miguel Plateau Area, Colo. - C. T. Smith, May 1

(42) Waterpocket Fold Dist., Kaiparowits Plateau Area, Utah - E. H. Eakland, Feb. 1945

(43) West Paradox Dist., Dolores Plateau Area, Colo.-Utah - C. W. Livingston, Oct. 1945

(44) Western Carrizo Uplift & Chuska Mts. Areas, Northern Navajo India Reservation, N.E. Arizona (Suppl. & Summary Rpt) - J. W. Harshber April 1946

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UNION MINES EXPLORATION REPORTS

United States

Alabama

1. Report of Reconnaissance Survey for S-37 in the East Central Part Alabama (District of the Southern Appalachian Area), W. G. Valenti June 23, 1944.

Eight mines were visited in the east central part of Alabama, Coosa, Randolph and Tallapoosa Counties. Material in the veins st gave no positive responses to bead tests, or G-M counter. Mr. Val concluded that this district offers no potential reserve of uraniu No further field work was recommended.

Alaska

2. Preliminary Reconnaissance Survey of Alaska Placer Deposits, J. H. Skidmore, Nov. 29, 1944.

From July 19 - October 19, 1944, Mr. Skidmore examined 11 auri ferous gravel-bearing districts in Alaska. Over 110 samples were tested in the field and only one, - sample 5335 (Woodchopper Creek) obtained from the Commissioner of Mines, Territory of Alaska, had a interesting amount of uranium. The sample assayed 10% equivalent U of which 50% may be due to thorium. It was recommended that the Pe River area be examined in the summer of 1945.

Arizona

3. Report on SOM Investigations in Arizona (except the Plateau provinc J. M. Hill, February 28, 1946.

Central and southeast Arizona including all the small mining

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districts but excluding the Plateau province and U.S. military res vations of the western part were surveyed during a two year period further work is recommended as significant uranium occurrences are existent and there are only minor amounts of monazite in a few pla deposits.

4. Possibility of S-37 in Nine Mountain Ranges in the Vicinity of Tuc Arizona, J. M. Hill, February 16, 1944.

A month's trip by the writer into the nine mountain ranges in vicinity of Tucson disclosed no uranium minerals.

California

5. Report on Reconnaissance Survey of Northern California, A. F. Carp Nov. 7, 1945.

The Mt. Lassen, Jackson-Mokelumne Hill, Copperopolis and Ange Camp-San Andreas-Columbia areas were examined. Visual examination chemical tests failed to show the presence of uranium minerals in rocks or ores. No further field work was recommended in these exa areas.

6. Report on Examinations for SOM At Two Localities in Southern Calif A. F. Carper & E. Judd, May, 1946.

The Gold Stone area north of Barstow, San Bernardino County, mined in the past for gold, silver, lead, copper and tungsten, was vestigated. Bead tests for uranium were negative. Summit Digging series of dry placer workings, was reported to contain autunite bu vestigation of the rocks did not disclose anything of interest.

7. Preliminary Reconnaissance Survey of Southern California Placer Deposits with Minor Work in Oregon and Arizona, J. H. Skidmore, De 1944.

During four months-February to June, 1944, three large gravel bearing auriferous areas were examined. Uranium minerals are pres only in traces, and no further work is believed warranted.

8. Possibilities for SOQ In The Wingate Pass Area, Death Valley, Inyo County, California, A. F. Carper, April, 1945.

In a careful study of the area for three days, testing with b pipe and Geiger-Counter, nothing was found rich enough to be consi as a possible source of uranium.

9. Field Reconnaissance Survey for S-37 in Riverside County, Californ A. F. Carper, May 26, 1944.

Of the many properties examined by Mr. A. F. Carper in Rivers County, California, only one positive bead test for uranium was ob tained at Williamson Mine. As considerable ground was covered and tests made without positive results, it was recommended that no fu work be done in the county.

10. Reconnaissance for S-37 in the San Bernardino Mts., San Bernardino County, California, A. F. Carper, September, 1945.

Mr. A. F. Carper spent two days in September, 1945, examining pegmatites in the San Bernardino Mountains, California in an area extending from 10 miles to 25 miles northeast of San Bernardino. Results of bead tests performed on a large number of pegmatites wer

negative. This area cannot be considered as a possible source of uranium.

11. Report on the Reconnaissance Survey for S-37 in the Northeast Port of San Bernardino County, California, and Area Adjacent, A. F. Car May 27, 1944.

Mr. Carper visited the Ivanpah and Standard mining districts, Sunrise Claim, the Section from Blythe to Needles, and the Eldorad Canyon and Searchlight areas and spent one day at each locality. pegmatites were found and tests performed on samples from these lo ities gave negative results. No further work was recommended in t area.

12. Reconnaissance Study of Pegmatite Deposits in San Diego County, California, A. F. Carper, May 19, 1944.

In fourteen districts in San Diego County, Mr. Carper examine many pegmatites where openings had been made and where they were a sible in road cuts. Hundreds of bead tests made for uranium gave negative results. In view of the absolute lack of uranium mineral no further work was recommended.

Colorado

13. Report of Preliminary Field Reconnaissance of Reported S-37 Occurr in Eastern Colorado, G. B. Guillotte, Feb. 22, 1944.

Six areas were examined by Mr. Guillotte in Eastern Colorado w were reported to contain uranium minerals. Of these, two areas may warrant further development: carnotite deposits in Park County and

uranium deposits at Jamestown, Boulder County, which are possible s of very small future production.

14. S-37 Occurrences in Grover Pegmatite Mine in North Beaver Brook, Cl Creek County, Colorado, G. B. Guillotte, June 14, 1944.

In May, 1944, Mr. G. B. Guillotte examined the Grover Pegmatit Mine on North Beaver Brook, Clear Creek County, Colorado. The depo contained minute amounts of columbite containing about 1% uranium (G-M counter) but production would not exceed more than a few pounds each several hundred tons mined. This property is not a potential source of uranium.

15. SOM Deposits of Gilpin County, Colorado, G. B. Guillotte, Feb. 28,

Mr. Guillotte examined 73 mines in a 6 sq. mi. area of Gilpin County, Colorado, for uranium minerals, and radioactivity. Uranium been reported from 16 mines but incomplete production records indic that an output of several tons of U_3O_8 has come mainly from three properties: Kirk, Wood, and German-Belcher Mine. Uranium mineral reserves are limited to 3 mine dumps containing about 1800 tons of averaging 0.15% U_3O_8. High U_3O_8 content is indicated in the uranium mineral bearing veins but tonnages and grade cannot be ascertained until the mines are dewatered.

16. Unwatering & Sampling of Kirk Mine, Gilpin County, Colorado and Geology of Kirk Mine, Gilpin County, Colorado, J. M. Hill and G. B. Guillotte, April 30, 1945.

Dewatering of the Kirk Mine, Gilpin County, Colorado, was compl during October, 1944, and subsequent visual inspection supplemented

Geiger-Muller counter traverses disclosed that only negligible amo of pitchblende were available for extraction. Further work in the district was deemed inadvisable.

17. Geology and Ore Deposits of Brown Derby Pegmatites, Box Canyon Min District, Gunnison County, Colorado, G. B. Guillotte, June 8, 1945

Several days between July 27 to August 3, 1944, were spent in field study of the Brown Derby pegmatites, Box Canyon Mining Distr Gunnison County, Colorado, by Mr. G. B. Guillotte. Positive and probable ore reserves are calculated at 8,400 tons containing about 62,700 lbs. of microlite, having an average U_3O_8 content of 5.6%, t giving a reserve of 3,500 lbs. of contained U_3O_8.

18. Summary of Investigation of Vanadium and Uranium Occurrence in Huer Park District, Raton Basin Area, Huerfano and Costilla Counties, Colorado, J. F. Emerson, Nov. 29, 1943.

The prospects in this district, except for a few isolated occu rences, can be grouped in three general localities, Ojo Springs, Muleshae and LaVeta Pass. Twenty assays of samples taken at variou localities show that five samples range from 0.05 to 0.30% U_3O_8. T occurrences are widely scattered and small and have a low Uranium content. Not more than one or two tons of ore has been taken from one prospect. No further work is recommended in this district.

19. SOM Occurrences near Garo, Park County, Colorado, L. B. Riley, May, 1946.

During 1946, Mr. Riley examined the Garo carnotite deposits in

Park County, Colorado. The deposits are small, with a limited amo of low grade ore. Aside from a few tons of ore from the dumps, no reserve could be estimated. Under the existing economic condition the deposits were deemed unworthy of further development or explor

Georgia

20. Report on Reconnaissance Survey of S-37 Occurrences In The Northern Part of Georgia, W. G. Valentine, June 30, 1944.

Reconnaissance in northern Georgia by Mr. Valentine indicates that with the exception of one small occurrence, uranium minerals a not present. No further work was recommended.

Idaho

21. Preliminary Reconnaissance Survey of Idaho Placer Deposits, J. H. Skidmore, March 16, 1944.

Seven placer areas in Idaho were sampled by panning during thi investigation by Mr. J. H. Skidmore from Sept. 27, 1943, to Jan. 18 1944. Tests show that uranium is present only in insignificant qua ties. These areas have a potential 17,755,000 yards of placer grou containing 5.33 tons of U_3O_8 which would be difficult to recover. further work in these districts is recommended, except possibly in Boise Basin area.

22. Supplement No. 1 to "Preliminary Field Reconnaissance of S-37 Occur rences in Idaho Placer Deposits", R. H. Ridgway, November 7, 1945.

Six samples from the Idaho placer deposits re-analyzed by the

Bureau of Standards indicated four times the content given in the original assays in Mr. Skidmore's report of March 16, 1944. Resul indicated an average U_3O_8 content of 0.16% for the six samples and average ThO_2 content of 1.47 percent. Most of the samples collecte in 1943 were not available for re-analysis but on the basis of the above findings it was recommended that the Idaho Placers, promisin potential sources of uranium and thorium, be given more detailed st

Montana

23. Reconnaissance Survey of Montana, A. F. Carper, Oct. 31, 1945.

Mr. Carper examined 7 areas for pegmatites. Only the Sapping Ranch deposit was found to have any uranium minerals. Here samarsk containing about 10% U_3O_8 and comprising less than 0.05 percent of pegmatite, occurs associated with very small amounts of uranium-be mica and a yellow stain. Between 600 and 1,000 pounds of samarskit were mined in 1941 as a by-product of mica. No further production consequence is expected.

Nevada

24. Examination of Alleged SOM Occurrences in Southeast Nevada, A. F. Carper, May, 1946.

The Moapa, Gold, Butte, Atlanta and Overton districts were investigated during May, 1945. The Overton district had a carnotite zone which might furnish a limited amount of high cost uranium. Tw samples from the Atlanta district reacted positively to a bead test

were only of academic interest.

25. Reconnaissance of Placer and Opalite Deposits in Nevada, A. F. Carper Nov. 21, 1945.

Sixty-four placer deposits, constituting nearly all those in Nevada, were examined but only very small amounts of high cost monazi could be recovered. A sample from the Virgin Creek area, supposedly uranium-bearing opalite district, had assayed 0.26% equivalent U_3O_8 and the area is scheduled for further study.

26. Report on Reconnaissance Survey of S-37 Occurrences in The Erie to Ar Area, Clark County, Nevada, J. M. Hill, A. F. Carper, May 24, 1944.

Mr. J. M. Hill and A. F. Carper discovered a yellow uranium mineral occurring sporadically in small amounts in calcareous alluviu over an area of approximately 50 sq. miles between Erie and Arden are Clark County, Nevada. An average sample assayed only 0.025% U_3O_8. Th mineralization is considered too low-grade and sporadic for successful mining. No further work was recommended on the alluvium of this area, however, the mountain ranges to the west might be prospected for the source of the uranium.

27. SOM Occurrences in Yellow Pine or Goodsprings District, Clark County, Nevada (Jean-Goodsprings Project), J. M. Hill, November 15, 1944.

As a result of the study of the ore deposits in the Goodsprings mining district in southern Clark County, Nevada made by Mr. Hill and Mr. Carper between February 22 and April 5, 1944, it was determined th uranium occurs at 4 of the 45 mines examined. At three of these, uranium mineralization was too weak and erratic to be of consequence.

At the Green Monster mine, sampling indicated 8000 tons of material underground and on dumps assaying from 0.025 to 0.19% U_3O_8 , but mine ization is too limited and insufficiently strong to be of further int

28. Report on Reconnaissance Survey for S-37 In the Caliente-Pioche Area, Lincoln County, Nevada, A. F. Carper, May 25, 1944.

Mr. A. F. Carper examined the Caliente-Pioche area of Lincoln Co Nevada, for the reported occurrences of carnotite in sandstones near Caliente. Many samples were taken and tested but all tests were nega No further work was recommended in this district.

29. Report on The Rink Copper and Gold Properties Near Yerington, Lyon Co Nevada, A. F. Carper, May, 1946.

Mr. A. F. Carper examined the Rink Copper and Gold Properties, n Yerington, Lyon County, Nevada in December, 1944, and found that U_3O_8 could be detected in 9 of the 156 samples taken from these localities. However, because of the low grade, the erratic distribution and irregu ity of uranium mineralization, there is little likelihood of obtaining uranium production from these areas.

30. Report on Reconnaissance Survey of Majuba Hill, Pershing County, Nevad J. M. Hill, February 18, 1946.

Mr. J. M. Hill's examination of the copper-tin-bearing rhyolite plug of Majuba Hill revealed that radioactive material occurs only in traces. The average of 12 samples was less than 0.01 percent U_3O_8. Because of the extreme low grade of the rhyolitic material and the

impracticability of concentrating the values, it was recommended that more field work be done in the area for the present.

New England Region

31. Report of Field Examination and Appraisal of The S-37 Resources of Th New England Region, T. B. Holmes and G. N. Bourret, June 30, 1944.

Of 47 mines and prospects examined in the New England States, on the Ruggles Mine near Grafton Center, New Hampshire, has production p sibilities for uranium minerals. One or two tons of uranium mineral centrates (averaging 0.20% U_3O_8) from autunite-bearing feldspar coul mined annually by hand sorting at a cost of several dollars per pound The 60,000 tons of feldspar waste dumps would give about 15 or 20 ton ore averaging 15% U_3O_8.

New Jersey

32. Report of Field Examination for Occurrences of SOM Near Netcong, New Jersey, W. Valentine, July 1945.

No uranium minerals were identified in the dump and the 2 open p of the Crane Iron Mine, alleged to contain uranite.

New Mexico

33. Examination for SOM in New Mexico, J. M. Hill, September, 1945.

Five areas, covering 1500 square miles, in New Mexico were exami for uranium by Mr. J. M. Hill, Dr. C. N. Apsouri and others and resul indicate that there is small hope of developing any large resource of uranium minerals.

34. Reconnaissance Study of Pegmatite Deposits in Petaca Area, New Mexico, C. N. Apsouri, Mar. 1944.

Field work was carried out by Dr. C. N. Apsouri in the aut of 1943 in the Petaca-Picuris area of New Mexico. About half o 250 known pegmatites were examined. About a dozen pegmatites c uranium minerals. Occurrence of these minerals is exceedingly sporadic. About one ton of uranium minerals, principally samar averaging 3% - 4% U_3O_8 might be obtained annually. No further work was contemplated.

35. Reconnaissance of White Signal, Black Hawk & San Lorenzo Distri & Swanson-Lauer Property, New Mexico, S. B. Keith, April 5, 194

Between March 27 and April 2, 1944, Mr. Stanton B. Keith conducted a reconnaissance survey of the White Signal, Black Ha and San Lorenzo Districts, and the Swanson-Lauer Property, New Mexico. Detailed examination of the Black Hawk and White Signal Districts was recommended, the latter having an estimated reser 10,000 tons of ore containing 0.5% U_3O_8. The other properties w ranted no further field work.

36. White Signal & Associated Districts, Grant County, New Mexico, S. B. Keith, July 14, 1945.

Detailed examination of the White Signal, Black Hawk Distri and associated Districts in New Mexico was carried on from July, to May, 1945 by Mr. Stanton B. Keith. Reserves of all classes amounted to 980 tons of rock averaging 0.34% U_3O_8 and 14,245 ton

averaging 0.08% U_3O_8, plus a limited additional amount of lower grade material.

New York

37. Reconnaissance Survey of Bedford Feldspar Quarries of S. E. New York, W. G. Valentine, July 24, 1945.

The dumps and quarries of Bedford were examined by Mr. Val for uranium minerals but none were found. A survey of all the of consequence shows a slight radioactivity of this material in dicating an average content of U_3O_8 of approximately 0.001%. T total quantity of U_3O_8 available in the dumps is less than 500 The amount of uranium minerals is too minute to cause the disca dump material to be considered a potential uranium source.

North Carolina

38. Reconnaissance of SOM Possibilities in Bailey Springs and Union Grove District, North Carolina, W. G. Valentine, June 26, 1944.

The Bailey Springs and Union Grove Districts in North Caro were examined by Dr. Valentine. There is no evidence of uraniu minerals in appreciable amounts at either of the localities. R mended that no further work be done.

39. Reconnaissance Study of The Occurrence of SOM In The Pegmatite of Spruce Pine District, North Carolina, W. G. Valentine, March 1944.

Dr. Valentine spent three months examining the pegmatite deposits in the Spruce Pine district. 193 mines or prospects w

visited, 147 or 76.3% of which exposed no uranium mineralizatio It is estimated that there might be an annual production of 9 t of ore of about 0.60% grade from 7 operating mines and a total production of 300 tons of ore of about 0.30% U_3O_8 grade from 5 dumps.

40. Supplementary Report on SOM Possibilities in The Spruce Pine District, North Carolina, W. G. Valentine, June 30, 1944.

The Spruce Pine District was revisited by Dr. Valentine du the month of February and the first week of the month of May, 1 Most of the time was spent in making maps and G. M. counter sur of the more promising properties especially the larger dumps. the McKinney Mine is considered to contain enough uranium miner to be a workable reserve. There is an estimated 11½ tons of U_3 in the dumps of this mine.

41. Reconnaissance Surveys of SOM Possibilities in Jackson and Hend Counties, North Carolina, W. G. Valentine, July 27, 1945.

The Grimshawe Mines and Jones Zircon Mine in North Carolin were examined by Dr. Valentine for uranium minerals. None were in the Grimshawe Mine. A counter survey of old cuts and dumps r vealed a content of about .001% U_3O_8. Some radioactivity, due t thorium, is present in the Jones Zircon Mine. Only specimen quantities of uranium minerals are contained in these properties

Oregon

42. Reconnaissance Survey of Oregon, A. F. Carper, November 23, 1945

During the summer of 1944, Mr. A. F. Carper examined the granitic rock exposures in Oregon for pegmatite dikes that migh carry uranium. No uranium minerals were found in the areas exp and no further field work was recommended.

Pennsylvania

43. Report on Reconnaissance Surveys in Eastern Pennsylvania, W. G. Valentine, July 27, 1945.

Dr. Valentine examined three districts in eastern Pennsylv for uranium: southeastern Pennsylvania, near Chester and Phila the Williams Quarry, northeast of Easton: and the area near Ma Chunk. It was concluded that exceedingly small quantities of uranium minerals are present in each of the three districts, bu that no further work was warranted.

44. Report on S-37 Minerals in Chester County, Pennsylvania, G. B. Guillotte, Aug. 21, 1944.

Mr. Guillotte examined 14 graphite and lead-zinc properties Chester County, Pa., from Aug. 27 to Sept. 2, 1943. A bibliogr study had indicated that there were possible similarities betwe the graphite-bearing metamorphic rocks of the area and the urani mineral bearing kolm deposits in Sweden. Visual examination an bead tests failed to reveal the presence of any uranium minerals It was recommended that no further work be done in the area.

South Carolina

45. Reconnaissance Survey of SOM Possibilities in South Carolina, W Valentine, July 11, 1945.

A small amount of polycrase, recovered from a placer depos and containing 19.47% U_3O_8 was reported in the literature. Thi placer deposit was searched for by Dr. Valentine for 1 day but evidence was discovered of any placer workings. One gold mine visited but nothing of interest found. There were no identifia uranium minerals in a sample of sand taken from South Saluda Ri

South Dakota

46. Northern Black Hills Mineral Area, South Dakota, J. F. West, Ma 20, 1944.

Mr. West investigated 26 mines, numerous prospect pits, dum and outcrops. Only at one mine-Imperial Gold Mining Company-wa uranium mineral identified. He concluded that uranium minerals as rare accessory minerals in a few gold-silver replacement dep and traces of uranium occur in some secondary minerals of the o zone. Uranium does not occur anywhere in the area in recoverabl quantities.

47. Southern Black Hills Mineral Area, South Dakota, J. F. West, Jun 19, 1944.

In the course of his field work in the Southern Black Hills mineral area, South Dakota, Mr. J. Frank West examined numerous pegmatites, one pyritic deposit and two feldspar grinding plants

Seven of the pegmatite deposits contained uranium minerals in small quantities. Of these only the Bob Ingersoll mine has any production possibilities but since in this deposit there is indicated a total U_3O_8 content of only one ton in ore assaying 0.10-0.20 U_3O_8, attempts at recovery were not considered warran

Texas

48. Reconnaissance Report on Trans-Pecos Region, Texas, J. M. Hill, September 24, 1945.

A reconnaissance examination of the more important mineral deposits in the Trans-Pecos Region of Texas during 1945 by Mr. J. M. Hill showed that this region contains no significant occurrences of uranium minerals.

49. Reconnaissance Report on Rossman SOM Prospect, Hudspeth County, Texas, Benj. M. Webber, March 25, 1946.

Very scattered, minor occurrences of the mineral tyuyamunit on the Rossman Prospect, Hudspeth County were investigated by Mr Benjamin M. Webber in February 1946. After examination with a G-M counter, he concluded that the quantities of uranium mineral available are negligible and are of no economic importance.

Utah (Colorado)

50. SOM in Hydrocarbons of Uinta Basin of Utah and Colorado, G. B. Guillotte, June 29, 1944.

Mr. George B. Guillotte examined and sampled 27 hydrocarbon

deposits in the Uinta Basin of eastern Utah and western Colorac All samples gave negative reactions for uranium with the lithiu fluoride bead test. It was recommended that no additional work done on the deposits.

51. Supplement #1 to Report of Reconnaissance for S-37 Occurrences The Uinta Basin of Utah & Colorado, R. N. Ridgway, June 27, 194

Subsequent chemical assaying of 5 samples and radioactivit assaying by G-M Counter of 11 samples of the asphaltites of the Basin, Utah & Colorado, during the early part of 1945, confirms previously reached conclusion that no additional work should be performed on these deposits because of the negative reactions f uranium.

Virginia

52. Reconnaissance of SOM Possibilities in Amelia and Piney River Districts, Virginia, W. G. Valentine, June 20, 1944.

Six properties in the Amelia and Piney River Districts in Virginia were examined for SOM by Dr. Valentine. No uranium min were found at four of these. Mierolite and other uranium miners were found in insignificant quantities in the Morefield and Rutherford mines. It is estimated that the total contained U_3O_8 would not exceed a few tons. It was recommended that no further field work be done.

53. Reconnaissance Survey in Amherst County, Virginia, Dr. W. G.

Valentine, July 12, 1945.

On Nov. 24, 1944, two allanite localities, the Lucian B. B prospect and the John Will Campbell prospect, in Amherst County Virginia, were examined by Dr. Valentine, A small radioactivit to thorium was detected. There are no ore reserves. No furthe field work was recommended.

Washington

54. Reconnaissance Survey of State of Washington for S-37 Minerals, A. F. Carper, Nov. 23, 1945.

Twelve intrusive granitic areas in the State of Washington including the pegmatites found therein were examined by Mr. A. F. Carper. No uranium minerals were found. It was recommended that no more field work be done.

Wyoming

55. Examination of Silver Cliff Mine, Lusk, Wyoming, J. F. West, Apr 13, 1944.

From January 5 to 12, 1944, Mr. J. Frank West examined the Silver Cliff mine near Lusk, Wyoming. Many specimens were taken and tests made for uranium. The mine was found to contain 2,580 tons of material with values from 0.030 to 0.098% U_3O_8 and avera 0.051% U_3O_8. Total U_3O_8 content of this material was calculated 1.319 tons. Increased depth might add another 1.76 tons of U_3O_8 No further investigation is warranted since the possibilities of developing any substantial tonnage of U_3O_8 are remote.

56. Schroeckingerite Deposits at Lost Creek, Sweetwater County, Wyo
G. B. Guillotte, Mar. 23, 1945.

During June, 1944, the schroekingerite deposits at Lost Cre
Sweetwater County, Wyoming, were examined by Mr. Guillotte. The
deposit was mapped and sampled and 29 test holes drilled. Reser
were estimated at some 1500 tons averaging 0.05% U_3O_8. On the b
of the small amount of reserves, it was recommended that the are
dropped from further consideration.

Murray Hill Area Report

57. S-37 and T-37 Resources of the United States, R. D. Mininger and
P. L. Guarin, October 30, 1945.

All the important and more interesting uranium and thorium
deposits that have been discovered so far in the United States a
Alaska are briefly described. Thorium resources constitute less
5% of the total of the world. United States is in the fourth or
fifth place among all nations as regards its immediate capacity t
produce commercial supplies of uranium. Almost all domestic uran
production comes as a by product of vanadium mining in the Colora
Plateau Region where average grade of carnotite ore has been 0.25
uranium oxide.

Colorado Plateau - General

58. Geology and Ore Resources of The Uranium-Vanadium Depositional
Province of The Colorado Plateau Region, B. N. Webber, Jan. 1947.

The report by Mr. Webber was written to supplement and compl the record contained in some 50 district and special reports on t Colorado Plateau. The fundamental purpose of the survey was to reconnoiter the Colorado Plateau region with sufficient study of its general geology, stratigraphy, structure, and the distributi magnitude and tenor of its ore deposits as was considered necess to completely evaluate the ultimate potential uranium resources o the region.

Principal results of the survey are given below. A total to nage of localized ore of 5,857,055 short tons, whose average ten is 0.16% U_3O_8 and 1.42% V_2O_5 has been estimated and divided into three classifications - positive, indicated and inferred. Maps w made that show the location, tenor, and degree of certainty class the estimated ore and critical geology. An additional potential quantity of ore is suggested of 1,400,000 short tons. Evidence i presented for additional uranium resources in the source rocks of Salt Wash Formation and in the terminal sediments of the Salt Wa paleo-drainage.

59. Report On The Carnotite Ore Reserves of The Colorado Plateau Regi B. Burwell, May 1, 1944.

The past production, reasonably indicated reserves, acreage in determinations of past production and indicated reserves, tota acreage in each district and additional possible tonnage are give the carnotite ore in 19 districts of the Colorado Plateau. Mr. Burwell's report estimates that up to Jan. 1944, 876,000 tons of

carnotite ore was mined, amounting to 25.3 tons per acre involv
that 561,000 tons of ore was indicated, allowing 16.2 tons per a
involved; that acreage involved in the production was 34,620 acr
that the total acreage in the districts was 1,398,100 acres; and
that additional possible tonnage amounts to 10,325 tons or 7.4 t
of ore per acre.

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EXPLORATION RESEARCH REPORTS

UNION MINES DEVELOPMENT CORPORATION

1. Preliminary Bibliographic Report on the Chemical Properties of the Desired Metal, April 13, 1944.

2. The Alkaline Fluoride Test and Other Qualitative Chemical Tests for the Desired Metal, D. George, September 25, 1944.

3. Mode of Occurrences of SOM in Witwatersrand Gold Ores, D. George, July 31, 1946.

4. Mineralogy of Uranium and Thorium Bearing Minerals, D. George, February, 1947.

5. Beta-Ray Method of Assaying Radioactive Ores, C. Goodman and H. Paul, Jan. 15, 1947.

6. Notes on the Use of the Geiger-Muller Counter in the White Signal District, Grant County, New Mexico, S. B. Keith, Oct. 9, 1945.

7. Development of Portable Geiger-Muller Instruments for Field Exploration, H. Paul, Oct. 23, 1945.

8. Gamma-Ray Logging of Drill Holes-Part I. The Logging Instrument, C. Goodman and H. Paul, April, 1946.

9. Gamma-Ray Logging of Drill Holes-Part II, Calibration of the Instrument, C. Goodman, Jan. 14, 1946.

10. Gamma-Ray Logging of Drill Holes-Part III-Supplementary Calibrations of Instrument and Manual of Operating Instructions, C. Goodman and G. B. Guillotte, Dec. 1946.

11. Gamma-Ray Logging of Drill Holes-Part IV-Directional Barnaby Attachment, G. B. Guillotte, Dec. 1946.

12. Gamma-Ray Logging of Drill Holes in the Slick Rock District, Dolores Plateau Area, Colorado, G. B. Guillotte, February 11, 1947.

13. Gamma-Ray Logging of Drill Holes in the Calamity District, Uncompahgre Uplift Area, Colorado, G. B. Guillotte, February 26, 1947.

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EXPLORATION RESEARCH REPORTS - 1

UNION MINES DEVELOPMENT CORPORATION

CHEMISTRY

1. Preliminary Bibliographic Report on the Chemical Properties of the Desired Metal, April 13, 1944.

The report gives the chemical properties of uranium based on a literature study. The account deals chiefly with the preparation and properties of the various compounds of uranium that can be prepared and studied in the laboratory.

MINERALOGY

2. The Alkaline Fluoride Test and Other Qualitative Chemical Tests for the Desired Metal, D. George, September 25, 1944.

The report describes the alkaline fluoride bead test which is judged as being superior to any other for detecting uranium in ores, minerals, and other products both in the field and in the laboratory. The test is based upon the principle that when uranium is fused with an alkaline fluoride and the cold bead examined under an ultraviolet ray lamp, the bead fluoresces. Other simple chemical tests have been investigated and are described.

3. Mode of Occurrence of SOM in Witwatersrand Gold Ores, D. George, July 31, 1946.

Mr. George conducted a laboratory mineralogical investigation on the mode of occurrence of uranium in Witwatersrand gold ores. The study showed the existence of additional uranium associated with a carbonaceous mineral

and also demonstrated that the average equivalent percent U_3O_8 of a large number of radioactive specimens of Rand ores is higher than the content indicated by the field party's study. The possibility of a really substantial uranium annual production potential for the Rand mines was indicated.

4. Mineralogy of Uranium and Thorium Bearing Minerals, D. George, February, 1947.

The report represents a final result of Mr. George's three years' experience while employed by U.M.D.C. The first section of the report deals with the chemistry and general modes of occurrence of the minerals. The second section treats all the minerals individually. It contains all new laboratory data and, in addition, gives a summary of the most important properties already observed and given in the literature.

ASSAYING

5. Beta-Ray Method of Assaying Radioactive Ores, C. Goodman and H. Paul, Jan. 15, 1947.

During the previous 2 years, a rapid routine, laboratory method of assaying radioactive ores was developed. Of several types of instruments tested, the "Higenbotham" amplifier and scaler was found to be superior. The report presents the theory of the method, the equipment and the operating procedure, various experiments that were performed during its development, and basic calibration curves for carnotite and pitchblende ore.

EXPLORATION RESEARCH REPORTS - 3

UNION MINES DEVELOPMENT CORPORATION

GEOPHYSICAL PROSPECTING

6. Notes on the Use of the Geiger-Muller Counter in the White Signal District, Grant County, New Mexico, S. B. Keith, Oct. 9, 1945.

The U.M.D.C. field counter was used in random and systematic field prospecting to determine the distribution and extent of uranium mineral occurrences. The instrument is very useful for detecting uranium minerals and under controlled conditions can be used for rough quantitative assaying. The irregularities of external factors encountered in field work prevent accurate quantitative estimations of grade of a deposit except by testing individual samples.

7. Development of Portable Geiger-Muller Instruments for Field Exploration, H. Faul, Oct. 23, 1945.

The report describes the development of G-M counters by U.M.D.C. for use by engineers in field exploration. The first field instrument was completed in Aug. 1944. Biggest drawbacks of the instrument were insufficient "ruggedness" and too great weight. Satisfactory improvements appeared possible.

8. Gamma-Ray Logging of Drill Holes-Part I. The Logging Instrument, C. Goodman and H. Faul, April, 1946.

The report describes the basic elements and operating procedure of the "Barnaby" geophysical instrument developed by U.M.D.C. for logging drill holes. The instrument gives a permanent quantitative record of gamma ray activity in vertical or steeply-dipping diamond and jackhammer

drill holes. The instrument was completed on April 22, 1945 after 3 months work.

9. Gamma-Ray Logging of Drill Holes-Part II, Calibration of the Instrument, C. Goodman, Jan. 14, 1946.

The report describes the experiments made with simulated drill holes in order to determine the response of the instrument to a given distribution and grade of ore. Results obtained were encouraging, but at best only semi-quantitative. Additional development of the instrument is indicated.

10. Gamma-Ray Logging of Drill Holes-Part III - Supplementary Calibrations of Instrument and Manual of Operating Instructions, C. Goodman and G. B. Guillotte, Dec. 1946.

In section "a" of the report, methods and results are presented for supplementary calibration work performed with the "Barnaby" machine, indicating that considerable accuracy in logging is possible with careful calibration. Section "b" is a manual of operating instructions giving consecutive detailed steps to be followed for employing the machine in the field.

11. Gamma-Ray Logging of Drill Holes-Part IV - Directional Barnaby Attachment, G. B. Guillotte, Dec. 1946.

The addition of a Directional Attachment to the instrument makes it possible to ascertain whether the mineralization in a drill hole is uniformly distributed around the hole or whether it is concentrated within

a particular radial segment. The report describes preliminary experiments performed to improve the design of the instrument, the calibration procedure employed, and the recommended method of operation. Further calibration required for best use of directional attachment.

12. Gamma-Ray Logging of Drill Holes in the Slick Rock District, Dolores Plateau Area, Colorado, G. B. Guillotte, February 11, 1947.

Contains G-M Log Evaluations in form of tabulated data. Results used in reserve estimates given in Exploration Reports.

13. Gamma-Ray Logging of Drill Holes in the Calamity District, Uncompahgre Uplift Area, Colorado, G. B. Guillotte, February 26, 1947.

Contains G-M Log Evaluations in form of tabulated data. Results used in reserve estimates given in Exploration Reports.

METALLURGICAL RESEARCH REPORTS - 1

UNION MINES DEVELOPMENT CORPORATION

1. Preliminary Report on Development of Concentration Methods for Carnotite Ores - R. W. Handley. January 28, 1944.

2. Metallurgical Report on Concentration Methods for Carnotite Ore Employing Special Flotation Practice - R. W. Handley and C. W. Sawyer. October 16, 1945.

3. Concentration of Carnotite Ores Typical of the Uravan (Colorado) District As Verified by Continuous Scale Pilot Plant Operation - R. W. Handley. July, 1946.

4. Concentration of Carnotite Ore Other Than Those of the Uravan (Colorado) District - R. W. Handley. August, 1946.

5. Report of Metallurgical Research on Fluorspar Ores and Tailings of the Jamestown District, Colorado - R. W. Handley. July 3, 1945.

6. Extraction of Uranium from Microlite from the Brown Derby Mine, Gunnison County, Colorado - D. George. February 19, 1947.

7. Gravity Concentration and Leaching Tests on North Carolina Samarskite Ore - R. W. Handley. February 18, 1947.

8. Preliminary Report of Metallurgical Research on Ores of the White Signal District, New Mexico - R. W. Handley, June 7, 1945.

9. Ferric Chloride Leaching of Pitchblende Concentrates from Eldorado Mining and Refining Company, Ltd. - R. W. Handley. August 30, 1946.

10. Treatment Procedures Applicable to Ores and Tailings from the Belgian Congo - R. W. Handley. February 24, 1947.

11. Report of Metallurgical Research on Autunite from Vinaninkarina, Madagascar - R. W. Handley. June 27, 1945.

12. Uranium Ore from Vinaninkarina, Madagascar. Results of Supplementary Studies Employing Ferric Chloride as Leach Solvent - R. W. Handley. February 24, 1947

13. Preliminary Report of Metallurgical Research of Plant Residues and Tailings from Urgeirica Mine, Portugal - R. W. Handley. March 18, 1945.

14. Metallurgical Investigations of Ores from the Urgeirica Mine, Viseu District, Portugal - R. W. Handley. February 19, 1947.

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15. Supplementary Report on the Beneficiation of Uranium Ore and Resid Collected by E. N. Cooper, at the Urgeirica Mine, Viseu District, Portugal, - R. W. Handley. February 19, 1947.

16. Preliminary Report of Metallurgical Research of Mine Samples for Reboleiro Mine, District of Guarda, Portugal - R. W. Handley. Mar 22, 1945.

17. Supplementary Report on the Beneficiation of Uranium Ore Sampled a Reboleiro Mine, Guarda District, Portugal - R. W. Handley. Februa 19, 1947.

18. Flotation Testing of Uraniferous Cobalt-Nickel-Copper Ores, La Profunda Mine, Villa Manin, Leon, Spain - R. W. Handley. February 1947.

19. Extraction of Uranium from Brazilian and Spanish Monazite Concentr R. W. Handley. February 20, 1947.

20. Recovery of S-37 from Witwatersrand Pyrite Concentrate by Flotatio R. W. Handley. September 10, 1945.

21. Witwatersrand Pyritic Material Recovery of S-37 by Ferric Chloride Leaching System - R. W. Handley. September 4, 1946.

22. Preliminary Bibliographic Report on the Recovery of the Desired Met from Waters - C. Goodman. August 23, 1944.

23. Procedure for Recovery of Pitchblende and Similar Uranium Minerals from Ores of Same - R. W. Handley and C. W. Sawyer. November 9, 1

24. Procedure for Extraction and Recovery of Uranium and Radium From Or of Same - R. W. Handley. August 14, 1946.

UNITED STATES

Carnotite:

1. Preliminary Report on Development of Concentration Methods for Carno Ores, R. W. Handley, Jan. 28, 1944.

The report describes the progress of research work which was be carried on in the laboratories of the Denver Equipment Company at De Colorado, under the supervision of U.M.D.C. employees. Tests were m on concentrating low-grade carnotite ores with only slightly encoura results. More work is required, but indications are that gravity co centration is not feasible.

2. Metallurgical Report on Concentration Methods for Carnotite Ore Empl ing Special Flotation Practice, R. W. Handley and C. N. Sawyer, Oct. 1945.

Between November 9, 1943 and June 16, 1944, a study was made of method for the recovery of carnotite from siliceous ores of same by ferential flotation utilizing a special combination of reagents. A : cleaned concentrate assaying 3.08% U_3O_8 was obtained from a head ass 0.23% U_3O_8 with a recovery of 64.2% of the total U_3O_8.

3. Concentration of Carnotite Ores Typical of the Uravan (Colorado) District As Verified by Continuous Scale Pilot Plant Operation, R. W Handley, July, 1946.

A flotation method of selective concentration of carnotite ores typical of Uravan District, Colorado, was investigated in a small pil plant operation by U.M.D.C. in 1943-1944 with the object of decreasi

total treatment costs. Although the system was found to be satisfa the high operating cost, combined with the low concentration ratios and the relatively low recoveries obtained, indicate that the flota techniques as developed cannot supplant the bulk chemical treatment methods now employed at the plants.

4. Concentration of Carnotite Ore Other Than Those of the Uravan (Colo District, R. W. Handley, August, 1946.

Concentration of carnotite ore other than those of the Uravan District, Colorado by flotation techniques was carried on by R. W. Handley in 1944. The standard flotation practice that had been eve for the treatment of Uravan-type ore was followed and proved satisf in a number of samples tested. No new conclusions as to its applic bility were reached.

Other:

5. Report of Metallurgical Research on Fluorspar Ores and Tailings of t Jamestown District, Colorado, R. W. Handley, July 3, 1945.

Wifley and Buckman tables tests made on fluorspar ore (average grade about 0.018-0.06% U_3O_8) from the Jamestown District, Colorado, failed to effect appreciable concentration or recovery of uranium minerals. The tests show that values are in the finest slimes from which it is not possible to obtain a concentrate of commercial impor

6. Extraction of Uranium from Microlite from the Brown Derby Mine, Gunn County, Colorado, D. George, February 19, 1947.

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Screening tests made on microlite from the Brown Derby Mine, Gunnison County, Colorado, showed that the microlite was concentrat in the fines. Recommendation was made that the problem of recoveri uranium from microlite should be taken up with the processors and c sumers of this product.

7. Gravity Concentration and Leaching Tests on North Carolina Samarski Ore, R. W. Handley, February 18, 1947.

Gravity concentration and leaching tests performed on a sample samarskite ore from the McKinney Mine, North Carolina gave the foll ing results. Crushing, classification, jigging and tabling indicat that some 95% of the U_3O_8 can be recovered in a samarskite concentr assaying about 15% U_3O_8 from a hand cobbed head containing about 1. U_3O_8. Ferric chloride leaching is not effective for the extraction U_3O_8 from samarskite concentrates.

8. Preliminary Report of Metallurgical Research on Ores of the White Signal District, New Mexico, R. W. Handley, June 7, 1945.

Preliminary metallurgical testing carried on during 1945 by Mr. R. W. Handley, on ores from the Merry Widow Mine, White Signal Dist New Mexico indicated that successful flotation concentration of the ores can be effected. However, the grade of concentrate obtainable would only be in the order of 2.5% U_3O_8 because of the floatability accompanying gangue minerals.

CANADA

9. Ferric Chloride Leaching of Pitchblende Concentrates from Eldorado Mining and Refining Company, Ltd., R. W. Handley, August 30, 1946.

Small scale tests made by Mr. R. W. Handley on a single sample of pitchblende concentrates from Eldorado Mining and Refining Compa Ltd., indicate that ferric chloride leaching may offer advantages o the procedure now in use. Results of the tests are sufficiently positive to conclude that material containing 25% U_3O_8 can be more easily and economically treated by this method.

BELGIAN CONGO

10. Treatment Procedures Applicable to Ores and Tailings from the Belgi Congo, R. W. Handley, February 24, 1947.

A great many gravity, flotation and ferric chloride leaching t were made by Mr. R. W. Handley on low grade uranium ores and tailin from Belgian Congo (Shinkolobwe Mine). By using the first two meth the grades of concentrates and overall recovery are too low to warr their use in plant practice. The direct leaching by ferric chlorid followed by precipitation of Uranium from the leach solution by bar carbonate, after prior calcium carbonate purification, yields an ex tion of 90-95% of the contained U_3O_8. In this process the ores are leached at a consumption of 3-5 lbs. of ferric chloride salt per po of U_3O_8 extracted.

MADAGASCAR

11. Report of Metallurgical Research on Autunite from Vinaninkarina,

Madagascar, R. W. Handley, June 27, 1945.

A preliminary study of Concentration treatment and leachment possibilities was made by Mr. R. W. Handley on 2 small samples of autunite. Two flotation tests were run on one sample which represe average grade ore (0.40-0.50% U_3O_8) and one flotation test and one chloride leaching test were run on the second sample assaying 2.14% U_3O_8. Definite conclusions cannot be drawn because of the small qu of samples, yet results obtained from the test indicate that flotat of average grade ore assaying about 0.50% U_3O_8 can result in 80% re and 10% U_3O_8 concentrate. There is a possibility of 95% extraction U_3O_8 by use of 5% $FeCl_3$ as leach solvent.

12. Uranium Ore from Vinaninkarina, Madagascar. Results of Supplementa Studies Employing Ferric Chloride as Leach Solvent, R. W. Handley, February 24, 1947.

Ferric Chloride was employed as a leaching solvent on the uran ore from Vinaninkarina, Madagascar in the tests made by Mr. Handley. The leaching study was limited to two tests on a sample (#6950) whi contained about 2.14-2.40% U_3O_8. An extraction of 90-93% of the co ed U_3O_8 can be obtain with the use of about 23.7 pounds of $FeCl_3.6H_2$ per ton of ore treated. The cost of producing U_3O_8 has been estima at $.50 per lb. of U_3O_8 recovered.

PORTUGAL

13. Preliminary Report of Metallurgical Research of Plant Residues and Tailings from Urgeirica Mine, Portugal, R. W. Handley, Mar. 18, 194

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Experiments were conducted by Mr. W. R. Handley on ores from the Urgeirica Mine in Portugal. The tests were made on plant treatment residues, tailings, and mine rejects. It was found that the two precipitates from old plant operations are easily responsive to the e traction of the uranium contained by any acid leach method employed f such work in this country. The low grade handsorting rejects will on give some 60% recovery of the U_3O_8 by special flotation into a concen of less than 1.0% U_3O_8. The plant tailings (residues) are not respon to any concentration methods.

14. Metallurgical Investigations of Ores from the Urgeirica Mine, Viseu District, Portugal, R. W. Handley, February 19, 1947.

Numerous flotation tests made by Mr. R. W. Handley on ore samples collected by Mr. D. D. Baker from the Urgeirica Mine, Viseu District, Portugal were relatively unsuccessful, principally because of the difficulty of floating pitchblende even with prior activation by ferric chloride. Leaching tests yield good extractions, although consumption ferric chloride was relatively high. Leaching techniques are advisabl for the recovery of uranium from these ores.

15. Supplemantary Report on the Beneficiation of Uranium Ore and Residues Collected by E. N. Cooper, at the Urgeirica Mine, Viseu District, Port R. W. Handley, February 19, 1947.

Tests made under the direction of Mr. R. W. Handley on the benefi tion of uranium ore and residues at the Urgeirica Mine, Viseu District

Portugal, collected by E. N. Cooper, indicate that direct leaching with ferric chloride solutions is the most feasible and economical method of handling crude or hand sorted ores from this mine. Sati factory concentration results by flotation were not obtained. Ura probably can be extracted successfully from the small amounts of r tively high grade treatment residues available at the property by acid, soda ash, or hot water leach, depending on the composition o the residue.

16. Preliminary Report of Metallurgical Research of Mine Samples for Reboleiro Mine, District of Guarda, Portugal, R. W. Handley, March 1945.

Metallurgical test work on representative samples of ores fro Reboleiro Mine, Trancoso, Guarda District, Portugal, was carried o study ore treatment possibilities. Only the "average unsorted ore' gave satisfactory response to the flotation system that has been a to carnotite ores. For the other samples modification of reagent combinations and systems of treatment were worked out. The study i volved the development of new, unproved flotation practice. Doubt exist at to possible commercial application.

17. Supplementary Report on the Beneficiation of Uranium Ore Sampled at Reboleiro Mine, Guarda District, Portugal, R. W. Handley, February 1947.

Metallurgical research carried on by Mr. R. W. Handley demonst that both flotation concentration and direct leaching with ferric

chloride solution yield satisfactory results on uranium ores from Reboleiro Mine, Guarda District, Portugal. If much pitchblende is present, flotation should be preceded by ferric chloride activatio Of the two treatments direct leaching probably will yield higher recovery and an overall lower cost per pound of uranium.

SPAIN

18. Flotation Testing of Uraniferous Cobalt-Nickel-Copper Ores, La Profunda Mine, Villa Manin, Leon, Spain, R. W. Handley, February 1 1947.

Two flotation tests on uraniferous cobalt-nickel-copper ores f La Profunda Mine, Villa Manin, Leon, Spain, by Mr. R. W. Handley, demonstrated that the uranium in the ore is mainly associated with cobalt-nickel minerals, and not with the copper minerals. Insuffic material was available for further testing. It is probable that straight flotation will not be successful in effecting noteworthy concentration of uranium. If further testing is carried on, leachi is recommended as the most promising method of extracting and recov the uranium from the ore.

19. Extraction of Uranium from Brazilian and Spanish Monazite Concentra R. W. Handley, February 20, 1947.

The report is a result of the metallurgical research conducted by Mr. R. W. Handley. One sample each of Brazilian and Spanish mon concentrates were subjected to leaching tests with 5% $FeCl_3$ and

concentrated H_2SO_4. The $FeCl_3$ leaches gave negligible, if any, ex traction of uranium from the monazite, while the concentrated H_2SO leach left only 0.01% U_3O_8 in the residue, indicating a very high extraction of uranium.

WITWATERSRAND

20. Recovery of S-37 from Witwatersrand Pyrite Concentrate by Flotatio R. W. Handley, Sept. 10, 1945.

Metallurgical research was carried out by Mr. Handley on the recovery of uranium minerals from Witwatersrand Pyrite Concentrate flotation. Tests showed that a worthwhile recovery of uraninite c be obtained as a by-product by a special concentration of the cord blanket concentrates produced in the slime of most mills. For max recovery of uraninite, the corduroy blanket product should be carei tabled to separate the gangue from the pyrite and heavy minerals i such a way as to include the finest-grained uraninite with the pyr

21. Witwatersrand Pyritic Material Recovery of S-37 by Ferric Chloride Leaching System, R. W. Handley, September 4, 1946.

Tests conducted during the latter part of 1945 and early part of 1946 on small quantities of Witwatersrand pyritic material indic that an alternate method for the extraction of the uranium by ferri chloride leaching offered excellent potentialities. By using this system for the treatment of Rand uranium-bearing pyritic concentrat the recovery of at least 95% of the uranium contained in a very des carbonate product of about 70% U_3O_8 equivalent is possible.

GENERAL

22. Preliminary Bibliographic Report on the Recovery of the Desired M from Waters, C. Goodman, Aug. 23, 1944.

Dr. Clark Goodman's report on recovery of uranium from waters based primarily on a bibliographic study. It is recommended that investigation be made on brines associated with petroleum as recen studies on the radioactive content of oil-field shales suggest the certain of these waters might contain commercial amounts of uraniu although at present they must be classified as poor prospects. Th is a possibility of the presence of uranium in interesting amounts waters in and adjacent to uranium ore bodies.

23. Procedure for Recovery of Pitchblende and Similar Uranium Minerals Ores of Same, R. W. Handley and C. W. Sawyer, November 9, 1945.

Between January and May, 1945, R. W. Handley and C. W. Sawyer under the direction of U.M.D.C., conducted tests on a sample from Reboleiro Mine in Portugal and developed a method of activating pitchblende or other natural black oxides of uranium by a prelimin leach with ferric chloride solution, thus making them susceptible subsequent flotation with a reagent combination consisting of fatt acids and aliphatic amines. This process was definitely an advanc ment in the methods used in the recovery of uranium.

24. Procedure for Extraction and Recovery of Uranium and Radium From

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Ores of Same, R. W. Handley, Aug. 14, 1946.

The report summarizes the discovery by Mr. R. W. Handley of a process for extracting uranium and radium by leaching with ferri chloride solution and the subsequent selective precipitation of uranium and radium from the solution. The procedure was developed between Feb. 1945 and Sept. 1945.

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APPENDIX C

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APPENDIX C. - REFERENCES

(All documents are on file in the classified files of the AEC, Office of New York Directed Operations.)

C-1 Letter Contract No. W-7405 eng-78, Supplement No. 2, 13 August 1943 (to Union Mines Development Corp. from Lt. Col. C. Vanden Bulck).

C-2 Letter, 11 April 1944, to Mr. J. R. Van Fleet from Major Paul F. Guarin, Area Engineer.

C-3 Letter, 1 July 1944, to Area Engineer, Madison Square Area, from General Groves.

C-4 Letter, 31 December 1943, to F. L. Guarin from William A. White, Administrative Director, Union Mines Development Corp.

C-5 Letter, 17 October 1944, to the Minister, Department of Munitions and Supply, Ottawa, Ontario, Canada, from Colonel Nichols, District Engineer; copy of Canadian Order in Council reserving to the Crown radio-active substances, Yukon Territory, P.C. 7167, 15 Sept. 1943; and copy of Canadian Order in Council reserving to the Crown radio-active substances, Northwest Territories, P.C. 7168, 15 Sept. 1943.

C-6 (a) Letter, 11 December 1943, to Wade & Curran, from the Area Engineer.

(b) Letter, 17 December 1943, to Mr. J. R. Van Fleet and Mr. R. Ridgway, from the Area Engineer .

(c) Letter, 10 January 1944, to F. L. Guarin, from Mr. Robert R. Ridgway.

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(d) Letter, 15 March 1944, to the District Engineer from Major Paul L. Quarin, Area Engineer.

(e) Letter, 12 April 1944, to P. L. Quarin from Mr. J. R. Van F

(f) Letter, 5 December 1944, to Union Mines Development Corp., from U. S. Department of the Interior, Office of Indian Affairs by W. D. Weekley for the Commissioner.

C-7 Agreement, 16 August 1944, between Mrs. Loring Gale Nesmith (ow and Union Mines Development Corp. (Lessee).

C-8 (a) Acquisition of lands in the Colorado Plateau Region. Paraphrase of secret teletype message dated 27 June 1944 from Col. K. D. Nichols to Maj. Gen. L. R. Groves.

(b) Letter, 5 August 1944, to Major Paul L. Quarin, from Blair Burwell, Union Mines Development Corp.

C-9 Trustee's Deed of Conveyance, 10 August 1945, Molybdenum Corp. to Union Mines Development Corp.

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