

ANNUAL REPORT OF RESEARCH PROGRESS

MINERAL INDUSTRY RESEARCH LABORATORY
COLLEGE OF EARTH SCIENCES AND MINERAL INDUSTRY
UNIVERSITY OF ALASKA
COLLEGE, ALASKA 99701
1969

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In order to sustain our culture, we must "foster and encourage: 1, the development of an economically sound and stable domestic mining and minerals industry, 2, the orderly development of domestic mineral resources and reserves necessary to assure satisfaction of industrial and security needs, and 3, mining, mineral and metallurgical research to promote the wise and efficient use of our mineral resources."

U.S. Senate Bill S719
Introduced by Senator Gordon
Allott of Colorado with
15 other Western Senators

MINERAL INDUSTRY RESEARCH LABORATORY CESMI

ANNUAL REPORT

OF

RESEARCH PROGRESS

1969

Editor Lawrence E. Heiner

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UNIVERSITY OF ALASKA COLLEGE, ALASKA 99701

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FOREWORD

The great importance of minerals to a state's sound economy can be no better illustrated than by the discovery of oil and gas in Alaska in 1957 in the Kenai Peninsula. This event has led to the establishment of local basic and secondary industries which in turn will enrich the coffers of the state. In a parallel manner, the discovery of oil and gas on the North Slope in 1968 will not only produce basic and allied industries but will also be a catalyst assisting the development of other mineral resources to provide a diversification of industry--so important to the long range economic strength of a state.

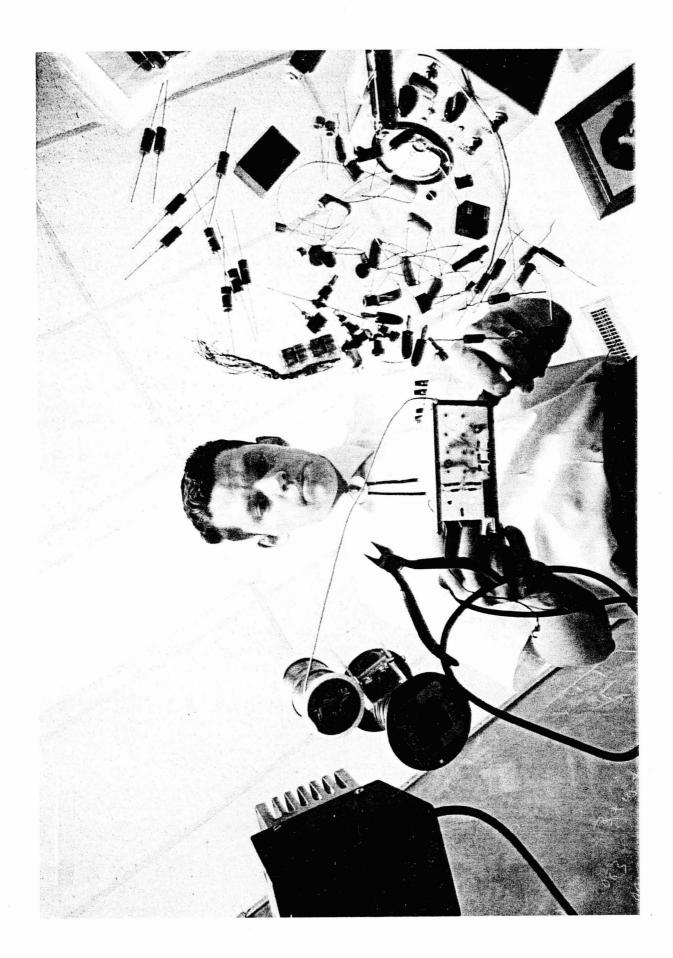
Also, further economic development of mineral resources is, to a large degree, dependent on mineral science research in the same way that research and development were necessary to develop the jet engine and hence, give a break-through in air transportation; thus, without geological and mineral processing research, mines cannot continue to be found and developed. The following pages will provide evidence of a significant contribution toward the shortening of the knowledge gap in mineral search instrumentation, gold size distribution, coal processing, prospector education, resource evaluation, and exploration oriented computer techniques. The demand by the Alaskan public, industry, and governmental agencies for this information has justified the reprinting of several of this year's research reports.

This response by industry and the public has given increased impetus to the goal of MIRL: to aid in the expansion of Alaska's mineral economy through a program of applied and basic research--to seek knowledge today for use tomorrow.

Earl H. Beistline

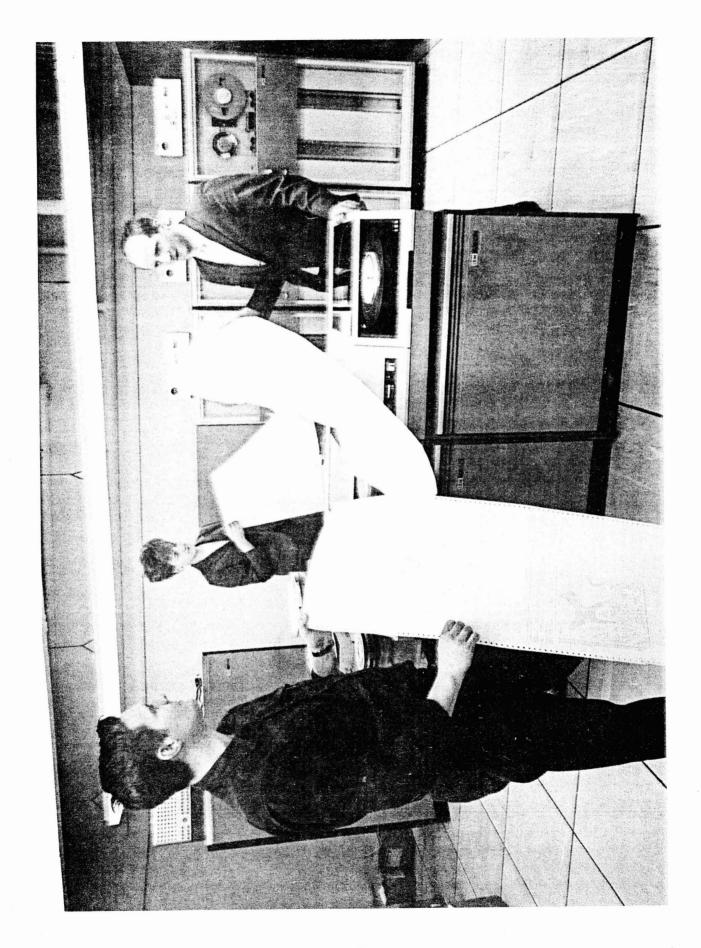
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ORGANIZATION AND FUNCTIONS

The Mineral Industry Research Laboratory is an integral part of the College of Earth Sciences and Mineral Industry (CESMI) and as such, most of the administrative costs of operation are absorbed by the college. It is directed by the dean of the college and has two full time scientists and one full time secretary. A close working relationship is maintained with the three departments of the college. These departments, Mineral Engineering, Geology, and Geography, broaden the scope of MIRL both by their physical presence and through cooperative research projects. In addition to this, much of the work accomplished by the laboratory is through part time employment of professionals and graduate students of various disciplines on campus. Assistance from specialists in these fields, i.e., electrical engineering, mathematics, economics, and physics, enhances the scope of research conducted by the laboratory. This academic environment greatly stimulates progressive research directed toward the advancement of the mineral industry of the state. The State Division of Mines and Geology, the U. S. Geological Survey, and the U.S. Bureau of Mines, all of which have offices on campus or in Fairbanks, have also stimulated research conducted by MIRL. This has been a result of the physical presence of these organizations, discussions of mineral science related problems, and through cooperative research and contracts. Constant association with prospectors and miners of both small and large operations also has an affect upon the research conducted by MIRL. An understanding of the problems of these groups leads to research or publications which will aid segments of Alaska's mineral industry.

Research projects are reviewed and approved by an advisory committee to insure conformance to the limits of authorizing legislation. The direction and scope of individual studies are coordinated with government agencies and other institutes where possible overlap may occur.

In addition to its research goals the laboratory is a definite aid to the educational structure of the College of Earth Sciences and Mineral Industry. The expertice of professionals in the laboratory is utilized in formal courses offered to students, the laboratory provides student employment in the mineral field, and student association with professionals of varied specialities and interests strengthens his overall education. Much of the sophisticated equipment utilized by students of the college is available as a direct result of the laboratory. Expansions in the curricula of the Department of Mineral Engineering have been possible by utilizing MIRL professionals and research equipment. Such curricula development not only allows better guidance of the ambitious student through a challenging and comprehensive educational program but stimulates the teaching and research effort of faculty members.



FACILITIES

Major progress has been made in obtaining the most advanced instrumentation possible to more efficiently conduct research programs. This instrumentation is also necessary to provide the basis for obtaining research grants from federal and private sources. While some equipment has been purchased from MIRL funds, other equipment was obtained through National Science Foundation grants, pooling of University departmental funds, construction by research personnel, private donations, and placement of related equipment in the Laboratory by other research institutes.

COMPLETED RESEARCH

Research projects which have been completed this year are briefly described in this section.

Resource Potential Seward Peninsula Delineated

This project was accomplished under contract No. DAW85-68-C-0117 with the U.S. Corps of Engineers and the study has been published as MIRL Report No. 18. Part I is entitled "Known Mineral Resources, Production, and Occurrences, Seward Peninsula, Alaska." This portion of the study utilizes all available information pertaining to the resources of the peninsula. Part II, "Potential Mineral Resources, Seward Peninsula, Alaska," utilizes the techniques of spatial and geostatistical analysis for estimates of the resource potential. The study indicated the existence of over 408 million tons of ore at a \$16.50 per ton average (based upon a 130% cost level over that of Canada). Consideration of the necessity for exploration in finding and developing mineral resources reduced this tonnage to an estimated 66 million tons at an average grade of \$42.93. In value terms the 66 million tons of ore amount to about 2.8 billion dollars of economic mineral resources, approximately \$200 million of which have already been produced.

Handbook Brings Alaskan Prospector Up-to-Date

An informative report describing the major geophysical prospecting methods, theories, utilization, and costs has been prepared. This handbook is intended to provide the prospector with an introduction to the methods of geophysical prospecting and act as a guide to where geophysical services and supplies can be obtained.

Five hundred copies of this report were printed in October of 1968. Within a few months the report was out of print. The CESMI foundation fund has since been utilized to reprint the handbook and it is now available through the College of Earth Sciences and Mineral Industry for \$1.00.

Field Geochemical Data Computerized

A general computer program has been written to process geochemical data resulting from the analysis of up to 34 trace elements per sample. This program will:

- 1. Produce a table for direct inclusion in formal reports. The table contains the map number and field number of the geochemical samples and the corresponding elemental values. Prior to printing the samples are arranged according to map number for easy correspondence between the table of values to the geochemical map.
- 2. Compute the average value for each element.
- 3. Compute the standard deviation for each element.
- 4. Compute the threshold value for each element.
- 5. Compute the anomalous concentrations for each element.

6. Draw normalized, lognormal, or standard histograms for each element.

All geochemical samples taken by the Alaska Division of Mines and Geology during the summer of 1968 were processed by this program. The program will be modified slightly to produce automatic maps and tables of anomalous samples.

A report describing the computer program and algorithms is currently being prepared.

Coal Study Shows Preparation of Metallurgical Coal Feasible

Two samples of low-volatile bituminous coal from the Bering River Coal Field were sized to 0.525" x 3, 3 x 6, 6 x 10, 10 x 20, and 20 x 35 mesh and their washability characteristics studied at specific gravities ranging from 1.29 to 1.55. The results showed that the coals can be up-graded to an ash content as low as 2% with a conventional cyclone heavy media process. A product containing less than 1% ash can be obtained from this coal with surprisingly high yields, ranging from 50 to 95%, depending on the ash content desired in the washed coal, and the characteristics of the raw coal.

The experimental work proves the technical feasibility of preparation of the coal for metallurgical and low ash carbon products. Further pilot plant testing would be required in the fields of preparation and utilization in order to design the final plant and for ascertaining the economic feasibility of commercial production.

The results of this investigation have been published by the laboratory as MIRL Report No. 21, "Washability Characteristics of Low-Volatile Bituminous Coal from Bering River Field, Alaska."

Water Pollution Study

The Federal Water Pollution Control Administration through its Alaska Water Laboratory conducted a study of placer mining operations in Alaska as they relate to water pollution control programs.

In an attempt to secure sound facts on which to base a pollution control program that will consider environment and industry, the Mineral Industry Research Laboratory participated in the program by providing a professional staff member to work with the Water Laboratory along with other University and State Agency people. The contribution of Mineral Industry Research Laboratory personnel consisted of: assisting in designing a field sampling program; arranging cooperative efforts with miners and mining companies; and consulting on the technical phases of specific mining operations. Although a considerable amount of field data was obtained, the data collecting phase was not completed, in the opinion of Mineral Industry Research Laboratory personnel and as a result, a recommendation was made that the project be continued during the 1969 summer season.

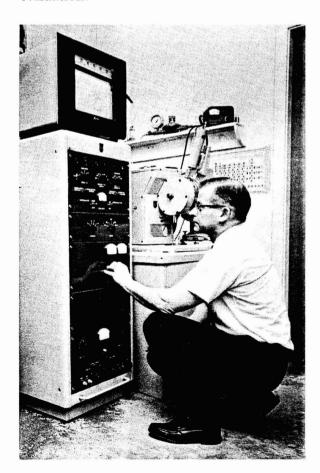
However, a report was issued on March 6, 1969 "Effects of Placer Mining on Water Quality in Alaska" by the Alaska Water Laboratory. The report does not represent the opinion of Mineral Industry Research Laboratory.

Economic Value of Alaskan Beachsands Studied

Beach sand deposits along Alaska's shoreline have been prospected and worked for their precious metal content since the time of Russian occupation. Areas such as the Nome Beaches of the Seward Peninsula have been very productive, and in recent years exploration has proceded to include off-shore extensions of these deposits.

Systematic and complete evaluation of all mineral constituents, including precious metals, is a major undertaking because of the erratic nature of the deposits. Special studies are required concerning sampling techniques, mining methods, recovery systems, and marketing procedures. It is, therefore, beyond the financial capabilities of most individuals and requires the involvement of government agencies or corporations to obtain the necessary data to determine the resource potential of Alaska beach sands.

MIRL Report No. 20 is concerned with samples of beach sand material submitted to the Mineral Industry Research Laboratory by individuals. These samples, taken from various locations, cannot be viewed as programs designed to delineate reserves from the respective areas. They should be considered as reconnaissance samples to indicate the mineral constituents present and the need for more comprehensive evaluation.



Laboratory Supports Master's Thesis--Valuable Study Results

Partial funding for the Master of Science thesis for William H. Smith of the University of Alaska was granted by MIRL on March 20, 1968. This project has been completed and the results are presented in a thesis for the Master of Science degree in Geology. Mr. Smith's thesis is available in the University of Alaska library.

Following is the abstract taken from the thesis:

"Hill 3560 is located between the Walker Fork and the South Fork of the Fortymile River in the southeastern portion of the Yukon-Tanana Upland. The area is underlain by the Birch Creek Schist formation which is here predominately gneiss but it also includes quartz-biotite schist, and marble; and greenschist, greenstones, phyllites, and marble of probable Siluro-Devonian age. Within the study area the above sequences are in fault contact. A quartz monzonite stock is located in the northern part of the area. Mineralization in the area was investigated by a program of geological mapping and geochemical studies which included analyses of soil, stream sediment, and bedrock samples. Types of mineralization recognized include float from a possible zinc-lead replacement deposit, disseminated copper mineralization in silicified fault zones and fold apices, very low-grade gold and silver bearing quartz veins, calcite veins, and gold bearing placer deposits."

RESEARCH IN PROGRESS

There are currently five projects being conducted by MIRL. The following abstracts briefly explain the purpose of each.

Laboratory Developing Device for Mineral Search

A massive sulfide detector commonly referred to as an electromagnetic unit is currently under development. Minerals which have high conductivities such as galena, graphite, chalcopyrite, pyrite, pyrrhotite, and magnetite are susceptible to detection by the electromagnetic method. Electromagnetic disturbances can also be caused by faults, fractures, zones of crushed rock, and fissures containing water.

At the present time a low cost transmitter for the unit has been developed. The transmitter utilizes a ferrite core coil, operates at three frequencies, and is comparable to commercial units in performance and weight. The operational life of the batteries is at least 30 days and parts cost is approximately \$125.00. A compatible receiver for the two man unit is currently being designed. It will feature automatic readout of the real and imaginary parts of all three frequencies.

Upon completion of the system it will be field tested and a report written which will explain construction details and how to use the instrument for mineral search.

Volume Delineating S.E. Alaska Mineral Resources Underway

Alaska has often been referred to as a vast "storehouse of mineral wealth", yet whenever a mineral exploration company desires to focus its attention upon Alaska it is faced with innumerable reports, old and new, which describe both geology and mineralization. Many of these reports are out of print which necessitates trips to the libraries or USGS offices which have them. An immediate aid to mineral exploration companies is a report listing in abstract form all of the mineral prospects occurring in a particular area. MIRL has successfully accomplished this for two areas through two

reports pertaining to the geology and mineral resources of northern Alaska and the Seward Peninsula. These reports are entitled: "Final Report, Mineral Resources of Northern Alaska" and "Known and Potential Mineral Resources of Seward Peninsula, Alaska."

Wide acceptance and demand for these reports prompted a similiar study of southeastern Alaska. This report will contain a general section pertaining to geology and mineral resources of the area, a comprehensive listing of all mineral deposits and occurrences, a comprehensive bibliography, and reprints of pertinent papers pertaining to the economic geology of the area.

As mineral prospect data is extracted from the literature, it is coded and punched on IBM cards. Manual sorts of these cards to arrange mineral properties by name or by coordinate have aided identification and correlation of mineral prospects mentioned in the literature by various names. These cards form the basis of an automatic storage and retrieval mineral prospect file. Once the data on the cards is transferred to magnetic tape and appropriate computer programs written, the user will have a tool which enable studies to be accomplished in minutes rather than months, i.e., it would take a few minutes to search the mineral information of several quadrangles to print a list of active mineral properties. The same could be done for any element or elemental association. It is hoped that within the limited amount of funds available for the S.E. project to complete a model storage and retrieval system utilizing the S.E. data.

Microscopic Gold Sought in Alluvial Deposits

The Mineral Industry Research Laboratory is completing a contract with the U. S. Department of the Interior Bureau of Mines concerning the size-frequency distribution, and possible economic value of fine gold particles in alluvial type deposits. To accomplish this, a program was initiated, with the implementation of each later phase dependent upon the findings and success of the preceding phase. Phase I involves a literature search to determine if economic amounts of very fine gold may be expected, to establish tentative field and laboratory procedures, obtaining samples, processing these samples, and evaluating the eonomic parameters of the gold and associated mineral distributions. Phase II is an investigation of methods for recovering the gold and associated minerals.

A report describing the results of this study is being prepared for the Bureau of Mines. A second contract with the University for \$18,876 has been obtained from the Bureau for Phase II of the program.

Washability Characteristics of Coals from Northern Alaska

It is planned to obtain samples of coal through the U. S. Geological Survey from northern Alaska coal fields to investigate the possiblity of preparation to suit specifications for the export market. Samples of coal will be collected from Cape Beufort-Corwin Bluff area. The study would determine the washability characteristics of the coals and petrographic composition in order to determine coking and blending qualities as a raw material for metallurgical coke.

Engineers Study Characteristics and Utilization of Fly Ash from Alaskan Power Plants

Fly ash, generated by power plants using coal as fuel, is collected to prevent atmospheric pollution. It is a waste product from power plants and presents problems in disposal. A preliminary study is intended to help the potential consumer by giving the characteristics of the fly ash locally available and the producer by presenting an appraisal of the potential Alaskan markets.

Samples of fly ash were collected from power plants operated by Golden Valley Electric Association at Healy, the University of Alaska at College, the City of Fairbanks Municipal Utilities System at Fairbanks, and the United States Army at Fort Wainwright. The samples have been analyzed for chemical and physical properties and potential markets will be evaluated. The project is being conducted with the cooperation of the Alaska Department of Highways located at the University of Alaska.



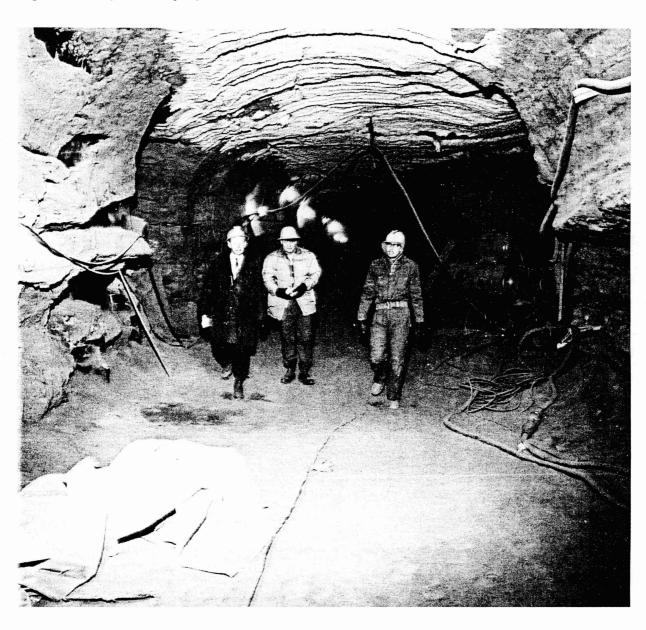
SERVICES

The laboratory has provided computer assistance to the University of Alaska Institute of Marine Science, Alaska Division of Mines and Geology, and several graduate students. This assistance has generally been confined to the utilization of an MIRL developed trend surface program and drawing upon the experience of MIRL personnel in regression analysis. Appropriate reports from these agencies and students acknowledge this assistance.

Several manhours per week are spent assisting prospectors, exploration companies, government agencies, and others. This assistance ranges from general discussions to occasional laboratory analyses and mill testing. The facilities of the laboratory are utilized by various state agencies and an occasional placer miner.

MIRL assisted a major exploration company in its desire for rapid field geochemical determinations. A portable lab, complete with atomic absorption equipment, crusher, and grinder, was suggested and later implemented by the company.

Assistance and valuable aid have been obtained from the Alaska Division of Mines and Geology. Conversely, MIRL has been instrumental in the initial stages of some of the DMG's programs. Discussions with the engineers and geologists of the DMG and the nearness of its files have been an invaluable asset to the laboratory.



FINANCES AND CONTRIBUTIONS

The Mineral Industry Research Laboratory funding for the year may be seen in the following catagorization:

TOTAL	\$77,902
Carryover from Fiscal 1968 contracts and grants	11,287
Contract with the Bureau of Mines, U.S. Department of the Interior, for a study of gold size distribution in alluvial material from selected off-and on-shore locations.	12,215
Contract with the Corps of Engineers for a study of "Known and Potential Resources of Some Metals on the Seward Peninsula, Alaska"	6,000
Support provided by the 1968 state legislature for continued research	\$48,400

PUBLICATIONS

- *ANNUAL REPORT OF RESEARCH PROGRESS by MIRL Staff, MIRL Report No. 1.
- *THE MARKET POTENTIAL FOR ALASKAN CLAY PRODUCTS by Charles A. Beasley, MIRL Report No. 2, January 1965.
- *ALASKA CEMENT MARKETS AND OPPORTUNITIES FOR REGIONAL PRODUCTION, published as research Monograph No. 4 by the Institute of Business, Economics and Government Research of the University of Alaska in cooperation with MIRL, February 1965.

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- *MARKET FOR INSULATION IN ALASKA AND FEASIBILITY OF REGIONAL MANUFACTURE by Robert C. Haring and Charles A. Beasley, MIRL Report No. 4, 1965.
- *ANNUAL REPORT OF RESEARCH PROGRESS 1965 by MIRL Staff, MIRL Report No. 5, January 1966.

INVESTIGATIONS OF LIGHTWEIGHT AGGREGATES IN ALASKA by Lawrence E. Heiner and Alvin N. Loskamp, MIRL Report No. 6, December 1966.

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*NATURAL RESOURCE BASE OF THE FAIRBANKS NORTH STAR BOROUGH by Ernest N. Wolff and Robert C. Haring, MIRL Report No. 8, March 1967.

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TRACE ELEMENT COPPER DISTRIBUTION AND AREAL GEOLOGY IN A PORTION OF THE CLEARWATER MOUNTAINS, ALASKA by Paul S. Galvinovich, MIRL Report No. 10, May 1967.

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*PRELIMINARY REPORT - MINERAL RESOURCES OF NORTHERN ALASKA by Ernest N. Wolff, Lawrence E. Heiner, and Frederick C. J. Lu, MIRL Report No. 13, November 1967.

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* FINAL REPORT - MINERAL RESOURCES OF NORTHERN ALASKA by Lawrence E. Heiner and Ernest N. Wolff, MIRL Report No. 16, June 1968.

DEVELOPMENT OF A LIGHT-WEIGHT LOW COST SELF POTENTIAL UNIT by Kenneth L. Zonge, MIRL Report No. 17, June 1968.

KNOWN AND POTENTIAL ORE RESERVES, SEWARD PENINSULA, ALASKA by Frederick C. J. Lu, Lawrence E. Heiner, and DeVerle P. Harris, MIRL Report No. 18, September 1968.

HANDBOOK OF GEOPHYSICAL PROSPECTING METHODS FOR THE ALASKAN PROSPECTOR by Lawrence E. Heiner and Steven A. Wulf, MIRL Report No. 19, October 1968.

HEAVY MINERALS IN ALASKAN BEACH SAND DEPOSITS by Donald J. Cook, MIRL Report No. 20, January 1969.

WASHABILITY CHARACTERISTICS OF LOW-VOLATILE BITUMINOUS COAL FROM BERING RIVER FIELD, ALASKA by P. Dharma Rao, MIRL Report No. 21, February 1969.

*Out of print

