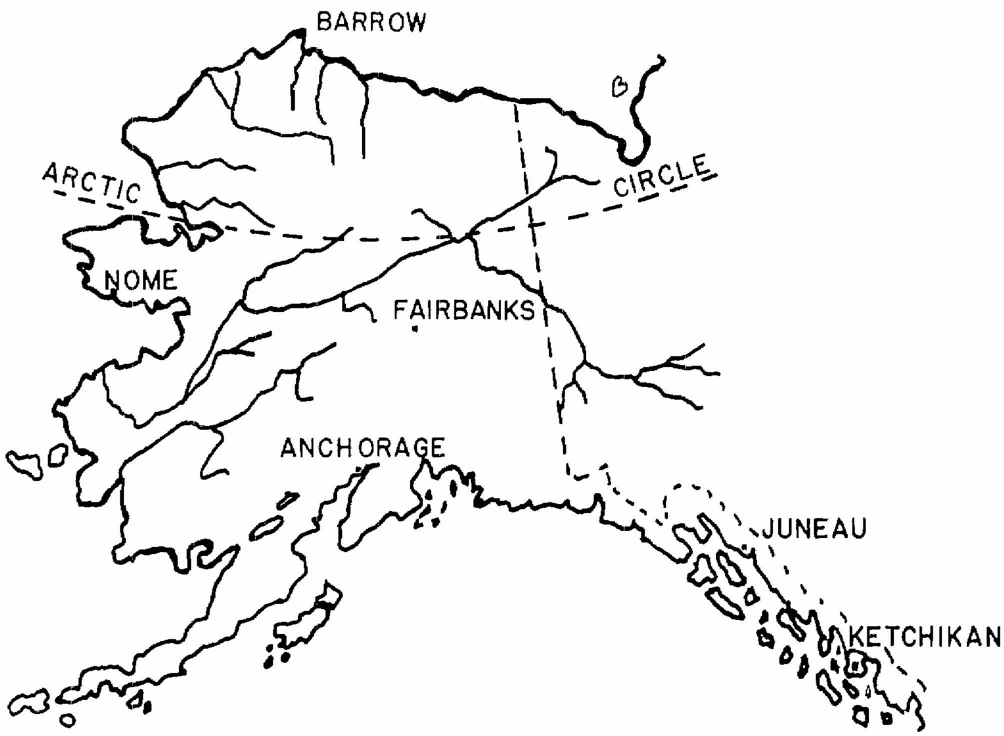
STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES



DIVISION OF MINES AND MINERALS

REPORT FOR THE YEAR

1964

JUNEAU, ALASKA

STATE OF ALASKA

William A. Egan - Governor

Department of Natural Resources

Phil R. Holdsworth - Commissioner

DIVISION OF MINES AND MINERALS

James A. Williams - Director

REPORT

FOR THE YEAR

1964

Juneau, Alaska

Honorable Phil R. Holdsworth, Commissioner
Department of Natural Resources
Juneau, Alaska

Dear Sir:

It is a pleasure to transmit to you this Annual Report of the Division of Mines and Minerals covering the calendar year 1964. Summaries of mineral production, exploration, and developments during the year are outlined in the report. Data in other fields over which the Division has jurisdiction are included. The activities and accomplishments of the Division are outlined, and our geological investigations are briefly described.

Progress of Alaska's petroleum industry continues to be of real significance. New fields will soon be in production. More than $61,000,000 was spent by the industry in Alaskan exploration and development, and approximately $15,000,000 was received by the State in direct revenue from oil and gas production. Continuing high metal prices, options on a number of mining properties, and increased inquiries indicating plans for organized prospecting ventures give promise of increased mining activities in Alaska in the near future.

This Division will continue to aid in the growth of the minerals industries.

Respectfully submitted,

James A. Williams

James A. Williams, Director
Division of Mines and Minerals
Box 1391, Juneau, Alaska
December 31, 1964

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December 31, 1964

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Preface

Nature richly endowed Alaska with the types of geology favorable to the formation of valuable mineral deposits - metallic, nonmetallic, and petroliferous. Our petroleum deposits are being explored for and developed at a satisfactory rate. Because of the bulk involved in connection with long-distance shipping, most of our nonmetallics will probably develop only as local and Pacific Coast markets expand because of the relatively high expense of transporting high-bulk low-unit-price materials. Metals and concentrates of metallic ores can be shipped relatively cheaply, yet those ores are not being searched for in Alaska at a rate commensurate with their possibilities. And make no mistake about it - Alaska _is_ good ore-hunting country.

At the 1964 Alaska Mining Conference, a well-known Canadian mining man presented a paper comparing mining incentives in Alaska and Canada. The comparisons were conclusions drawn from a compilation of answers to a questionnaire sent to some sixty active Canadian mining companies. Their objections to working in Alaska varied, but a significant result was that nearly every company stated that Alaskan hardrock geology is as favorable as that in Canada where mining activity continues to increase every year. Another speaker emphasized the fact that judged area-wise with the western mining states with which Alaska has comparably favorable geology, Alaska's metal production exclusive of iron should be sixty times its present level.

Obviously, Alaska has great potential. Development of this potential depends on exploration by mining companies and prospectors. Alaskan exploration is moving at a snail's pace compared to that in B. C. and Yukon. What can be done to get mining exploration moving in Alaska?

Most numerous of the above Canadian companies' objections to working in Alaska was stated to be high costs. These objections are not all well-founded. Much of this thinking stems from a traditional belief, and the facts are not often carefully checked. Alaskan costs relative to those of Canada are not as high as generally supposed. An informative factual article on this subject is contained in this report.

Another of the Canadian complaints was that not enough geological work is being done in Alaska. When a company is considering exploratory work in a new area, one of its first requests is for geological maps and information. Also, it has been pointed out in various surveys and studies of Alaska's economic possibilities that not enough is known of Alaska's mineral resources and that too little basic field data is available. The Division of Mines and Minerals is endeavoring to provide this data. With good professional field men, and modern laboratory facilities for the necessary mineral, rock, and soil analyses on which the reports and maps are partially based, the Division can provide professional technical reports and maps on economic mineral possibilities and where and how to look for them that will be respected and followed by exploration men and prospectors. This is in part the basic information on her resources that Alaska needs for mining development.

James A. Williams

Mineral Production

Mineral production for 1964 (see Table 1) is estimated to be $71,000,000 compared to $67,800,000 for 1963. This represents an increase of about 5%, and is the result of increased oil, gas, and sand and gravel production. The cumulative production for Alaska has reached $1,571,000,000 (at present prices).

Revenue obtained by the State from the minerals industry for the year amounted to approximately $15,000,000. This includes production taxes, royalties, and sale of sand and gravel, but does not include income and license taxes in connection with the minerals industry.

Table I - Mineral Production in Alaska

	1963		1964 (1)	
	Quantity	Value (Thousands)	Quantity	Value (Thousands)
Coal----------thousand short tons	853	$ 5,910	800	$ 5,536
Gold---------thousand troy ounces	99	3,485	63	2,188
Mercury-----------76 pound flasks	400	76	340	104
Natural Gas----million cubic feet	4,498	1,111	5,982 (2)	1,610
Petroleum, crude-thousand barrels	10,740	32,650	11,030	33,880
Sand & Gravel-thousand short tons	16,926	22,005	21,000	23,300
Silver-------thousand troy ounces	14	18	7	9
Undistributed (3)--------------		2,589		4,395
Total------------		$67,840		$71,022

(1) All figures for 1964 except petroleum are preliminary and subject to revision.

(2) Includes only gas sold. An additional 5,479 million cf was used on the leases for pressure maintenance and power, or was unavoidably lost.

(3) Undistributed includes gem stones, platinum group metals, uranium ore, clay, and copper.

Note: Above statistics prepared under a cooperative agreement for the collection of mineral data between the Bureau of Mines, United States Department of the Interior, and the Division of Mines and Minerals, Department of Natural Resources, State of Alaska. Figures for coal, petroleum, natural gas, and undistributed commodities are presented on authority of the Division of Mines and Minerals only.

Figure 1 - Annual Value of All Mineral Production - Alaska 1900 - 1964

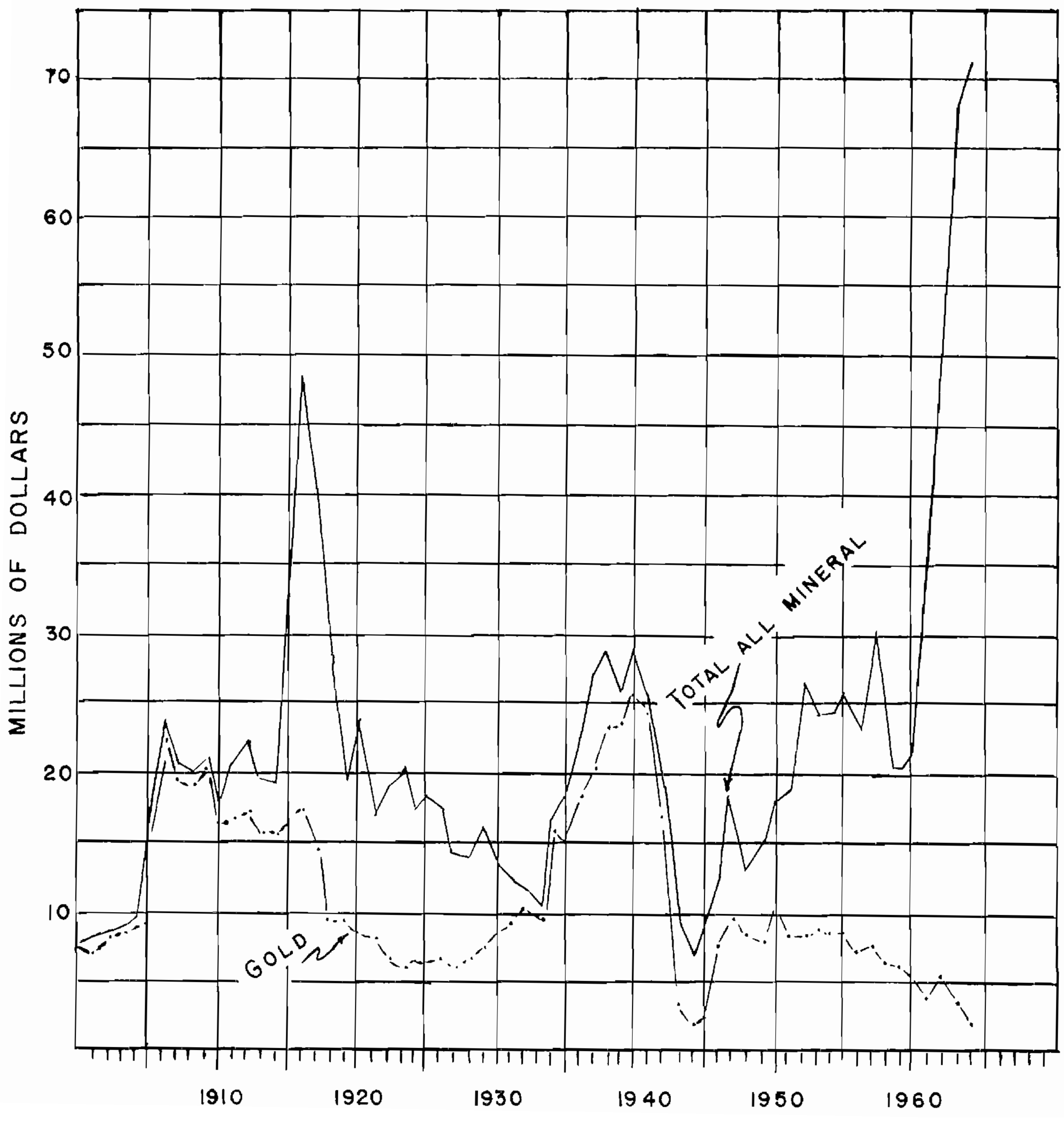


Table II - Production of Major Commodities
Dollar Value (Thousands)

Year	Gold	Mercury	Coal	Oil and Gas	Total All Production (Millions)
1950	$ 10,125	$	$ 3,033	$	$ 17.9
1951	8,387		3,767		19.5
1952	8,420	6	5,779		26.3
1953	8,882	8	8,452		24.3
1954	8,699	277	6,442		24.4
1955	8,725	12	5,759		25.4
1956	7,325	853	6,374		23.4
1957	7,541	1,349	7,296		30.2
1958	6,525	774	6,931		20.9
1959	6,262	851	6,869	311	20.5
1960	5,887	940	6,318	1,496	21.9
1961	3,998	816	5,868	17,776	34.7
1962	5,784	711	6,409	31,657	54.2
1963	3,485	76	5,910	33,760	67.8
1964	2,188	104	5,536	35,490	71.0
	$102,233	$6,777	$90,743	$120,490	$482.4

Table III - Physical Volume of Alaska Mineral Production (1)

Mineral	Quantity	Years
Total gold-----------troy ounces	29,828,000	
placer------------------do----	20,924,000	1880-1964
lode--------------------do----	8,904,000	1882-1964
Total silver--------------do----	19,044,000	
placer------------------do----	2,542,000	1906-1964
lode--------------------do----	16,502,000	1906-1964
Copper----------------short tons	690,000	1900-1964
Coal----------------------do----	16,304,000	1880-1964
Sand and gravel-----------do----	118,857,000	1951-1964
Crude petroleum------42 gal bbls	39,129,000	1958-1964 (2)
Natural gas----------million ft^3	13,764,000	1958-1964
Stone-----------------short tons	6,495,000	1948-1964
Mercury-------------76-lb flasks	34,459,000	1921-1964
Tin-------------------short tons	2,400	1902-1964
Chromite (approx. 45% Cr_2O_3) long tons	29,000	1917-1964
Tungsten----short ton units WO_3	7,000	1916-1964
Antimony (approx. 53$ Sb) short tons	3,400	1928-1964
Lead----------------------do----	25,000	1906-1964

(1) Other than platinum, uranium, and commodity figures that are confidential. 1964 production estimated and included in total.

(2) Only other crude petroleum recorded production was from the Katalla area. From 1901 to 1932, 154,000 barrels of oil were produced.

Precious Metals

Alaskan gold production continued to decline during 1964. The closure of the last dredge in the Fairbanks district accounted for a large part of the decline. Other dredges were mining lower grade ground which also affected production. Hopes were raised at the end of the year when France announced plans to convert more dollars into gold and thus lower the nation's gold stocks, but the administration reiterated that other steps would be taken and the price of gold would not be raised. There were 497 claims staked for gold during the year compared to 302 claims staked during 1963. Approximately 300 men were employed in gold mining compared to 370 in 1963.

Underground gold exploration and mining was carried on in a few areas. Keystone Mines, Inc., continued exploration under an OME participating loan near Fairbanks. They also mined and milled ore from parts of the mine not covered under the exploration contract.

Vetters produced several hundred tons of gold ore near Fairbanks. Little Squaw Mining Company continued exploration of their mine in the Chandalar, also under a participating loan from the OME.

A few of the gold placer operations noted during the season were as follows:

The U.S.S.R. & M. Company had dredges operating at Chicken and Hogatza River.

Mathews Mining Company dredged on Coal Creek on the upper Yukon.

New York-Alaska Gold Dredging Corporation operated one dredge at Nyac.

Flat Creek Placers mined with elevated sluice boxes on Willow Creek near Flat.

The Goodnews Bay Mining Company dredged platinum-bearing gravel and again was the only important producer of primary platinum in the United States.

Base Metals

At least 40 tons of antimony concentrates were shipped to Japan from the Stampede Mine in the Kantishna. Late in the year two groups of several claims each in the Fairbanks and Kantishna districts had been leased with exploration and development planned to start in the spring.

Robert Lyman recovered and shipped several tons of cinnabar concentrates from the White Mountain deposit near McGrath. There were also a few flasks of mercury produced from claims leased at Red Devil.

Radioactives

The Kendrick Bay Mine was closed because of the lack of a contract with the AEC. They had just completed drilling out an extension of the orebody and were planning to construct a road to a lower adit.

Nonmetallics

Sand, gravel, and stone production increased from $22,000,000 during 1963 to $23,000,000 in 1964. The reconstruction after the Anchorage earthquake and normal road construction accounted for most of the production.

Coal

Coal production is estimated to have decreased from 853,000 tons in 1963 to 800,000 tons in 1964, a decrease in value of approximately $370,000. This decrease probably resulted from lower military purchases due to a mild 1963-64 winter. Usibelli Coal Mine, Inc., was the largest producer followed by Evan Jones Coal Company, Vitro Minerals Corporation, and Yutan Construction Company. Several individuals in the Homer area produced a few tons of coal for local use.

A mine-mouth, coal-fired power plant is planned for construction at Sutton in the Matanuska Coal Field as soon as financing and contracts are firmed up. A similar plant is in a preliminary stage of construction at Healy in the Nenana Coal Field.

Prospecting and Exploration

Exploration activity continued to increase in the State. The most notable events were the following: Pan American Petroleum Corporation's announcement of an extensive iron discovery in the vicinity of Lake Iliamna; Kennecott Copper Corporation's purchase and development of the Ruby Creek copper deposit; Bear Creek Mining Company's continued exploration near Orange Hill in the Nabesna area; U.S. Steel's activity on tin deposits on the Seward Peninsula; Moneta Porcupine Mines, Ltd., exploration of a copper occurrence discovered in 1963 by a Division of Mines & Minerals geologist during the course of a mapping program; Little Squaw Mining Company in the Chandalar; and Keystone Mining Company near Fairbanks. Options were taken on three properties late in the year on which details cannot yet be disclosed. Interest and work on offshore prospecting permits continues. One offshore production lease was issued for an area near Daniels Creek, Seward Peninsula.

Exploration expenditures by private firms and individuals are estimated to have been $1,600,000 during 1964 as compared to $1,500,000 in 1963.

The U.S. Geological Survey spent approximately $3,000,000 in the State during 1964. They continued topographic mapping, geologic mapping, water resource studies, and administered regulations covering the conservation of oil, gas and coal. New geological publications of interest released during the year were as follows:

Bulletin 1108-D, Geology of the North Bradfield River Iron Prospect, Southeastern Alaska, by E. M. MacKevett, Jr., and M.C Blake, Jr.

Prospecting and Exploration (Contd)

Professional Paper 303-E, Geology of the Chandler River Region, Alaska. Exploration of Naval Petroleum Reserve No. 4 and Adjacent Areas, Northern Alaska.

Bulletin 1154, Geology and Ore Deposits of the Bokan Mountain Uranium-Thorium Area, Southeastern Alaska, by E.M. MacKevett, Jr.

Map I-410, Geologic Map and Section of the Northern Part of the McCarthy A-4 Quadrangle, Alaska, by Don J. Miller and Robert S. MacColl.

Map I-411, Reconnaissance Geologic Map of Baranof and Kruzof Islands, Alaska, by Robert A. Loney, John S. Pomeroy, David A. Brew, and L.J. Patrick Muffler.

Bulletin 1043-E, Recognition of Igneous and Metamorphic Rocks on Aerial photographs of Chichagof and Kruzof Islands, Southeastern Alaska, by J.S. Pomeroy.

Map I-375, Geologic Map and Section of the Chandalar Quadrangle, Alaska, by W.P. Brosge and H.N. Reiser.

Professional Paper 316-H, Geologic Interpretation of Magnetic and Gravity Data in the Copper River Basin, Alaska.

Open file report, Preliminary Geologic Map of the Eagle D-1 Quadrangle, East-Central Alaska, by Earl E. Brabb and Michael Churkin, Jr.

Open file report, Planetable Maps and Drill Logs of the Camp Creek and Bessie-Maple Beryllium-Fluorspar Deposits, Lost River Area, Alaska, by C.L. Sainsbury.

Report, Mineral and Water Resources of Alaska, for use of the Committee on Interior and Insular Affairs.

The U.S. Bureau of Mines spent approximately $475,000 in mineral investigation as part of their mineral inventory program. They also made beneficiation studies, coal mine safety inspections, and compiled statistics on production which are released in the annual Minerals Yearbook.

Mineral investigations were carried on at Gravina Island, Glacier Basin, Sitklan Passage, Bokan Mountain, Bohemia Basin, Bradfield Canal, and Tracy Arm all in southeastern Alaska. They also investigated deposits on Knight Island, Willow Creek, Sleetmute, and Nixon Fork in Southcentral Alaska and various places in the Fairbanks area. A beryllium deposit was drilled on the Seward Peninsula.

Prospecting and Exploration (Contd)

A total of 1665 mining claims were staked in 1964 compared to 686 claims staked in 1963. This total included 337 gold placer, 160 gold lode, 225 copper, 692 iron, 28 molybdenum, 29 platinum, 39 antimony, and others in smaller numbers. Affidavits of assessment work were filed for 5166 claims.

Prospecting Costs

Calculation of the expenses of the first two years of the Prospector's Assistance Program reveals that it costs about $20.64 per day to field a prospector in the State. The total cost of 1151 man days in the field was $23,751.22 for the two year period. This cost includes transporation, food, and supplies (including prospecting equipment) but not wages. The State reimburses approved applicants for a portion of the expenses. Distributed costs were as follows:

Transportation	$12.66	per man day
Food	3.91	" " "
Supplies	4.07	" " "
Total	$20.64	

Transportation includes aircraft charter, helicopter charter, tracked vehicles, and rubber-tired equipment. Food costs include ordinary groceries and the dry pack camping variety. Supplies include tents, tools, equipment rental and chemical supplies.

Small fixed-wing aircraft are available in nearly every town in Alaska. Charter rates for a Piper Cruiser are about $20-40 an hour; a Cessna 180 is about $40-60 an hour. Helicopters are available in Ketchikan, Juneau, Anchorage, and Fairbanks. The rate is usually about $100-135 an hour with a guarantee of three hours flying a day.

Future of the Industry

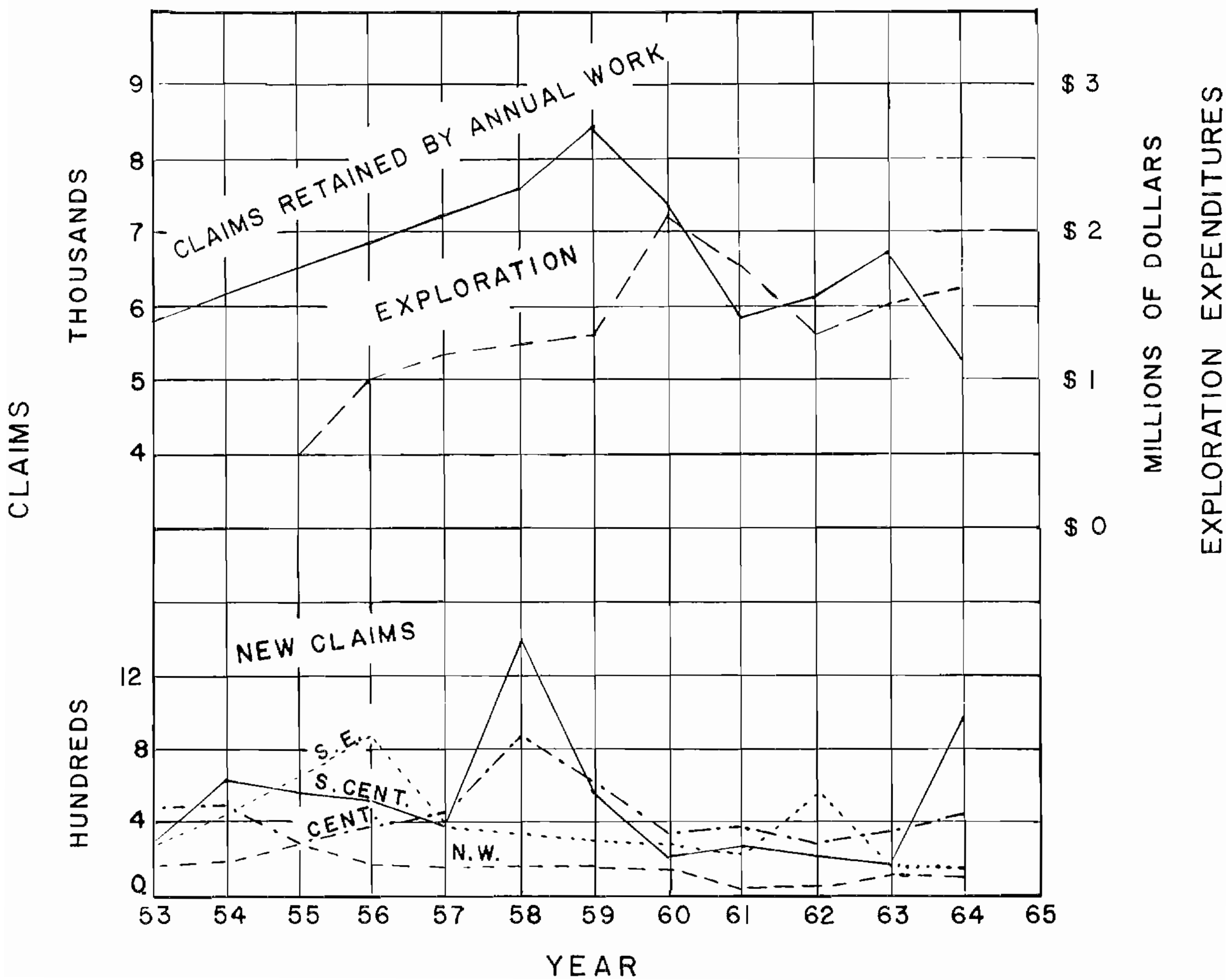
Gold

Gold production is expected to remain at present production levels during 1965. Unless there is Congressional relief or new deposits are found, production will probably remain stable for two years and then decline further as more dredges are shut down.

Coal

Coal production will drop markedly if the military establishments now using coal in the Anchorage area convert to gas. This will be somewhat alleviated if the proposed mine-mouth power plant at Sutton is constructed. Production from the Nenana field should remain constant or will increase if the mine-mouth power plant is constructed at Healy.

Figure 2 - Barometer of Exploration Activity



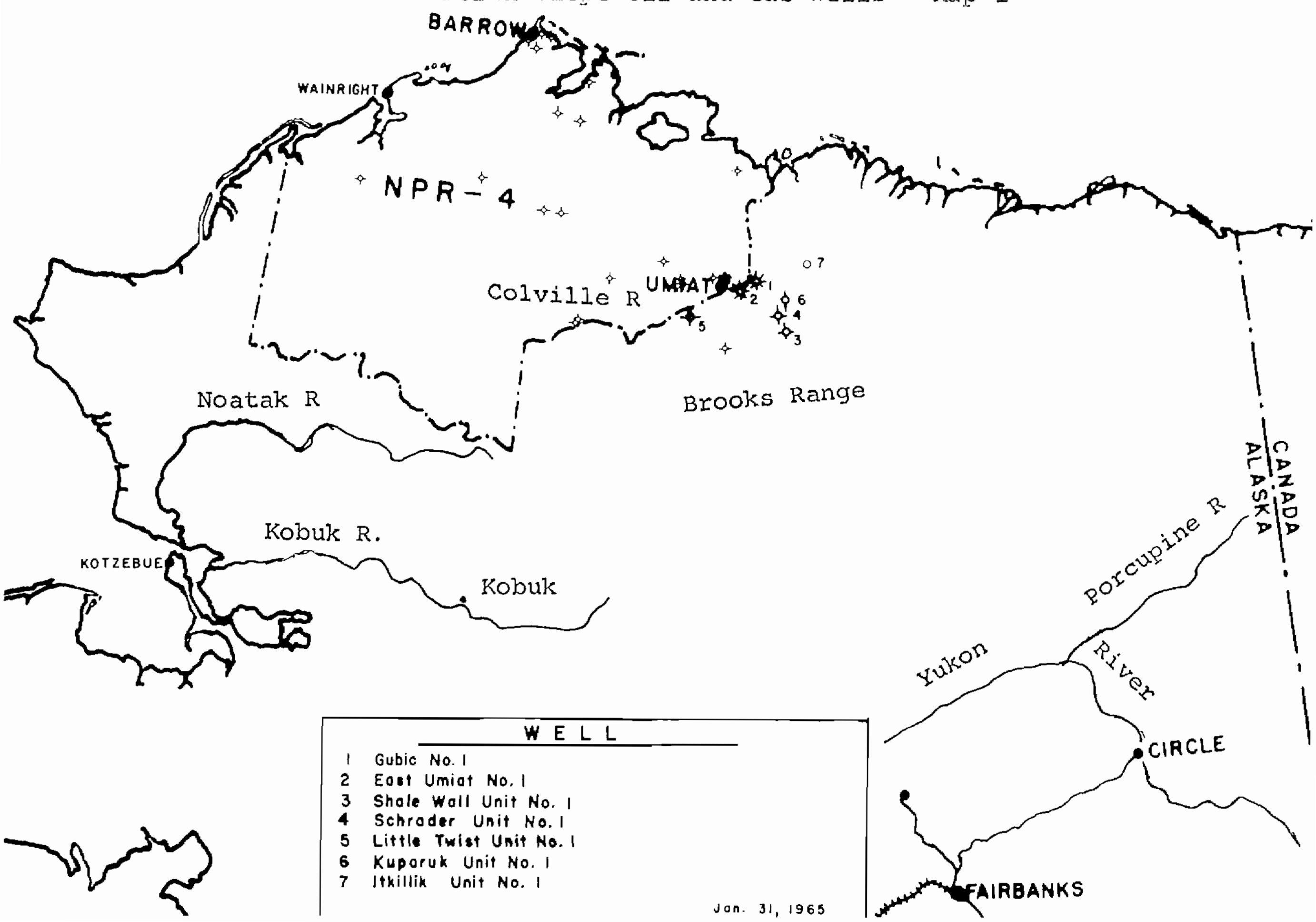
Future of the Industry (Contd)

Base Metals

In view of recent options of various base metal deposits by mining companies, it is anticipated that production of these ores will increase gradually over the next few years.

Higher prices for base metal ores on world markets are making Alaska's prospects and potential more appealing to producers. The increase in the price of tin caused an increase in ore development on the Seward Peninsula. The increase in the price of antimony resulted in accelerated interest and the optioning of several antimony claims in the State. The high mercury price has brought additional correspondence with mining companies and individuals interested in mercury. Lead-silver ore is also of active interest. Many companies have inquired particularly about silver prospects in Alaska.

North Slope Oil and Gas Wells - Map I



THE PETROLEUM INDUSTRY

Highlights

(See Table IX)

In 1964 it became apparent that a large oil field would be rapidly developed under Cook Inlet waters owned entirely by the State of Alaska. Until now all oil and gas production has been from Federal Units.

A successful new pay discovery and a successful field extension well on the Middle Ground Shoal structure beneath Cook Inlet waters have provided additional encouragement to the Pan American Petroleum Corporation group and the Shell Oil Company group to develop the field by constructing permanent offshore drilling and producing platforms. Both platforms are projected to become operational in 1965 and drilling will be possible on a year round basis. Plans are underway for a pipeline from the platforms to the east side of Cook Inlet.

Another discovery well and field extension well were completed on the Cook Inlet structure, also on State-owned submerged lands. This structure is approximately 25 miles northeast of Middle Ground Shoal.

An ascending position for Alaska as an oil producing state is assured.

A total of 24 exploratory drilling operations were active in 1964. Six exploratory wells were drilled on the North Arctic Slope resulting in a gas discovery at East Umiat.

In the Cook Inlet area unsuccessful attempts were made to extend the Beluga River Gas Field and the Kenai Gas Field north of their presently known limits.

In the Cook Inlet Basin upland areas nine exploratory wells were active but did not result in discoveries.

An offshore drilling operation was commenced on the newly formed West Foreland Unit lying in Cook Inlet waters and will be resumed in the spring of 1965.

Geophysical exploration was most active on the North Arctic Slope of Alaska. This was partly due to the noncompetitive opening of Bureau of Land Management Area #1 containing approximately 3,686,400 acres of Federal Lands and the forthcoming opening of Bureau of Land Management Area #2 probably during the first quarter of 1965. The competitive opening of 449,894 acres of State-selected lands east of the mouth of the Coleville River also spurred seismic activity.

Development and Production

Development

Only two development wells were drilled in Alaska during 1964. Union Oil Company of California drilled a sixth gas well in the Kenai Field, and the

U. S. Navy drilled a fourth gas well in the South Barrow Field. The latter well has a capacity almost double that of the best of the three wells drilled previously. It assures a good supply of fuel for the native village of Barrow as well as for the facilities still operating in the old Arcon camp.

Swanson River Field development was completed in 1963, and no new wells were drilled in 1964.

Production - Oil

All of Alaska's oil production in 1964 came from the Swanson River Field with the exception of a small amount of clean oil recovered from production tests of Pan American Petroleum Corporation's Middle Ground Shoal #4.

In the Swanson River Field 37 wells were flowing and 17 were on gas lift at the end of the year.

(See Table IV)

Producing Mechanism

Expansion of reservoir fluids augmented by pressure maintenance through gas injection is still the source of energy. A gradual pressure drop, however, indicates the need of a considerable increase in the rate of gas injection to maintain constant rate of production. This is planned for 1965, using gas from the Kenai Gas Field.

Production Problems

Water production has increased from 4.1% of the gross production in 1963 to 10.2% in 1964. In order to dispose of the increased volume of water one well was reconditioned by perforating opposite upper barren sands, then setting a packer on the tubing below the perforations which permits the well to be produced while injecting the waste water between strings.

Gas Injection

During 1964 gas has been injected in the Hemlock Zone in the Soldotna Creek Unit through three wells at rates of 9,900 to 18,700 MCF per day at pressures up to 6,000 psi. A total of 5,479,694 MCF was injected in 1964.

Union Oil Company of California has contracted to deliver more than 100,000 MCF per day to Standard Oil for pressure maintenance starting in 1965. This along with the dry gas and depropanized wet gas produced in the field should maintain the reservoir pressure.

(See Table VII)

Production - Gas

In addition to the wet and dry gas produced in the Swanson River Field, most of which was injected in the pressure maintenance program, all other gas produced in the state came from four fields: Kenai, Sterling and Beluga River in the Cook Inlet Basin, and the South Barrow Field in the Arctic.

Kenai Field

Although gas sales from this field increased from 3,095,147 MCF in 1963 to 4,502,836 MCF in 1964, it was necessary to produce only one to three wells at a time to supply the demand. All gas not used on the property was sold and was distributed by the Anchorage Natural Gas Company in Anchorage for industrial and residential use.

(See Table VIII)

Swanson River Field

All surplus gas produced in the Swanson River Field, except a small amount sold to Kenai Pipe Line Company and some used on the property for fuel and gas-lift, was injected to repressure the oil zone.

A total of 6,997,186 MCF was produced in 1964 compared to 7,454,678 in 1963.

(See Table VIII)

Sterling Field

The Sterling Field, with only one of the two wells producing, sold 57,680 MCF to Consolidated Utilities, Ltd. for local consumption compared to 45,722 MCF in 1963.

Beluga River Field

The production of 133,519 MCF from one well during the first five months of the year was all used as fuel for the drilling of an exploratory well. All four wells were shut-in for the rest of the year.

(See Table VIII)

South Barrow Field

No figures are available for production from this field, which is within the Naval Petroleum Reserve No. 4.

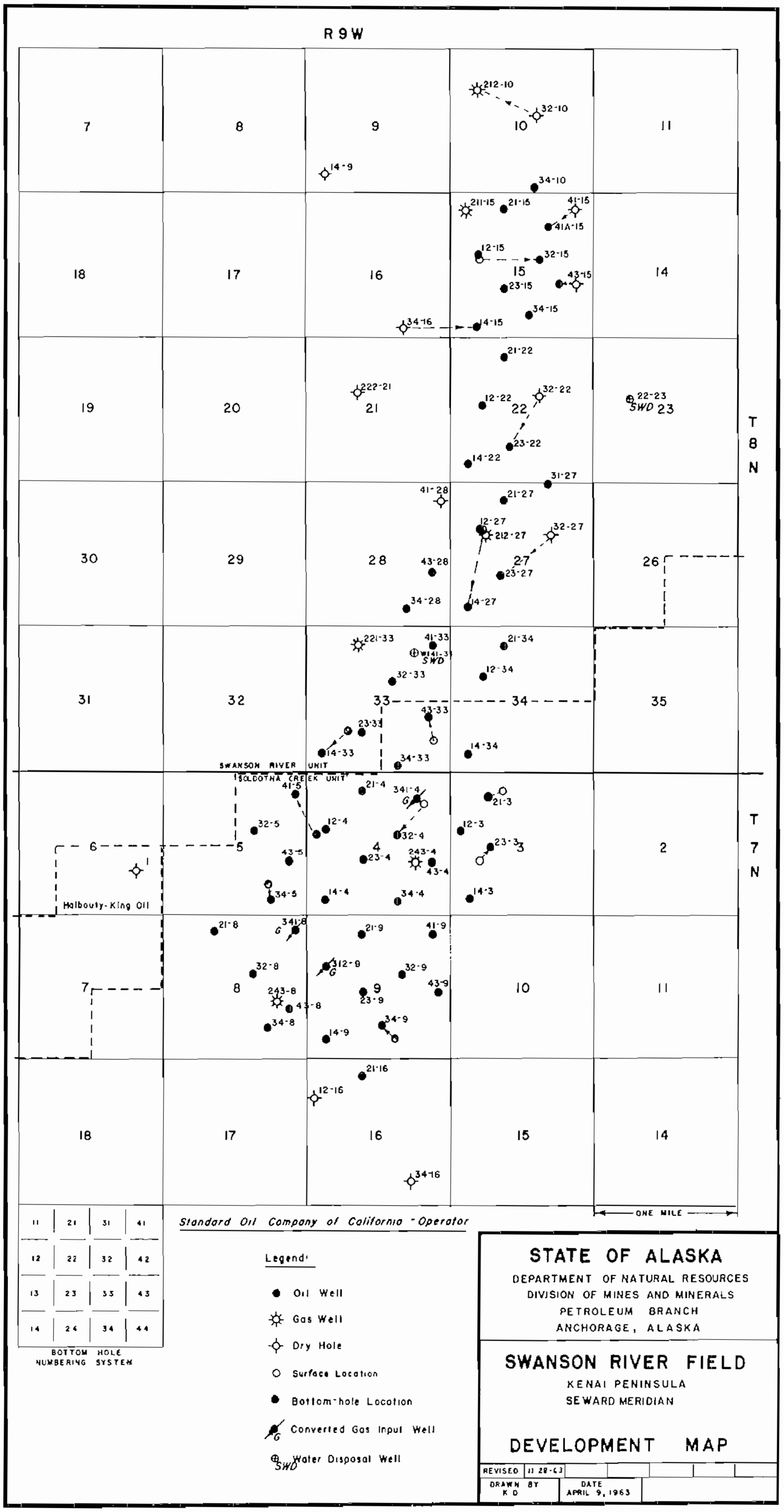
Other Fields

Other gas fields in the state were shut-in during the year because of lack of market or lack of pipe line facilities. These were: West Fork, 1 well; Falls Creek, 1 well; West Foreland, 1 well; Cook Inlet, 1 oil well and 1 gas well; and East Umiat, 1 well.

Swanson River Field
Kenai Peninsula, Alaska

Standard Oil Company of California, Western Operations, Inc., Operator

Location		T7N & 8N R9W, Seward Meridian
Discovery Well		SRU 34-10
Discovery Date		August 24, 1957
Producing Formation		
	Oil	Hemlock Zone - 10,150'-11,700'
	Gas	Kenai - 3,000'-5,800'
Deepest Test		SCU 22A-32 - 14,796'
Wells		
	Oil - Flowing	39
	Gas Lift	15
	Shut-in	1
	Gas - Producing	4
	Shut-in	2
	Salt Water Disposal	2 (one is dual - gas producer and disposal)
	Gas Injection	3
Production Data - 1964		
	Oil Production	11,053,872 bbls.
	Water Production	1,253,159 bbls.
	Gas Production - with oil	3,152,531 MCF
	Gas Production - gas wells	3,844,655 MCF
Cumulative Production 12/31/64		
	Oil	39,159,790 bbls.
	Water	2,209,717 bbls.
	Gas - with oil	9,146,517 MCF
	Gas - gas wells	8,734,384 MCF
Reservoir Data - Hemlock Zone		
	Initial Reservoir Pressure	5,650 psi.
	Reservoir Pressure 12/31/64	4,330 psi.
	Saturation Pressure	1,000-1,400
	Oil Gravity	29.0°-39.5° API
	Temperature	180°F
	Net Pay Thickness	8'-300'
	Porosity	18-26%
	Permeability	0-3,275 Mds.
	Connate Water	40%
	Formation Volume Factor	1.12
	Gas-Oil Ratio	139-753 SCF/STB
	Participating Area	6,245 Acres


R 9 W
T 8 N
T 7 N
SWANSON RIVER UNIT
SOLDOTNA CREEK UNIT
Halbouty-King Oil
SWD
ONE MILE
BOTTOM HOLE NUMBERING SYSTEM
Standard Oil Company of California - Operator
Legend:
Oil Well
Gas Well
Dry Hole
Surface Location
Bottom-hole Location
Converted Gas Input Well
Water Disposal Well
STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINES AND MINERALS
PETROLEUM BRANCH
ANCHORAGE, ALASKA
SWANSON RIVER FIELD
KENAI PENINSULA
SEWARD MERIDIAN
DEVELOPMENT MAP
REVISED 11-20-63
DRAWN BY K D
DATE APRIL 9, 1963

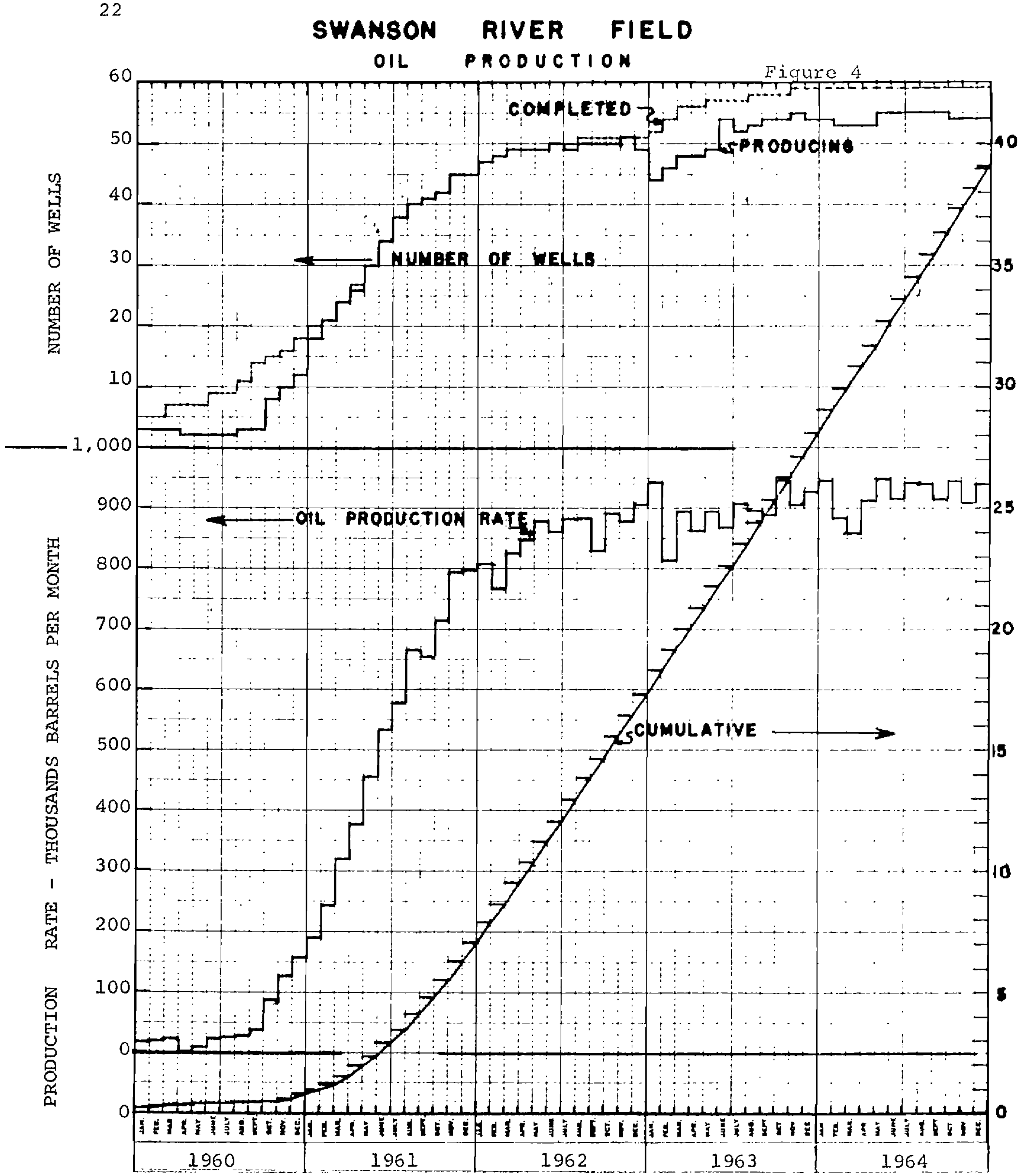

SWANSON RIVER FIELD
OIL PRODUCTION
Figure 4
NUMBER OF WELLS
COMPLETED
PRODUCING
NUMBER OF WELLS
OIL PRODUCTION RATE
CUMULATIVE
PRODUCTION RATE - THOUSANDS BARRELS PER MONTH
60
50
40
30
20
10
1,000
900
800
700
600
500
400
300
200
100
0
0
40
35
30
25
20
15
10
5
0
1960
1961
1962
1963
1964

Table IV - Swanson River Field Oil Production by Months

Year	Month	Oil Prod. Month-Bbls.	Oil Prod. Year-Bbls.	Cumulative Oil Prod.-Bbls.	Number of Wells
Oil Produced Prior to 1962				7,106,844	
1962	Jan.	808,752			47
	Feb.	768,203			48
	Mar.	824,760			49
	Apr.	848,253			49
	May	877,642			49
	June	860,969			50
	July	882,674			50
	Aug.	883,754			51
	Sept.	830,246			51
	Oct.	890,016			51
	Nov.	878,220			51
	Dec.	905,621	10,259,110	17,365,954	52
1963	Jan.	943,558			44
	Feb.	812,837			46
	Mar.	894,241			46
	Apr.	862,546			48
	May	892,244			49
	June	866,712			54
	July	907,343			53
	Aug.	896,308			53
	Sept.	888,777			54
	Oct.	945,016			54
	Nov.	903,311			55
	Dec.	927,071	10,739,964	28,105,918	54
1964	Jan.	945,348			54
	Feb.	883,858			54
	Mar.	858,811			53
	Apr.	912,185			53
	May	948,770			55
	June	915,204			55
	July	941,565			55
	Aug.	940,175			55
	Sept.	914,025			55
	Oct.	944,743			54
	Nov.	908,956			54
	Dec.	940,232	11,053,872	39,159,790	54
Middle Ground Shoal Field					
1964	Sept.& Oct.	* 5,329	5,329	5,329	1
Total Oil Produced			11,059,201	39,165,119	

*(Oil recovered in tests of Pan American Petroleum - MGS #4 and sold.)

Table V A

Swanson River Field
Individual Well Oil Production Statistics

Swanson River Unit

Well No.	Comp. Date	1960	1961	1962	1963	1964	Cumulative
				Oil Production			
SRU 34-10*	10-1 -57	21,264	59,933	29,227	1,918	1,043	216,792
12-15	10-5 -60	21,387	34,327	45,426	104,164	90,296	295,600
14-15*	7 -25-59		7,332	3,636	66		14,269
21-15	6 -7 -61		79,545	167,236	109,481	69,941	426,203
23-15	4 -5 -61		107,040	146,300	123,448	143,904	520,692
32-15*	10-24-59	108,308	186,776	162,708	124,600	128,923	725,679
34-15	8 -4 -61		66,800	123,776	45,810	43,725	280,111
41A-15	12-9 -62			6,647	136,024	116,995	259,666
43-15	11-1 -61		2,675	19,181	29,234	22,469	73,559
12-22	8 -11-62			75,395	224,733	195,084	495,212
14-22	2 -2 -63				27,900	23,581	51,481
21-22	1 -3 -62			135,195	65,423	78,025	278,643
23-22	3 -9 -60	32,581	120,145	86,685	52,411	103,032	394,854
12-27*	11-30-59	62,540	183,713	164,195	110,420	92,678	620,829
14-27	6 -14-60	6,582	238,272	312,415	270,366	305,697	1,133,332
21-27	5 -5 -61		119,571	232,324	194,880	233,780	780,555
23-27	2 -5 -61		98,751	66,458	88,721	76,064	329,994
31-27*	10-26-58	9,231	40,032	16,666	12,718	2,399	175,101
34-28	5 -16-63				51,160	87,008	138,168
43-28	7 -22-61		83,914	173,245	201,821	209,299	668,279
14-33	6 -11-62			65,473	119,161	185,039	369,673
23-33	6 -10-61		37,452	44,818	50,644	111,367	244,281
32-33	8 -25-60	36,655	195,087	294,175	227,676	195,219	948,812
41-33	3 -12-61		182,225	363,453	247,490	319,533	1,112,701
12-34	10-21-60		142,787	160,764	175,760	200,189	679,500
21-34	3 -25-63				141,416	178,252	319,668
Totals SRU		298,548	1,986,377	2,895,398	2,937,445	3,213,542	11,553,654

* Produced prior to 1960 - Total 222.344 bbls.

Table V B

Swanson River Field
Individual Well Oil Production Statistics

Soldotna Creek Unit

Oil Production

Well No.	Comp. Date	1960	1961	1962	1963	1964	Cumulative
SCU 12-3	3 -23-61		201,829	241,286	163,195	257,984	864,294
14-3	8 -2 -61		66,962	127,862	111,475	86,680	392,979
21-3	1 -10-62			253,580	199,238	123,737	576,555
23-3	11-12-63				13,452	70,841	84,293
12-4	4 -8 -61		206,870	315,308	448,589	337,381	1,308,148
14-4	8 -13-60	83,768	305,632	406,899	474,979	433,066	1,704,344
21-4	11-5 -61		29,605	215,841	255,905	286,564	787,915
23-4	6 -1 -61		175,004	370,771	472517	375,279	1,393,577
32-4	6 -5 -60	74,003	317,492	398,596	425,710	381,621	1,597,422
34-4	11-26-60		246,747	355,595	437,873	387,460	1,427,675
41-4	3 -21-60	97,543	301,962	280,253	*		679,758
43-4	5 -14-61		181,890	330,931	327,105	316,238	1,156,164
32-5	3 -16-62			29,846	67,290	102,283	199,419
34-5	10-9 -61		30,817	262,993	420,163	343,194	1,057,167
41-5	9 -20-61		41,594	116,075	102,833	173,845	434,347
43-5	5 -28-61		91,504	127,021	219,725	233,669	671,919
21-8	2 -5 -63				164,964	260,072	425,036
41-8	5 -14-61		119,506	355,493	87,270*		562,269
32-8	2 -22-61		130,833	194,030	204,460	242,599	771,972
34-8	1 -28-62			76,666	105,205	162,007	343,878
43-8	7 -24-61		161,965	154,901	120,657	153,302	590,825
12-9	10-9 -60		275,247	236,586	*		511,833
14-9	10-26-60		181,998	195,332	314,525	292,351	984,206
21-9	7 -19-61		137,997	353,681	390,652	411,971	1,294,299
23-9	7 -17-61		115,333	331,927	341,006	215,240	1,003,506
32-9	1 -16-61		185,766	282,033	373,733	387,757	1,229,289
34-9	11-8 -61		26,014	194,171	259,224	285,562	764,971
41-9	6 -11-61		118,240	260,815	288,681	277,325	945,061
43-9	7 -5 -63				83,926	164,747	248,673
21-16	7 -8 -63				110,491	281,106	391,597
34-33	11-12-60	4,137	281,661	243,842	227,676	256,625	1,013,941
43-33	3 -8 -61		164,602	290,258	260,721	233,723	949,304
14-34	12-23-60		243,004	361,114	329,369	306,201	1,239,685
Totals SCU		259,451	4,340,124	7,363,712	7,802,519	7,840,330	27,606,136
Totals SRU		298,548	1,986,377	2,895,398	2,937,445	3,213,542	11,553,654
Field Totals	Prior to 1960 222,344	557,999	6,326,501	10,259,110	10,739,964	11,053,872	39,159,790

* Converted to gas injection well

Price of Oil

Effective December 15, 1961, for Swanson River Field
Kenai Peninsula, Alaska

Gravity	Price per Barrel *
25-25.9 - degree	$2.41
26-26.9	2.49
27-27.9	2.56
28-28.9	2.62
29-29.9	2.68
30-30.9	2.74
31-31.9	2.80
32-32.9	2.86
33-33.9	2.92
34-34.9	2.98
35-35.9	3.04
36-36.9	3.09
37-37.9	3.14
38-38.9	3.19
39-39.9	3.24
40-40.9	3.29

Average price for 1964 production: $3.07

Based upon price of (Long Beach) Signal Hill crude less 19¢/bbl. for transportation.

* Price at wellhead

Gas Production - 1964

The Kenai Gas Field produced 4,502 million cubic feet of gas during 1964, as compared to 3,105 million cubic feet during 1963. Gas sales during 1964 were made to Anchorage Natural Gas Company for electric power generation and sales for heating fuel.

The Sterling Gas Field produced 58 million cubic feet during the year, as compared to 45 million cubic feet during 1963. Gas sales were made to Consolidated Utilities, Ltd., which generated electric power for the city of Kenai and community.

The Swanson River Gas Field produced 3,844 million cubic feet during 1964. All of this gas was used in the gas injection project for the oil zone of the field. Casing head gas from the Hemlock Zone totalled 3,152 million cubic feet for the year, 122 million of which was sold, 777 million used, 616 million lost, and the remainder used in the injection project.

Table VI A

Kenai Gas Field
Kenai Peninsula, Alaska

Union Oil Company of California, Operator

Location	T4 & 5N - R11 & 12W, Seward Meridian
Discovery Well	Kenai Unit No. 14-6
Discovery Date	October 11, 1959
Producing Formation	Kenai 4,240'-5,728'
Deepest Test	No. 14-6 - 15,047'
Wells	
Producing	4
Shut-in	2
Reservoir Data	
Initial Reservoir Pressure	1,900-2,400 psi.
Average Reservoir Pressure	1,900-2,400 psi.
Gas Gravity	.557
Temperature	102-105°F
Net Pay Thickness	9'-135'
Porosity	15-35%
Permeability	350-3,000 Mds.
Connate Water	18-35%
Developed Area	11,000 Acres

Production Statistics

	Number of Wells			Gas Produced - MCF	
Year	Producing	Shut-in	Water (bbls)	Year	Cumulative
1960	2	0	0	14,474	17,474
1961	3	2	0	214,718	232,192
1962	3	2	0	1,460,171	1,692,367
1963	3	2	0	3,105,539	4,797,906
1964	4	2	0	4,502,836	9,300,742

Table VI B

Sterling Gas Field
Kenai Peninsula, Alaska

Union Oil Company of California, Operator

Location	Sec. 15, T5N-R10W, Seward Meridian
Discovery Well	No. 23-15
Discovery Date	August 4, 1961
Producing Formation	Kenai 5250 - 54' (Perforations)
Deepest Test	No. 23-15 - 14,832'
Wells	
Producing	1
Shut-in	1
Reservoir Data	
Initial Reservoir Pressure	2,200-2,300 psi.
Average Reservoir Pressure	2,200-2,300 psi.
Gas Gravity	.569
Temperature	108-110°F
Net Pay Thickness	10-30
Porosity	
Permeability	
Connate Water	
Developed Area	1,500 Acres

Production Statistics

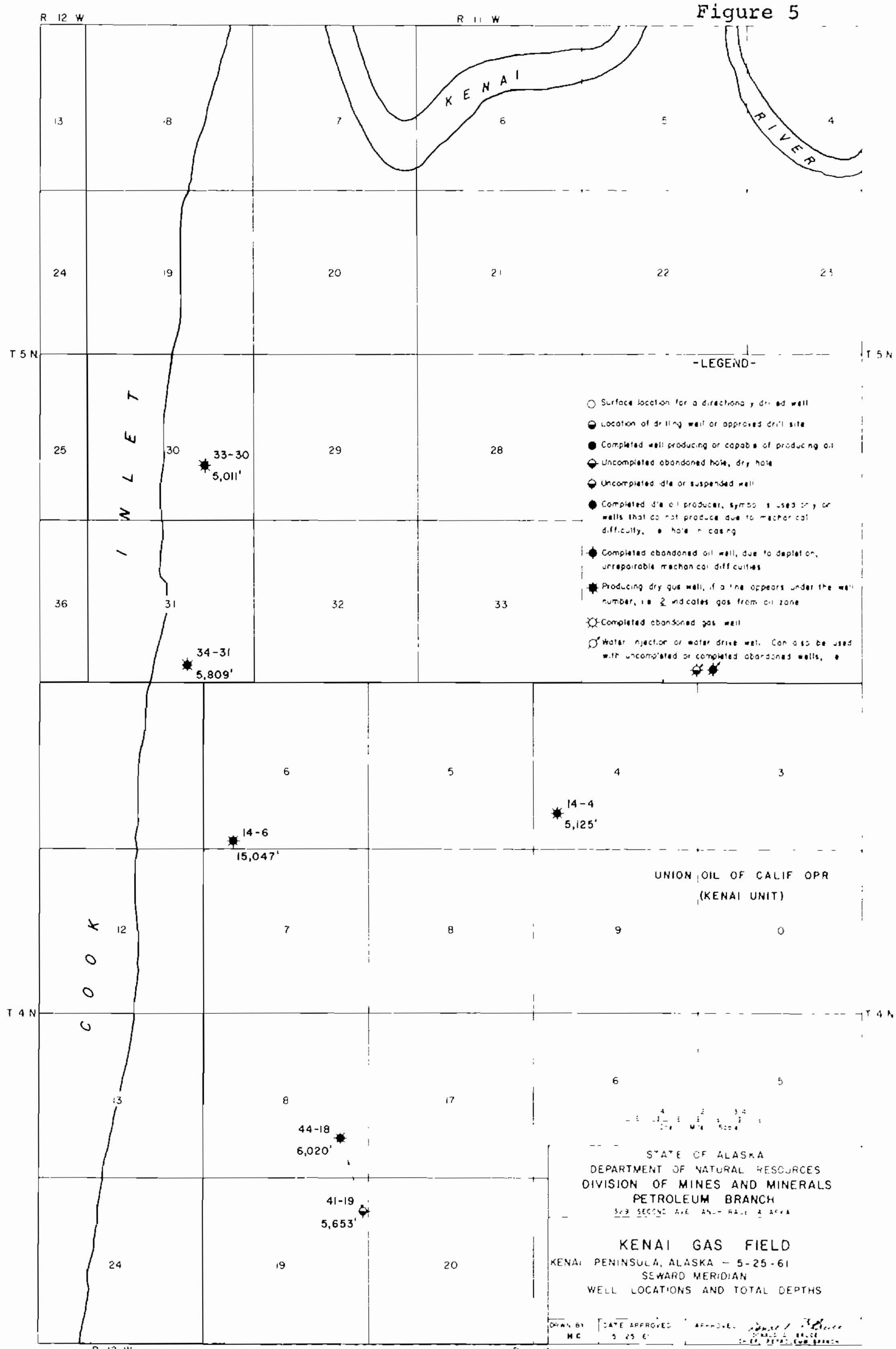
	Number of Wells			Gas Produced - MCF	
Year	Producing	Shut-in	Water (bbls)	Year	Cumulative
1962	1	0	0	25,186	25,186
1963	1	1	0	45,724	70,910
1964	1	1	0	58,383	129,293

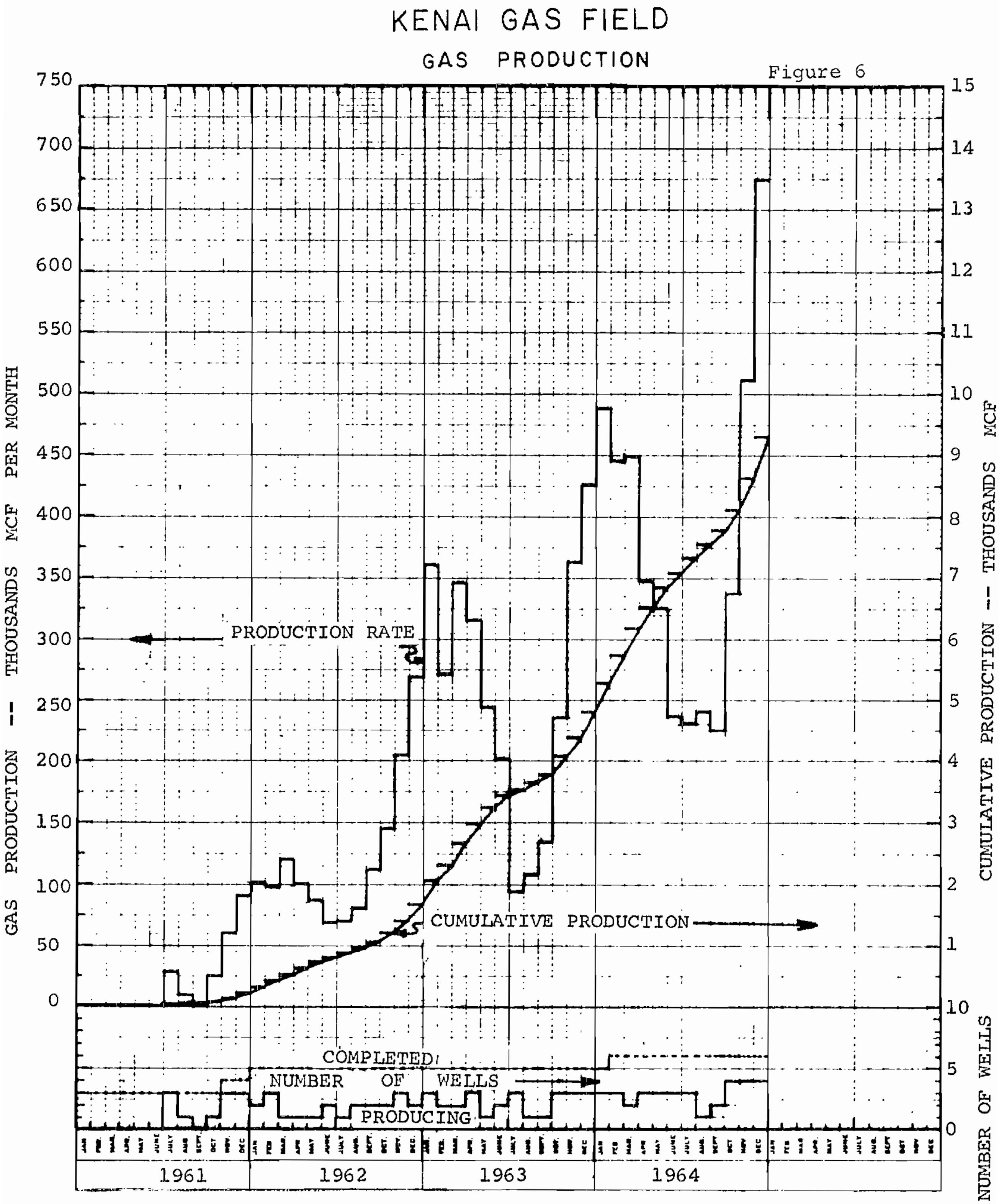
Table VII

Swanson River Injection Project
Injection Statistics
Cumulative Injected
Gas Injection Started November, 1962

Date	Number of Injection Wells	MCF Injected in month	Cumulative MCF Injected
1962, November	1	32,710	32,710
December	2	219,450	252,160
Total 1962		252,160	
1963, January	2	298,399	550,559
February	2	315,833	902,392
March	3	524,071	1,426,463
April	3	462,465	1,888,928
May	3	535,667	2,424,595
June	3	605,941	3,030,536
July	3	721,397	3,751,933
August	3	647,810	4,399,743
September	3	572,192	4,971,935
October	3	624,597	5,596,532
November	3	495,749	6,092,281
December	3	475,999	6,568,280
Total 1963		6,316,120	
1964, January	3	511,221	7,079,501
February	3	460,168	7,539,669
March	3	510,089	8,049,758
April	3	560,464	8,610,222
May	3	536,545	9,146,767
June	3	503,394	9,650,161
July	3	489,652	10,139,813
August	3	443,101	10,582,914
September	3	410,716	10,993,630
October	3	394,426	11,388,056
November	3	351,715	11,739,771
December	3	308,203	12,047,974
Total 1964		5,479,694	

Figure 5


R 12 W
R 11 W
T 5 N
T 4 N
KENAI RIVER
COOK INLET
33-30
5,011'
34-31
5,809'
14-6
15,047'
14-4
5,125'
44-18
6,020'
41-19
5,653'
UNION OIL OF CALIF OPR
(KENAI UNIT)
-LEGEND-
Surface location for a directionally drilled well
Location of drilling well or approved drill site
Completed well producing or capable of producing oil
Uncompleted abandoned hole, dry hole
Uncompleted idle or suspended well
Completed idle oil producer, symbol is used only for wells that do not produce due to mechanical difficulty, i.e. hole in casing
Completed abandoned oil well, due to depletion, unrepairable mechanical difficulties
Producing dry gas well, if a line appears under the well number, i.e. 2 indicates gas from oil zone
Completed abandoned gas well
Water injection or water drive well. Can also be used with uncompleted or completed abandoned wells, i.e.
STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINES AND MINERALS
PETROLEUM BRANCH
KENAI GAS FIELD
KENAI PENINSULA, ALASKA — 5-25-61
SEWARD MERIDIAN
WELL LOCATIONS AND TOTAL DEPTHS
DRAWN BY
MC
DATE APPROVED
5 25 61
APPROVED


KENAI GAS FIELD
GAS PRODUCTION
Figure 6
GAS PRODUCTION -- THOUSANDS MCF PER MONTH
CUMULATIVE PRODUCTION -- THOUSANDS MCF
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
PRODUCTION RATE
CUMULATIVE PRODUCTION
COMPLETED
NUMBER OF WELLS
PRODUCING
NUMBER OF WELLS
10
5
0
1961
1962
1963
1964

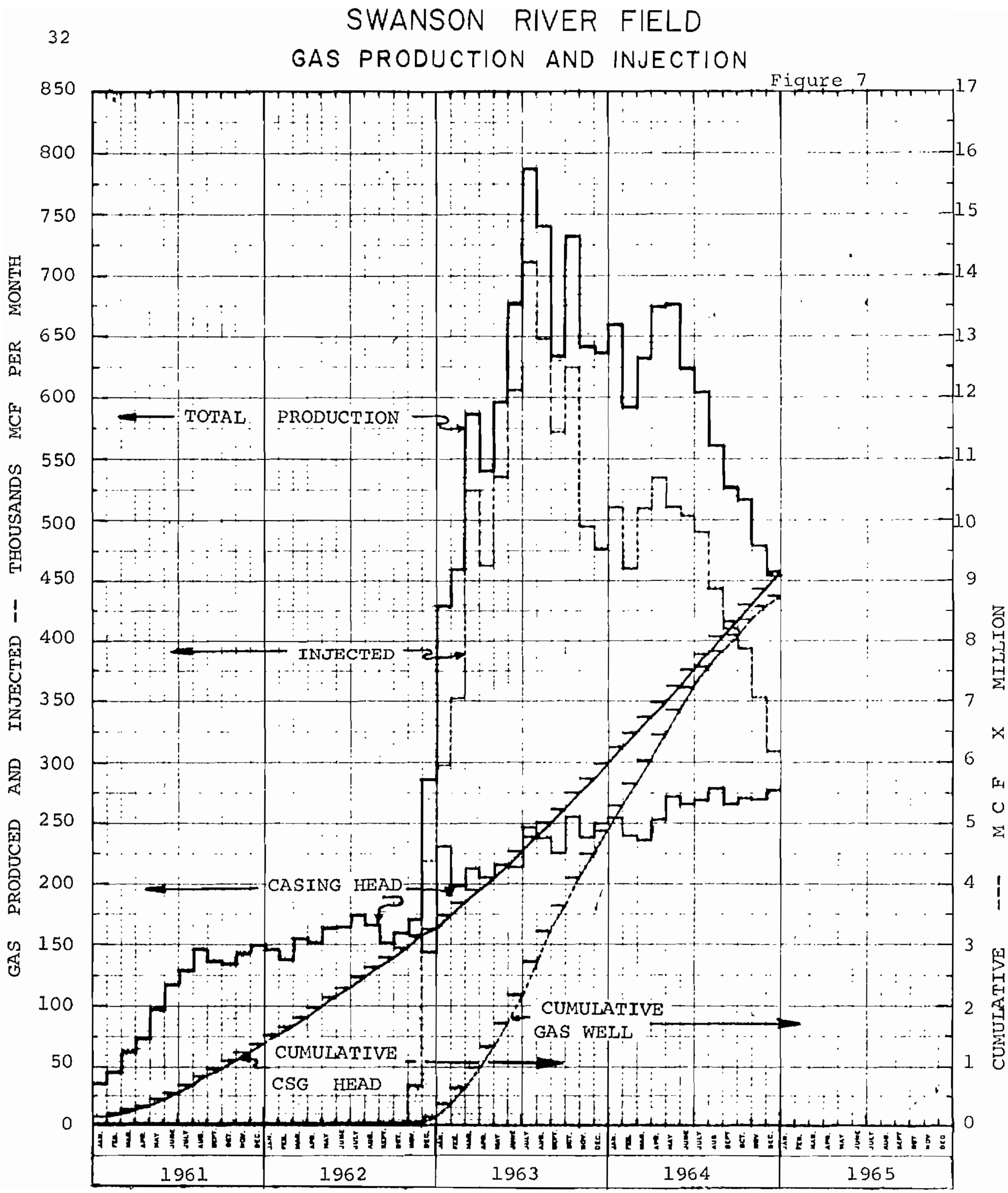

SWANSON RIVER FIELD
GAS PRODUCTION AND INJECTION
Figure 7
GAS PRODUCED AND INJECTED -- THOUSANDS MCF PER MONTH
CUMULATIVE --- M C F X MILLION
TOTAL PRODUCTION
INJECTED
CASING HEAD
CUMULATIVE GAS WELL
CUMULATIVE CSG HEAD
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
1961
1962
1963
1964
1965

Table VIII

Gas Production

Swanson River Field

Year	Csg. Hd. Hemlock Z.	Dry Gas Kenai Z.	Total	Blown or Lost	Used	Sold	Injected
Prior to 1959	5,502	0	5,502	5,502	---	---	---
1959	26,611	0	26,611	25,832	779	---	---
1960	96,700	19,760	116,460	58,342	56,593	1,525	---
1961	1,260,977	0	1,260,977	1,009,234	208,303	43,440	---
1962	1,866,275	153,212	2,019,487	1,439,366	233,107	94,854	252,160
1963	2,737,921	4,716,757	7,454,678	315,275	714,870	108,413	6,316,120
1964	3,152,531	3,844,655	6,997,186	616,763	777,836	122,893	5,479,694
Total	9,146,517	8,734,384	17,880,901	3,470,314	1,991,488	371,125	12,047,974

Kenai Field

Year	Csg. Hd. Hemlock Z.	Dry Gas Kenai Z.	Total	Blown or Lost	Used	Sold	Injected
Prior to 1961		17,474	17,474	898	---	16,576	---
1961		214,718	214,718	49	5,349	209,320	---
1962		1,460,175	1,460,175	347	3,673	1,456,155	---
1963		3,105,539	3,105,539	13	10,382	3,095,147	---
1964		4,502,836	4,502,836	1,156	6,297	4,495,383	---
Total		9,300,742	9,300,742	2,463	25,701	9,272,581	---

Sterling Field

Year	Csg. Hd. Hemlock Z.	Dry Gas Kenai Z.	Total	Blown or Lost	Used	Sold	Injected
1962		25,186	25,186	14	466	24,706	---
1963		45,724	45,724	1	1	45,722	---
1964		58,383	58,383	500	203	57,680	---
Total		129,293	129,293	515	670	128,108	---

Beluga River Field

Year	Csg. Hd. Hemlock Z.	Dry Gas Kenai Z.	Total	Blown or Lost	Used	Sold	Injected
1963		13,200	13,200	---	13,200	---	---
1964		133,519	133,519	---	133,519	---	---
Total		146,719	146,719	---	146,719	---	---

Total - All Fields

Year	Csg. Hd. Hemlock Z.	Dry Gas Kenai Z.	Total	Blown or Lost	Used	Sold	Injected
1964	3,152,531	8,539,393	11,691,924	618,419	917,855	4,675,956	5,479,694
Cumulative	9,146,517	18,311,138	27,457,755	3,473,292	2,164,578	9,771,814	12,047,974

Table IX

DEVELOPMENT WELLS ACTIVE IN 1964
SWANSON RIVER, KENAI, MIDDLE GROUND SHOAL

State Permit	Company	Well Name	Well No.	Location ¼	Sec.	T.	R.	B&M	Date Spud	Date Comp.	Footage T.D.	Footage Drilled 1964	Status 12-31-64	Initial Production Bbls or MCF	Remarks
64-1	Union Oil	Kenai Unit	33-1	SE	1	4N	12W	S	1-28-64	2-27-64	5,136	5,136	GSI	10,119 MCF	48"/64 bean-BHP1758-psi
	U.S. Navy	So. Barrow	6	NW	14	22N	18W	UP	2-28-64	3-24-64	2,363	2,363	GW-P	9,600 MCF	2" bean
												7,499			

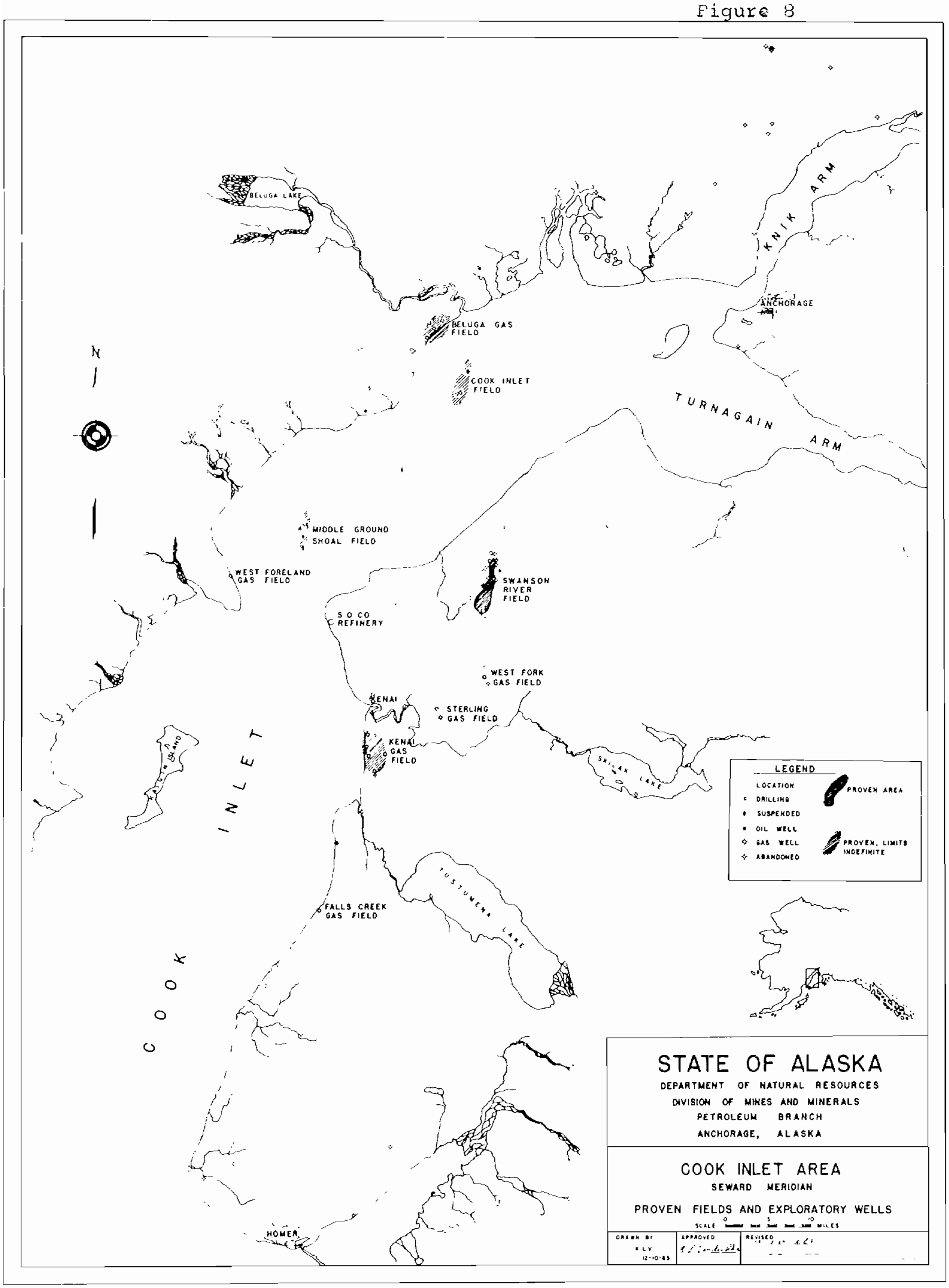
EXPLORATORY WELLS ACTIVE IN 1964
Includes Stepout Wells one mile or more from Production

State Permit	Company	Well Name	Well No.	Location ¼	Sec.	T.	R.	B&M	Date Spud	Date Comp.	Footage T.D.	Footage Drilled 1964	Status 12-31-64	Initial Production Bbls or MCF / Remarks
28-62	Pan Am	Cook Inlet St.	1-A	SW	6	11N	9W	S	8-27-62	7-8-64	12,676	119	GSI	4,700 MCF gas 554 B/D condensate 56°API
63-6	Pan Am	Tyonek State	2	NW	25	11N	12W	S	8-19-63	6-24-63	12,588	4,874	P&A	
63-18	Shell	N.Cook Inlet State	1	NW	29	12N	9W	S	10-12-63	9-13-63	14,850	13,346	OW-SI	2270 B/D 53°API 842 MCF/D gas
63-19	Pan Am	Romig Park	1	SE	9	12N	4W	S	10-20-63	3-12-64	11,566	2,556	P&A	
63-20	SOCAL	Beluga R.U.	14-19	SW	19	13N	9W	S	12-28-63	5-15-64	14,948	14,596	P&A	
63-21	Socony	Salmon Berry Lake	1	NW	24	6N	6W	CR	12-23-63	3-18-64	7,913	7,778	P&A	
63-22	Humble	Susitna State U.	1	SE	18	15N	4W	S	12-28-63	3-12-64	12,550	12,035	P&A	
63-23	Union-Tex.	Kahiltna R.St.	1	NW	33	23N	8W	S	1-18-64	3-11-64	7,265	7,265	P&A	
63-24	B.P.Expl.	East Umiat	1	NW	19	1S	2E	UP	1-13-64	3-28-64	3,347	3,347	GSI	3,500 MCF-80"/64 TP 684 psi - CP 684 psi
63-25	B.P.Expl.	Shale Wall U.	1	SE	2	5S	5E	UP	1-15-64	3-7-64	4,026	4,026	P&A	
64-2	Union Oil	Kasilof St.	1	SW	28	3N	12W	S	3-11-64	6-28-64	16,121	16,687	P&A	
64-3	Socony	Ninilchik U.	1	NW	24	1S	14W	S	3-22-64	5-22-64	12,724	12,724	P&A	
64-4	Sinclair	Schrader U.	1	SE	18	3S	5E	UP	3-18-64	5-24-64	5,129	5,129	P&A	
64-5	Sinclair	Little Twist U.	1	NE	34	3S	4W	UP	5-12-64	6-7-64	3,625	3,625	P&A	
64-6	Pan Am	MGS State	4	NW	31	9N	12W	S	6-24-64	10-13-64	9,215	9,215	OW-SI	957B/D - 37.6°API - ½" bean - TP 235 (test on 1 sand only)
64-7	Pan Am	MGS State	3	SE	19	9N	12W	S	6-15-64	11-4-64	11,179	11,179	Susp.	
64-8	B.P. Expl.	Kuparuk U.	1	SW	1	2S	5E	UP	5-1-64	11-24-64	6,570	6,570	P&A	
64-9	Union Oil	Kasilof St.	2	SW	28	3N	12W	S	7-1-64	8-5-64	6,686	6,686	P&A	
64-10	Pan Am	MGS State	6	NW	8	9N	12W	S	8-13-64	11-15-64	10,709	10,709	GSI	
64-11	Humble	Tyonek Reserve	1	NE	5	11N	11W	S	9-3-64		13,600	13,600	Fishing	
64-12	Pan Am	West Foreland U.	1	SE	3	8N	14W	S	11-12-64		4,700	4,700	Susp.	11-30-64 until spring.
64-13	B.P. Expl.	Kuparuk U.	1-A	SW	1	2S	5E	UP	11-26-64	12-12-64	758	758	P&A	
64-14	Union Oil	Kenai Unit	13-8	SW	8	5S	11W	S	11-22-64	12-8-64	5,506	5,506	P&A	
64-15	B.P. Expl.	Itkillik U.	1	SE	11	1N	6E	UP					Loc.	
												177,110		

Havenstrite Oil Co., IBA No. 1 and Iniskin Unit Beal No. 1 in Sections 8 and 17, T5S, R23W, SB&M were abandoned 7-31-64.

Legend: GSI-Gas Well Shut-in. GW-P - Gas Well, Producing. P&A - Plugged & Abandoned OW-SI - Oil Well, Shut-in.
Susp. - Suspended Loc. - Location.

Figure 8


BELUGA LAKE
KNIK ARM
ANCHORAGE
BELUGA GAS FIELD
COOK INLET FIELD
TURNAGAIN ARM
N
MIDDLE GROUND SHOAL FIELD
WEST FORELAND GAS FIELD
SWANSON RIVER FIELD
S O CO REFINERY
WEST FORK GAS FIELD
KENAI
STERLING GAS FIELD
KENAI GAS FIELD
SKILAK LAKE
COOK INLET
TUSTUMENA LAKE
FALLS CREEK GAS FIELD
HOMER
LEGEND
LOCATION
DRILLING
SUSPENDED
OIL WELL
GAS WELL
ABANDONED
PROVEN AREA
PROVEN, LIMITS INDEFINITE
STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINES AND MINERALS
PETROLEUM BRANCH
ANCHORAGE, ALASKA
COOK INLET AREA
SEWARD MERIDIAN
PROVEN FIELDS AND EXPLORATORY WELLS
SCALE 0 5 10 MILES
DRAWN BY
APPROVED
REVISED

General

Oil and Gas Conservation Committee Orders Issued:

During 1964 the following orders were issued:

Order #13 allowing Pan American Petroleum Corporation an exception to spacing regulations for its Middle Ground Shoal #6 well in order to locate the offshore drilling equipment in workable water depths.

Order #14 allowing Humble Oil & Refining Company an exception to spacing regulations for its Tyonek Indian Reserve #1 well in order to eliminate a costly location problem due to thick muskegs.

Conservation Hearings Held:

Under the provisions of the Administrative Procedures Act, a hearing was held on the accusation filed by Shell Oil Company protesting the granting of a 5% royalty award by the State to Pan American Petroleum Corporation on the Middle Ground Shoal structure. As an exploration incentive, the State reduces its usual 12½% royalty to 5% on the first lease on the geologic structure in which is found commercial quantities of oil or gas. Only one award is made per structure. A 10-day hearing was held on this protest commencing August 4, but the final recommendations of the hearing officer are not expected until early in 1965. At the time the State awarded the 5% discovery royalty to Pan American Petroleum Corporation no regulations existed to clarify the generalized statements regarding the basis for the award as found in the basic statute.

Final certification was granted on the Cook Inlet structure lying in the waters of Cook Inlet about 20 miles north of Middle Ground Shoal. On November 23 the State certified the discovery lease as qualifying for the reduced royalty. Pan American Petroleum Corporation operates this lease for itself, Skelly Oil Company, Phillips Petroleum, and Sinclair Oil & Gas Company. Both the Cook Inlet #1, which blew wild for 14 months, and the Cook Inlet #1-A, which was used as a relief well to control the wild well, are within the lease. Cook Inlet #1-A was subsequently completed as a shut-in well capable of commercial production.

State of Alaska Lease Sales:

Competitive Sale #13: On December 9, 1964, a total of 736,328 acres were leased for total bonus bids of $5,619,967.57, an average of $7.63 per acre. This included 474,097 acres on the Arctic Slope for $4,387,977.51, 149,089 acres in Cook Inlet for $1,055,868.09, and 113,142 acres near Kodiak for $171,121.97.

General (Contd)

Unit Agreements for which the Petroleum Branch approved technical data during 1964.

Little Twist Unit - 27,986 acres. Sinclair Oil & Gas Company, Operator.
Slide Mountain Unit - 70,028.40 acres. Aledo Oil Company, Operator.
Kahiltna River Unit - 65,600 acres. Pure Oil Company, Operator.
Schrader Unit - 109,475 acres. Sinclair Oil & Gas Company, Operator.
Susitna State Unit - 12,664 acres. Humble Oil & Refining Company, Operator.
East Umiat Unit - 64,290 acres. B.P. Exploration Co. (Alaska) Inc., Operator.
Kuparuk Unit - 50,770 acres. B.P. Exploration Co. (Alaska), Inc., Operator.

Pursuant to Section 2008.1 of the Alaska Oil and Gas Conservation Regulations, well records for the following wells drilled in Alaska were released to the public during 1964 through local scouting services and reproduction firms in Anchorage.

Well Name and Number	Operator
Swanson River Unit 41-28	Standard Oil Company of California
Anchor River No. 1	Standard Oil Company of California
Soldotna Creek Unit 21-3	Standard Oil Company of California
Bering River Unit No. 2	Richfield Oil Corporation
Swanson River Unit 21-22	Standard Oil Company of California
Soldotna Creek Unit 34-8	Standard Oil Company of California
Stedatna Creek State No. 1	Pan American Petroleum Corporation
Soldotna Creek Unit 243-8	Standard Oil Company of California
Chaix Hills Unit No. 1-A	Standard Oil Company of California
Nenana No. 1	Union Oil Company of California
Soldotna Creek Unit 32-5	Standard Oil Company of California
Swanson River Unit 34-16	Standard Oil Company of California
West Foreland No. 1	Pan American Petroleum Corporation
Swanson River Unit 211-15	Standard Oil Company of California
Swanson River Unit 222-21	Standard Oil Company of California
West Fork 233-16	Standard Oil Company of California
Swanson River Unit 221-33	Standard Oil Company of California
Chuit State No. 1	Superior Oil Company
Pittman No. 1	Union Oil Company of California
Malaspina Unit No. 1	Colorado Oil and Gas Corporation
Bell Island Unit No. 1	British American Oil Prod. Company
Swanson River Unit 14-33	Standard Oil Company of California
Sterling Unit 43-28	Union Oil Company of California
Middle Ground Shoal State No. 1	Pan American Petroleum Corporation
Swanson River Unit 12-22	Standard Oil Company of California
Cook Inlet State No. 1	Pan American Petroleum Corporation
Riou Bay No. 1	Standard Oil Company of California
Chuit State No. 2	Superior Oil Company
S-R-S State No. 1	Shell Oil Company
Soldotna Creek Unit 22-32	Standard Oil Company of California
Swanson River Unit 41-15	Standard Oil Company of California
Malaspina Unit No. 1-A	Colorado Oil and Gas Corporation
South Diamond Gulch Unit No. 1	Occidental Petroleum Corporation
White River Unit No. 2	Richfield Oil Corporation
Tazlina Unit No. 1	Union Oil Company of California

Well Records to be Released During 1965 and their release dates

Well Name and Number	Operator	Date
Ninilchik No. 1	Union Oil Co. of Calif.	1 -1 -65
Anchor Point Unit No. 1	Standard Oil Co. of Calif.	1 -9 -65
Swanson River Unit No. 41A-15	Standard Oil Co. of Calif.	1 -9 -65
Beluga River Unit 212-35	Standard Oil Co. of Calif.	1 -18-65
Beluga River Unit 212-25	Standard Oil Co. of Calif.	1 -28-65
Swanson River Unit 14-22	Standard Oil Co. of Calif.	3 -2 -65
Beluga River Unit 232-4	Standard Oil Co. of Calif.	3 -2 -65
Tyonek State No. 1	Pan American Petroleum Corp.	3 -4 -65
Soldotna Creek Unit 21-8	Standard Oil Co. of Calif.	3 -5 -65
Swan Lake Unit No. 2	Sinclair Oil & Gas Company	3 -22-65
Wasilla State No. 1	B.P. Exploration Company	3 -25-65
Fritz Creek No. 1	Halbouty Alaska Oil Company	4 -3 -65
Swanson River Unit 21-34	Standard Oil Co. of Calif.	4 -25-65
Beluga River Unit 233-27	Standard Oil Co. of Calif.	4 -25-65
Soldotna Creek Unit 43-9	Standard Oil Co. of Calif.	5 -4 -65
Swanson River Unit 14-9	Standard Oil Co. of Calif.	5 -22-65
Soldotna Creek Unit 22A-32	Standard Oil Co. of Calif.	5 -22-65
Eureka No. 2	Aledo Oil Company	6 -6 -65
Swanson River Unit 34-28	Standard Oil Co. of Calif.	6 -16-65
Swanson River Unit 14-15 (Remedial)	Standard Oil Co. of Calif.	6 -31-65
Kenai Unit 43-9	Union Oil Co. of Calif.	8 -5 -65
Soldotna Creek Unit 21-16	Standard Oil Co. of Calif.	8 -8 -65
White River Unit no. 3	B.P. Exploration Company	8 -10-65
Moose Creek No. 1	Pan American Petroleum Corp.	8 -18-65
Knik Arm State No. 1	Union Oil Co. of Calif.	9 -31-65
Middle Ground Shoal State No. 1	Shell Oil Company (S-R-S)	10-24-65
Wide Bay No. 1	Richfield Oil Corporation	11-17-65
Soldotna Creek Unit 23-3	Standard Oil Co. of Calif.	12-12-65
Gubik No. 1	Colorado Oil & Gas Company	12-12-65
Middle Ground Shoal State No. 2	Pan American Petroleum Corp.	12-16-65

Table X

<u>Summary of Statistics</u>

Years 1959 - 1964

	1959	1960	1961	1962	1963	1964
Drilling Permits Approved	16	30	55	38	25	15
Exploratory Wells Spudded	8	10	25	31	16	16
Development Wells Spudded	8	16	29	10	9	2
Wells Completed (Oil)	3	13	27	7	8	2
Wells Completed (Gas)	3	3	5	5	4	5
Wells Abandoned	4	9	19	21	15	15
Footage Drilled, Exploratory	75,705	93,749	197,499	290,976	135,248	177,110
Footage Drilled, Development	62,197	166,592	302,989	78,619	80,337	7,499
Total Footage Drilled	137,902	260,341	500,488	369,595	215,585	184,609
Average No.Active Rotary Rigs	5	7	9	10	7	6
Average Daily Oil Production	510	1,529	17,333	28,107	29,424	30,285
State Oil & Gas lease acreage in effect at year's end		117,203	501,065	1,370,652	1,590,392	1,727,972
Federal Oil & Gas lease acreage in effect at year's end		33,287,120	26,807,695	19,035,381	14,035,381	11,589,149
Federal payment of Oil & Gas lease rentals						$5,529,110.46
Federal payment of Oil & Gas lease royalty						$3,374,603.35
State Oil & Gas lease bonus						$5,511,769.05
State Oil & Gas lease rental						$1,250,536.00
State Oil & Gas lease royalty						$ 76,310.00
					Total--	$15,742,328.86
State Oil & Gas lease acreage issued (does not include transferred Federal leases but does include 13th Competitive Sale.)			Competitive		235,197	739,663
			Noncompetitive		143,353	116,970
			Total-	662,852	378,550	856,633
Federal Oil & Gas leases transferred to State					86,127	6,413
Federal Oil & Gas lease acreage issued				683,246	996,616	2,609,714

Table X

Summary of Statistics

(continued)

Years 1959 - 1964

	1959	1960	1961	1962	1963	1964
Geologic Field Party Months	129	57.5	57.6	43	47	22
Seismic Crew Months	92.0	40.0	73.4	86.23	113	98
Gravity Crew Months	7.5	4.9	14.5	9.5	10	12
Magnetometer Crew Months						2

Estimated Industry Expenditures

	1959	1960	1961	1962	1963	1964
Exploration (includes geological & geophysical work, exploration drilling and administrative expense. Does not include money spent for oil & gas leases acquired by individuals & out of State companies.)					$54,030,000	$61,000,000
Development drilling costs					$ 4,635,000	$ 696,350
Production costs (including secondary recovery)					$ 1,594,000	$ 1,758,000
Refinery construction & maintenance					$ 5,600,000	$ 2,200,000
Total industry expenditures exclusive of marketing & sales activity	$30,654,000	$37,805,000	$42,405,000	$65,500,000	$65,859,000	$65,654,350
Full time year around employees of oil industry, excluding marketing				613	655	671
Cumulative mileage low grade roads & seismic trails built by oil industry				885	1,185	2,245
Cumulative mileage heavy duty roads built by oil industry				331	370	374
Total Crude throughput-Alaskan Refinery, barrels					2,600,000	5,993,600

EMPLOYMENT AND ACCIDENTS

	No. of Mines (1)		No. of men Employed (1)		Number of Accidents			
					1963		1964	
	1963	1964	1963	1964	Fatal	Nonfatal	Fatal	Nonfatal
Placer Mines								
Dredges	14	10	199	136		14		8
Nonfloat	48	36	146	110		2		7
Hydraulic	10	10	19	20				
Coal Mines								
Underground								
Strip	3	3	190	190		24		24
Lode Mines								
Metal (2)	4	6	43	30		4		8
Nonmetal (3)	6	6	12	12		2		
Petroleum								
Production & Exploration			737	755	1	101		95
Exploration								
Metals	75	70	227	200				
Totals	160	141	1573	1453	1	147		142

(1) Estimated
(2) Lode mines include lode, prospector and intermittent underground operation and exploration projects, excluding sand, gravel and stone operations
(3) Includes jade, limestone and peat

NOTE: The above data is compiled from information collected by the Division of Mines and Minerals, the U. S. Bureau of Mines, and the Employment Security Division and Safety Division of the Alaska Department of Labor. Many of the small mining operations are part time, and others accomplish little more than assessment work. This Division reports most of these small operators, whereas some of the other agencies do not because these individuals and partnerships do not employ help. Estimated average monthly insured employment in the Alaska Mining Industry for 1964 is 1137 compared to 1204 in 1963 according to data compiled by the R&A Section, Employment Security Division, Alaska Department of Labor.

REPORTS

Geologic Field Work

A summary of 1964 field work accomplished by the mining geologists and mining engineers of the Division is presented to indicate the type of work being done as well as the results of the work in the various areas. Detailed reports and maps on the various areas will be published before the 1965 field season begins. Notice will be given in the monthly Mines and Petroleum Bulletin as the reports become available. The map on Page 52 shows the approximate location of the various projects by corresponding numbers.

(1) BEAR CREEK, Seward Peninsula

G. Herreid, Mining Geologist
50 square miles mapped
August 1 - August 30, 1964

Gold, Lead, Zinc

The Bear Creek district provides the best exposures along the north-trending belt of igneous rocks which marks the boundary between the Seward Peninsula block and the Kuskokwim geosyncline. Bedrock in the map area is mainly greenstone, capped by Tertiary basalt east of Bear Creek. The syenite stock southwest of Bear Creek was also investigated.

Bear Creek appears to follow a major north-trending fault. Trachyte and syenite dikes are present along Bear Creek and apparently decrease in frequency away from it. A biotite-rich syenite near the Bear Creek airstrip is closely associated with small amounts of galena, sphalerite, pyrite, and gold. Moderately anomalous quantities of lead, copper and zinc found in the soil for 400 feet along the placer ditch west of the airstrip may be a western extension of this zone. The anomalous area is 1/4 mile west of the Bear Creek showings. No deposits approaching ore grade and size were seen in the map area.

Stream sediment samples were taken throughout the map area.

(2) BLUFF, Seward Peninsula

G. Herreid, Mining Geologist
17 Square miles mapped, 55 geochemical samples
June 18 - July 7, 1964

Gold, Mercury

This easily accessible area with considerable past placer gold production and known lode gold possibilities was investigated with the aim of evaluating the lode gold potential. Bedrock in the area is marble, overlain by schist. Known gold mineralization appears restricted to the schist near the marble contact.

Gold lodes occur in a tongue of schist about 6 miles long by 1/8 mile wide which is infolded with a great recumbent fold of marble which plunges gently northward. The productive placers in the area lie along the same structure. Preliminary data indicate that areas of schist up to several hundred feet wide carry $1 to $2 in gold and 0.1% arsenic. Prospecting of the gold deposits is hampered by almost complete cover of the schist by schist debris and tundra. Geochemical soil sampling for arsenic will probably provide a means of roughly evaluating the gold potential of the schist in covered areas.

The structural features of interest in the area are a strong parallelism of minor fold axes throughout the area and the presence of a single large recumbent fold of marble that protrudes above the relatively flat marble-schist contact. There is a striking similarity with the structure at Omilak.

(3) OMILAK, Seward Peninsula

G. Herreid, Mining Geologist
50 square miles mapped, 120 geochemical samples
July 8 - July 31, 1964

Lead, Silver, Tin

The geology and stream sediment geochemistry were mapped in an area known to contain lead and silver in lodes and placer tin. The map area is underlain by marble and schist except along the eastern border where greenstone and granite are present. The lead-silver deposits were found to be controlled by gently north-plunging folds subsidiary to the major Omilak anticline. These deposits occur in marble 6 to 7 miles west of the Darby granite. Placer tin is known approximately 2 miles west of the granite. A zonation of mineral deposits in which tin exists near the granite and lead-silver farther away appears to be present. The Darby granite is elongated north-south parallel to the folding along its west flank in the map area and in the region south of the map area. There is a better than average possibility that the region south of the map area contains additional lead-silver-tin deposits.

Geochemical analyses indicate that strong lead anomalies are present in the stream sediments below the known lead deposits. Any interesting lead deposit which crops out should produce an anomaly in the stream sediments.

Fold axes throughout the map area are nearly parallel to one another. This structural homogeneity is similar to that found at Bluff. Plunging folds appear to have controlled the deposition of ore in both areas.

(4) RICHARDSON AREA, Delta River District

R. Saunders & W. Burand, Mining Engineers
25 square miles of stream sediment sampling
August 10 - August 20, 1964

Copper, Lead, Zinc, Molybdenum

Seventy-three geochemical samples of stream sediments were tested in the field and later sent to the Division's assay offices for analysis. Duplicate samples were also sent to a commercial laboratory. Background values for copper,lead, zinc and molybdenum were lower than found in other areas investigated. Sampling indicated a northwest trending mineralized zone. A complete detailed report and geochemical map will be published prior to the 1965 field season.

(5) RAINY CREEK, Delta River District

Arthur Rose, Mining Geologist
51 square miles covered by mapping and stream sediment sampling
July 7-27, August 3-14, September 7-11, 1964

Copper, Nickel, Gold, Asbestos

This area is in the central Alaska Range just west of the Delta River and Richardson Highway. Most of the drainage of Rainy Creek and Broxson Gulch was mapped, plus small areas near copper-nickel shows at Rainbow Mountain and on the west side of the Delta River opposite Rainbow Mountain. The rocks present in the area include schist and gneiss; pre-Mississippian(?) slate, greenstone and diorite; Pennsylvanian (?) silicic volcanics, andesitic volcanics and limestones; Permian (?) limestone and black shale; Triassic(?) basic volcanics; ultramafic and gabbroic intrusives, some of which are altered to amphibole "serpentinites"; and Tertiary sediments. The schist and gneiss are thrust-faulted over the other rocks on the north side of the area. Several large normal faults strike approximately east-west and cut the younger rocks into several fault blocks.

Copper and nickel mineralization is associated with the ultramafic and gabbroic rocks. The copper-nickel prospect at Rainbow Mountain consists of small massive sulfide lenses in peridotite, and disseminated sulfides in a small body of basic gabbro. In the Rainy Creek area, small bodies of massive sulfide mineralization occur in skarn zones associated with the ultramafic and gabbroic rocks, and disseminated copper sulfides occur in several small bodies of gabbro. None of the copper-nickel showings so far known appear to be of ore grade and tonnage, but at least seven groups of stream sediment samples are weakly to moderately anomalous in copper (200-400ppm) and need more follow-up work. The ultramafic rocks are known to extend eastward from the area mapped, and also appear to extend farther west. Further mapping of this zone is planned for 1965.

(6) PAXSON, Chistochina District

A. Rose, Mining Geologist and R. Saunders, Mining Engineer
75 square miles of geological mapping and 150 square miles of stream sediment sampling
June 2 - August 14, 1964

Copper

Reconnaissance geologic mapping covered an area near the Richardson Highway from Mile 165 to Mile 195, with more detailed mapping west of Paxson where small copper showings are known. In the southern part of the area, greenstone schist and associated metasedimentary rocks have been intruded by a variety of mafic-rich diorites. The metamorphic rocks have east-west trends west of the Richardson Highway, but curve southward near the Highway. Several quartz diorite intrusives cut the metamorphic rocks and the diorite. No mineral showings of interest were found in this part of the area.

Near Paxson, a thick unit of shallowly-dipping basic volcanic flows is exposed. This unit may correlate with the Nikolai greenstone. About 10 miles west of Paxson, the volcanics are intruded by diorite. Ten copper showings were located in the volcanics near Paxson but none are very large. They consist of chalcopyrite, bornite and chalcocite with quartz, chlorite and epidote in vesicular zones, irregular pods and veinlets. The best showing, which has been known for several years, is near Mile 7 of the Denali Highway. The showings are most common in a northwest-trending zone a mile or two wide passing approximately through Paxson. The zone may be controlled by structure or by a unit of relatively thin vesicular flows in the volcanics. A detailed geochemical map will be published.

(7) AHTELL CREEK AREA, Slana District

D. Richter, Mining Geologist
80 square miles mapped
June 23 - August 27, 1964

Copper, Lead, Zinc, Molybdenum, Silver

Approximately 110 square miles of relatively detailed mapping (scale: 1"=1/2 mile) has been completed in the Slana district of southcentral Alaska during the past two field seasons. Concurrent with the field mapping, more than 400 stream sediment samples have been collected and analyzed for heavy metal content. During the 1963 field season a small silver-lead deposit and strong geochemical anomaly were discovered. Upon release of this information to the public in January 1964, the deposit was staked and is currently being explored. A preliminary geologic report based on the 1963 field work on the Ahtell Creek area in the Slana district was published in May 1964.

The dominant geologic feature in the Slana district is a large, zoned quartz monzonite stock which is informally referred to as the Ahtell Creek pluton. The pluton trends northerly in an irregular manner from the northern limit of pre-Tertiary rock exposure through the entire mapped area. Contact relationships with the interbedded volcanic-sedimentary country rock assemblage indicates that the pluton was emplaced relatively passively. The pluton consists of a core of coarse-grained porphyritic quartz monzonite, an intermediate zone of medium to coarse-grained equigranular quartz monzonite and a very irregular border zone of fine-grained quartz monzonite, orthoclase-rich rock, silica-carbonate rock, and masses of unassimilated but highly altered country rock. Biotite is the principal mafic mineral in the core of the pluton, whereas hornblende is dominant in the intermediate and border zones.

The edge of a large stock of diorite-quartz diorite trending northwesterly parallel to the Alaska Range is exposed in the northeast corner of the map area. The rock is very heterogeneous, ranging from dark fine-grained biotite diorite to light, coarse-grained hornblende-biotite quartz diorite. The effects of autobrecciation and autointrusion are generally conspicuous. Smaller stocks and plugs of diorite, and dikes of hornblende granodiorite-diorite porphyry, that appear to be genetically related to the larger diorite mass, occur throughout the area.

In the southeast corner of the area a differentiated basic sill, probably less than 100 feet thick, is exposed intermittently over a length of approximately one mile. The sill has a gabbro core and a coarse-grained peridotite-pyroxenite base. Small dikes of mica peridotite (kimberlite) are present within the sill and nearby bedded country rock.

Hydrothermal alteration has affected much of the rock in the area and sulfide-bearing quartz-carbonate veins are relatively common. The principal altered areas and vein deposits occur within or in close proximity to the border zone of the quartz monzonite pluton. In the altered areas the rocks have been largely replaced by quartz, carbonate, pyrite, and sericite and locally may contain minor amounts of chalcopyrite. The quartz-carbonate veins generally carry varying amounts of pyrite, chalcopyrite, galena, sphalerite and tetrahedrite. Both the alteration and vein-type mineralization are apparently genetically related to the quartz monzonite pluton. Irregular areas or zones of disseminated chalcopyrite are present in the larger diorite intrusive, especially along its contact with the bedded country rock.

A number of stream sediment geochemical anomalies were detected during the 1964 field season, with metal concentrations as high as 1000 ppm Cu, +1000 ppm Zn, 500 ppm Pb, and 25 ppm Mo. Most of these are on streams draining the border zone of the Ahtell Creek pluton and the contact of the diorite-quartz diorite intrusive; none were found in streams draining only the core or intermediate zone of the Ahtell Creek pluton and only a few weak anomalies were detected on streams draining bedded country rock.

Many of the anomalies are related to known altered areas in the Ahtell Creek pluton border zone and mineralized zones in the diorite-quartz diorite intrusive, however, some have no ready explanation.

In general, the favorable igneous geology and s ructure, and widespread alteration and mineralization lead to an optimistic economic appraisal for the Slana district. A geochemical map of the district will be published in the spring of 1965 and continued detailed investigations are planned for the 1965 field season.

(8) ROCK CREEK AREA, Mentasta Mountains

D. Richter, Mining Geologist
16 square miles mapped
August 29 - 31, 1964

Molybdenum

A reconnaissance survey of the Rock Creek molybdenum prospect and surrounding area was made at the end of the 1964 field season. Of principal interest in the area is a belt of very heterogeneous diorite, approximately 2 miles wide, that trends in the general direction of the dioritic rocks in the Slana district, 20 miles to the northwest. The rocks range from dark pyroxenites to light-colored feldspar-rich diorites and are both foliated and massive. A zone of gneissic monzonite and syenite up to 2,000 feet wide, occurs along the south contact of the diorite. Simple quartz-orthoclase pegmatites and quartz veins, which occasionally contain minor sulfides, are relatively common in the gneissic rocks. To the north, the diorite is in contact with relatively flat-lying shale and massive limestone. The zone of gneissic rocks may possibly represent the western continuation of the Cooper Pass fault, a major structural feature in south central Alaska.

Molybdenite and minor chalcopyrite occur in one of the small pegmatites in the monzonite-syenite gneiss zone near the head of Rock Creek. Although the deposit itself is not of particular economic importance, the general geology of the area is favorable, and because of its similarity to that of the Slana district, warrants additional reconnaissance study.

(9) TALKEETNA MOUNTAINS, Willow Creek District

M. Jasper, Mining Engineer
Stream sediment sampling
June 15 - August 30, 1964

Copper, Zircon, Molybdenum

One stream bed at Sheep Mountain on the Glenn Highway yielded a sample high in copper content. Two other nearby streams carried interesting concentrates of sulfides and zircon, thereby suggesting that further work is warranted in spite of the apparent scarcity of trace element indications. Along the Susitna Highway (State Highway No 3), only an anomalous zinc sample was found, but panned concentrates showed abundant zircon in several streams.

In the Willow Creek District, anomalous copper was found in sediments of three tributaries to Craigie Creek, and anomalous zinc and molybdenum in two Craigie Creek tributaries, in Grubstake Gulch, and in an upper Willow Creek tributary. On the Little Susitna side of the district, anomalous copper and molybdenum were found in the Reed Creek sediment below Glacier Creek.

While no outstanding anomalous area was found in these three areas or districts, a number of the individual anomalies indicate possibilities that should be investigated further. The forthcoming report and map will be of assistance.

(10) EKLUTNA

Arthur Rose, Mining Geologist
1 square mile mapped
June 2-3, 1964

Chromite

Small amounts of chromite have been known for many years near Eklutna between Anchorage and Palmer. The chromite occurs in dunite portions of a large layered ultramafic intrusive composed largely of pyroxenite. From mapping done to date, the dunite and associated chromite appears to occur near the margins of the body. The ultramafic intrusive probably occurs in the same structural zone as the chromite-bearing bodies on the Kenai Peninsula. Further mapping and investigation of the Eklutna area is planned for 1965.

(11) NELLIE JUAN, Prince William Sound

G. Herreid, Mining Geologist
12 square miles mapped
September 10 - September 17, 1964

Gold

A strip of about 1 x 12 miles was mapped along the east side of Nellie Juan River from Lake Nellie Juan northeast toward Port Nellie Juan. The bedrock is graywacke and slate. Quartz veins are sporadic throughout the area, but little evidence of mineralization was seen. Geochemical stream sediment samples were taken.

(12) BAY OF ISLES-DRIER BAY AREA, Knight Island, Prince William Sound

D. Richter, Mining Geologist
25 square miles mapped
May 27 - June 17, 1964

Copper

Field mapping at a scale of 1"=1/2 mile of a 4 to 5 mile wide band, approximately 10 miles long, trending northeast across central Knight Island was completed during the 1964 field season. This work, begun in 1963, has been directed primarily toward a better understanding of the genesis and control of the many small massive sulfide deposits which occur throughout the area, and if possible, to use this knowledge in fostering mineral exploration on Knight Island and other areas where the geologic environment is similar.

Knight Island is underlain chiefly by a wide and somewhat anomalous band of greenstone lava flows within the thick clastic sedimentary assemblage of the Chugach Mountain geosyncline. The rocks are isoclinally folded and have been subject to low grade regional metamorphism. Prior to this study no detailed geologic information was available for the area, and the relationship of the Knight Island greenstones to the sedimentary rocks of the geosyncline exposed elsewhere in the Sound was in doubt. Based on our 1963-64 field work, a much clearer picture now emerges of the structure and stratigraphy of Knight Island. From west to east across the island, the rocks consist of interbedded slate and pillow greenstone, pillow greenstone, massive semi-schistose greenstone, and interbedded slate and pillow greenstone. Except at the nose of folds, bedding, cleavage, and schistosity are all virtually parallel and generally trend N to N30E with vertical to steep dips. Minor structures indicate the presence of a large anticline or anticlinorium with its principal axis roughly following the belt of massive greenstone down the center of the island. Hence the slate-pillow greenstone units on the east and west sides of the island are apparently the same and overlie an unknown thickness of older massive volcanics.

A number of shear zones or zones of strong schistosity are present in the massive and pillow greenstone. These zones, trending parallel to the major fold axes, are upwards of 1000 feet wide and have been traced as far north as the Bay of Isles. None have been recognized in the slate-pillow greenstone units as evidently all deformational stress has been relieved by movement along the thin slate bands. A major fault zone may underlie the Bay of Isles and the West Arm extension of the Bay of Isles. From West Arm this possible fault evidently follows a curvilinear path to the southwest across the island where it may join with the westernmost of the major shear zones. Neither the shear zones in the massive greenstone nor the eastern slate-pillow greenstone unit continue north of the fault. The projected area of these structures and rocks on the north shore of the Bay of Isles is occupied by massive greenstone similar to the rocks in the core of the anticline, indicating minimum right lateral movement of 2 to 4 miles.

Discontinuous pods, lenses, and irregular bodies of massive sulfides (pyrrhotite, chalcopyrite, and cubanite) are found throughout the area but are principally concentrated in the major shear zones. The sulfides were apparently deposited within the shear zones, where (1) subtle changes in the direction of shearing, (2) abrupt warping of schistosity around competent rock masses, and (3) rotation of competent rock masses, could produce local areas of reduced pressure. The source of the metal elements and sulfur is believed to be the greenstone country rock rather than hypothetical underlying igneous intrusive body. A trace element study of the Knight Island rocks which is presently underway may help to answer some of the questions in regards to the origin of these deposits.

With the possible exception of the massive sulfide body at Rua Cove, none of the known deposits, nor the few small deposits discovered during the course of the present investigations appear to be economically interesting. Moreover, geochemical studies during the 1964 season failed to reveal any anomalous metal concentration in 32 streams that drain the west side of the island.

No further field work is planned for Knight Island. A detailed geologic report and map will be published in 1965.

(13) MIDAS MINE-SULFIDE GULCH

Arthur Rose, Mining Geologist & Robert Saunders, Mining Engineer
9 square miles of geological mapping and 60 square miles of stream sediment coverage
August 17 - September 3, 1964

Copper

This area is located a few miles south of Valdez. An east-west belt of greenstone lies in a thick sequence of weakly to moderately foliated slate and graywacke. Occurrences of copper mineralization are found along the greenstone belt and at the Midas Mine.

Ore at the Midas Mine occurs in veins containing quartz, pyrite, pyrrhotite, chalcopyrite, and sphalerite. The veins follow a shear zone sub-parallel to the foliation, and are located adjacent to a plug of meta-diabase that appears related to the nearby greenstone belt. A limited number of assays from the Midas vein suggest grades of 3 to 3.5% Cu and up to 7% Zn with low to moderate gold and variable silver values. The vein is up to 4 feet wide on the one accessible level, but wider portions are reported. Further sampling of the workings and a soil geochemical study to discover additional veins in the vicinity are suggested.

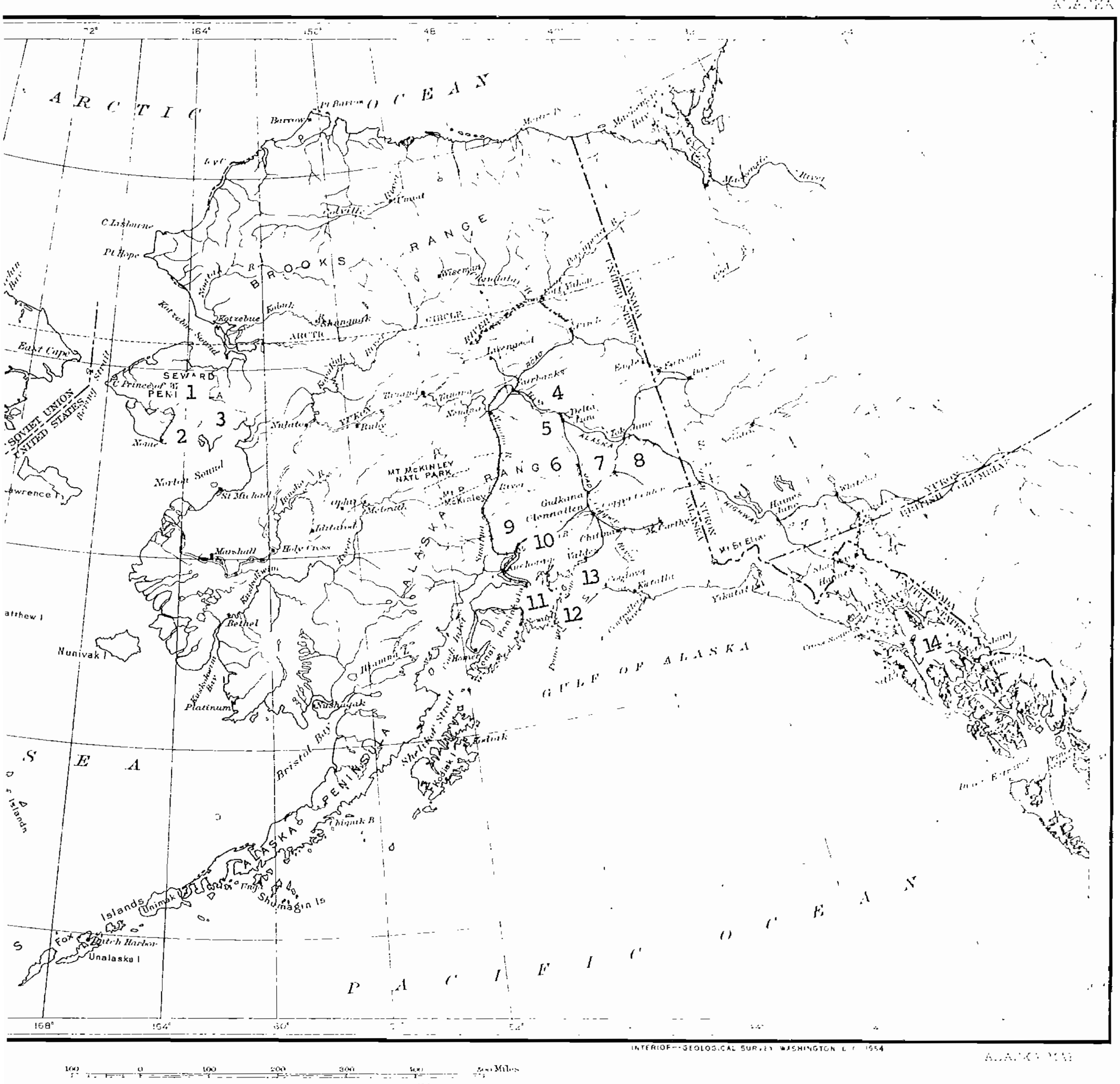
The greenstone belt south of the Midas Mine extends from Jack Bay at least 15 miles eastward to the Sulfide Gulch drainage, and may extend eastward to the Copper River, based on aerial observations. Copper shows along the belt consist of chalcopyrite with pyrite and pyrrhotite occurring as small veinlets in the greenstone sills and as lenses and veinlets in the adjacent metasediments. The largest observed copper showings have dimensions of a few feet, although iron sulfides are much more extensive. One strong stream sediment copper anomaly and several weaker anomalies were obtained from streams draining the greenstone belt. The zone in and adjacent to the greenstone appears to be the most favorable part of the area for further prospecting.

(14) SOUTHEASTERN

Division of Mines and Minerals Geochemical Report #1, Geochemical Investigations of Selected Areas in Southeastern Alaska, 1964, by C.F. Herbert and W.H. Race, describes the results of geochemical sampling of stream sediments and indicates bedrock where observed in each area. The areas include:

Skagway: Samples were taken from the area near the old molybdenum prospect at Clifton and the lower portion of the Taiya Valley.
Lynn Canal: Samples were taken on the mainland west of Sullivan Island at William Henry Bay and Berners Bay.
Taku River: A few samples were taken near the Canadian border.
Gambier Bay: Samples were taken over a large area including an old copper prospect.
Stikine River: A few samples were taken near the Canadian border.
Ratz Harbor: Samples were taken adjacent to the logging roads back of Ratz Harbor.
Hollis: Samples were taken adjacent to logging roads in the Maybeso and Harris Valleys.
Kina Cove: Streams adjacent to logging roads were sampled.
Twelvemile Arm: Most of the watershed of Twelvemile Creek was sampled.

Several areas contain anomalous amounts of copper, lead, zinc, or molybdenum and warrant further prospecting.



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Mining Costs in Southeastern Alaska

By C.F. Herbert

Southeastern Alaska's nearest neighbor, the Province of British Columbia, produces about a quarter billion dollars annually from its mines, but today there is not a single operating mine in Southeastern Alaska. This great disparity is most frequently attributed to lower costs and more favorable tax structures in British Columbia. Unfortunately, this opinion is rarely based on actual comparisons of cost or analyses of taxes.

Lack of mining operations in Southeastern Alaska prevents a direct comparison of mining costs, but an indirect comparison can be made. This is done by using or adapting typical, published mining costs in Interior British Columbia and applying these to a hypothetical mine in Southeastern Alaska, using cost factors from analogous industries or activities.

Although this article is limited to Southeastern Alaska, most of the information is directly applicable to the larger area in Southcentral Alaska bordering on the Gulf of Alaska, Prince William Sound and Cook Inlet. With allowance for increased freight rates, the comparison may also be helpful in areas with rail or road connection to Gulf ports and, after adjustment for shorter shipping season and higher ocean freight, to Bering Sea areas.

Various cost factors are discussed and observations on tax laws are made.

Labor

Southeastern Alaska undoubtedly has higher labor costs. Comparisons of average weekly earnings were made late in the summer of 1964. These show:

Industry	Ratio Alaska/B.C.	Ratio Alaska/Washington
Metal Mining	1.34	1.18
Oil and Gas (Alaska/Alberta)	1.28	none
Pulp and Paper	1.53	1.38

Payroll taxes and workmen's compensation are higher in Alaska than in British Columbia. Because of this and since the Alaskan metal mine earnings are strongly influenced by a single gold mining company in Interior Alaska, it is assumed that all labor costs in Southeastern Alaska will be about 1.5 times those in British Columbia.

Supplies

As noted above, payroll taxes in British Columbia are less than in Alaska. However, the true cost of social benefits in Canada is higher than in the United States because both Canadian Federal and Provincial sales taxes are, in part, reserved for such benefits. Besides higher Canadian duties on imported items, there are sales taxes of 11% at the Federal level and 6% at the Provincial level (British Columbia). Thus, in spite of freight costs to Southeastern Alaska, the cost of mine supplies in that area is about 0.9 times the cost in British Columbia.

Power

Power costs vary greatly from place to place in British Columbia, and there are areas where such costs exceed those in Southeastern Alaska. However, the power network in B. C. furnishes low cost, or moderately low cost, power to many mining sections of the province.

In Southeastern Alaska the Snettisham project will be operational in a few years, power from a Canadian development on the Iskut River is expected, and the low-power-cost Taiya project near Skagway is being re-evaluated as a possible joint U. S. - Canada project. In addition, there are numerous small water-power sites, and easy access to deep sea ports makes it possible to obtain low cost residual fuel oil or coal from Cook Inlet. Low interest rates on loans for power development are usually available if there is reasonable proof of sustained demand.

For the purpose of comparison, it is assumed that Southeastern Alaska mine power costs for some time will be about 1.5 times the power costs usually obtainable in Interior British Columbia.

Water Supply

Water supply varies sharply, but for the most part, Southeastern Alaska has abundant water that can be developed at low or moderate cost, and the quantity will usually be sufficient to obviate the need for reclamation. Restrictions on pollution are much the same in British Columbia and in Alaska.

Administrative Expense

High quality management and engineering services are much more readily obtainable in British Columbia than in Southeastern Alaska. In fact there is a growing movement of mine managers and engineers from Canada into the U. S., and more U. S. companies are employing Canadian consultants than formerly. Higher administrative and staff salaries will be required in Southeastern Alaska. It is estimated that the total of all administrative costs will be 1.3 times those in British Columbia.

Equipment

Because of duties and sales taxes, heavy duty earth moving equipment such as is used in open cut mines costs considerably more in Canada than in the U. S. We note that the Vancouver, B. C. cost for

large tractors (duty free) is 20% higher than in Seattle;
diesel shovels cost 45% more; and
35-ton trucks cost 41% more.

Lesser equipment such as small trucks, welders, shop equipment, etc., costs about 20% more.

In spite of additional freight costs to Southeastern Alaska it appears that equipment costs in Southeastern Alaska will be about 0.8 times those in Interior British Columbia.

Transportation

Within the last fifteen years British Columbia has greatly improved and extended its highway system and rail and port facilities. The lowered transportation costs afforded by these improvements have made an important contribution to the current mining boom. Rail-barge facilities at Prince Rupert and Vancouver now handle rail traffic to Central Alaska and could be used for similar traffic to Southeastern Alaskan ports where the volume of freight is sufficient to justify terminal costs.

Southeastern Alaska has reasonably good steamer service from Seattle with freight rates somewhat higher than those from Vancouver to ports along the northern coast of British Columbia and to rail and highway points in Interior British Columbia. However, consolidated shipping can be handled at considerable saving by contract barge shipments.

Southeastern Alaska probably will not have a developed road system within the next ten years, but the new State ferry system provides good service between Southeastern Alaska ports. The rapid construction of logging roads, many of which are built to high standards, are making many mineralized areas readily accessible from ports or bays capable of development.

A large portion of Southeastern Alaska is accessible to deep water, or can be made accessible by use of existing logging roads, or relatively short new roads. Therefore, shipment of ores or concentrates to the Japanese market (important to B. C. mines) will cost no more than shipment from the B. C. coast and will cost substantially less than shipment from points in Interior British Columbia.

For the purpose of this comparison it is estimated that inbound freight charges on equipment, and construction and operating supplies will be higher in Southeastern Alaska but that outbound shipments of concentrates will cost less than charges on freight originating in Interior British Columbia.

Construction Costs

Alaskan construction costs have been holding fairly steady in recent years, while those in British Columbia have been climbing. Nevertheless, construction costs (especially road building) in Southeastern Alaska are higher and, for a new mine, will probably be about 1.3 times the costs in Interior B. C.

Comparison of All Costs

The table at the end of this article illustrates the effect of the cost factors previously discussed. Note that the apparent operating cost of a mine in Southeastern Alaska is 15% higher than that of a similar mine in British Columbia.

The British Columbia costs are adapted from costs at the well managed 3,000 ton per day operation of Bethlehem Copper Corporation in the Highland Valley in Interior British Columbia. The cost of the mining operation shows a distribution based on information that is not part of the company's records, since mining is done on contract. Furthermore, the concentration ratio is that which might be expected from a Southeastern Alaska mine. Bethlehem has an unusually high concentration ratio, so its costs of concentrate shipment are less than shown in the table.

Taxes

There is no question but that the Canadian, and British Columbian, tax structure is far more attractive to the developer of new mines than are the tax laws applicable in Alaska or in any other state in the Union. In Canada, a new mine has an income tax exemption period that runs for a six month tune-up period plus three years, during which time depreciation can be accumulated for write-off during taxable years. Mining investment in Canada is encouraged by complete exemption from tax on profits won from the sale of a mining property and by a depletion allowance on dividends from mining companies to shareholders.

In Alaska the only special exemptions are the three and one-half year new mine exemption from the State mining license tax and a partial exemption from State and local taxes for a period of up to ten years under the provisions of the Alaska Industrial Incentive Act. There are no exemptions from Federal taxes.

Although the Canadian tax laws are remarkable incentives for developing new mines it is seldom realized that U. S. tax laws are more favorable for long lived mines. This is true because Canadian law permits a depletion allowance of not more than one-third of operating profit (or 40% for gold mines). U. S. law, on the other hand, permits a depletion allowance of as much as 50% of operating profit, subject to a limitation of 15% of the gross value of metals produced if the mine produces gold, copper, iron or other unspecified metals, or a limitation of 23% of the gross value if the metal produced is lead, zinc, nickel, mercury, platinum, cobalt, antimony, tin, tungsten, asbestos or certain other metals and nonmetallics.

The following graph illustrates the difference between the Canadian and U. S. depletion allowances. A very rich mine with low operating costs might make a profit so large that the Canadian depletion allowance would result in less taxable income than would the U. S. allowance. For example, a copper mine would have to show an operating profit equal to more than 45% of the value of its sales before the Canadian depletion allowance would be more favorable; a lead or zinc mine would have to show 69% of its sales as operating profit before favoring the Canadian law.

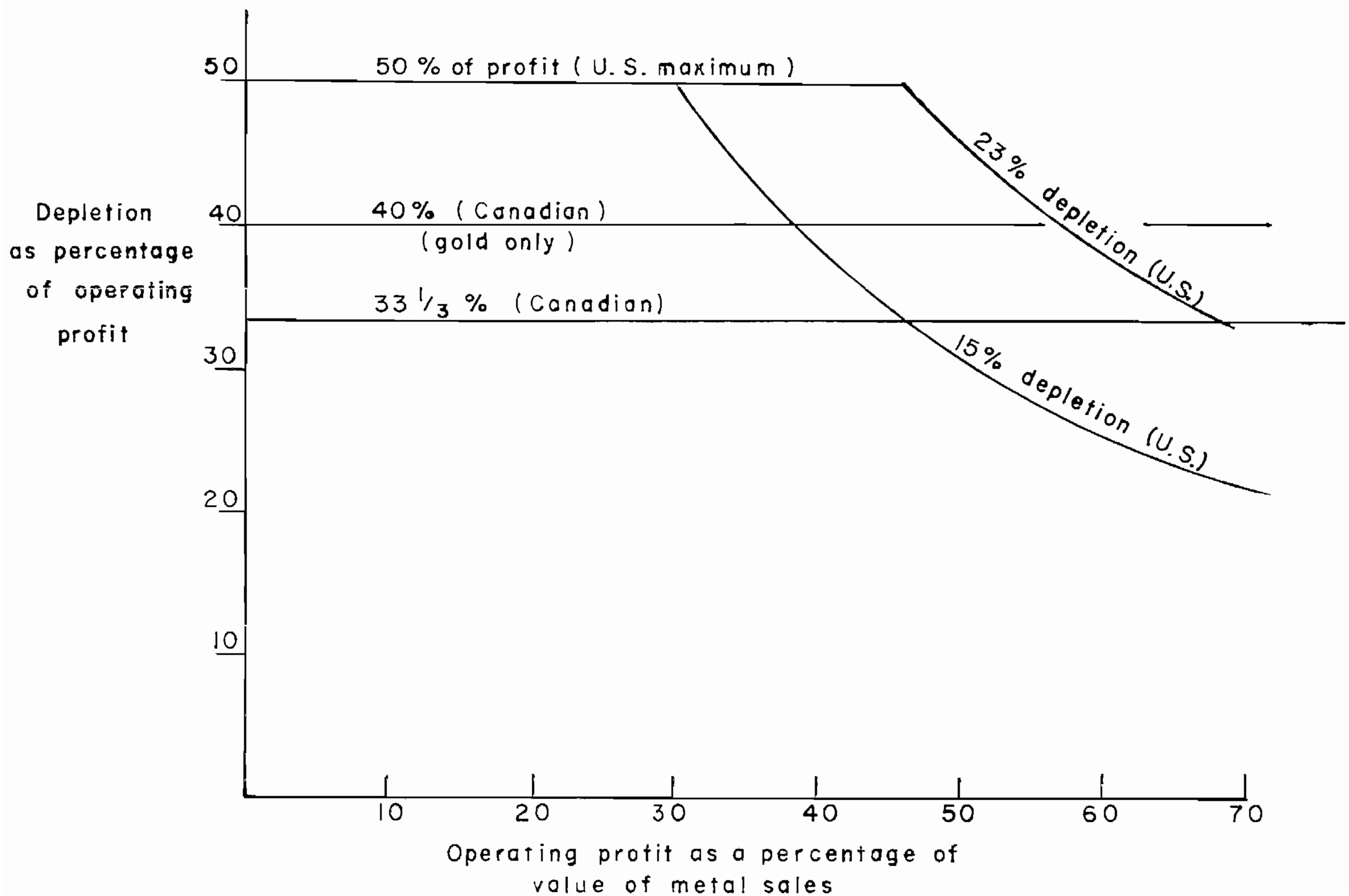
Table XI

Effect of Cost Factors

	British Columbia Cost/ton ore		Factor	Southeastern Alaska Cost/ton ore	
	%	$ C.		%	$ U.S.
Mining					
Labor	15	0.21	1.5	21	0.31
Supplies, repairs	45	0.63	0.9	38	0.56
Power & fuel	15	0.21	1.5	22	0.32
Depreciation	25	0.35	0.8	19	0.28
	100	1.40	1.05	100	1.47
Milling					
Labor	12	0.20	1.5	15	0.30
Supplies, repairs	31	0.50	0.9	23	0.45
Power & fuel	10	0.16	1.5	12	0.24
Depreciation (all except mine plant)	47	0.75	1.3	50	0.97
	100	1.61	1.21	100	1.96
Surface & Service					
Labor	38	0.03	1.5	50	0.05
Supplies, repairs	50	0.04	1.0	40	0.04
Power & fuel	12	0.01-	1.5	10	0.01
	100	0.08	1.25	100	0.10
Administration					
Labor	27	0.08	1.5	29	0.12
Supplies	3	0.01	1.0	2	0.01
Power & fuel			1.5	2	0.01
General admin.	70	0.21	1.3	67	0.27
	100	0.30	1.36	100	0.41
Concentrate shipment* & handling, 25/1 ratio					
Per ton conc.		(9.40)			(2.50)
Per ton ore		0.38			0.10
Total		$ C. 3.77	1.07		$ US 4.04
Total in $$ U.S. ($ C = 0.93 $ U.S.)		$ 3.51	1.15		$4.04

* Concentrate shipment 250 miles from Interior B.C., plus handling, storage, etc.
Concentrate shipment 15 miles from S. E. Alaska, plus handling, storage, etc.

Figure 10 Depletion Comparison



Tectonics and Ore Deposits in Alaska

by Gordon Herreid, Mining Geologist
State Division of Mines and Minerals

Presented at the 1964 Alaska A.I.M.E.
Conference, College, Alaska,
March 19, 1964

Introduction

The purpose of this paper is to analyze the regional geologic patterns of Alaska and attempt to relate ore districts to some of the major features of the geology. In order to do this it is convenient to consider the geology from a tectonic point of view, tectonics being the study of the large scale uplift and subsidence of the earth's crust and the movements along major crustal fractures.

The geologic map of Alaska shows a rather orderly arrangement of arcuate metamorphic-igneous belts flanked by late Mesozoic sediments and Cenozoic basins, all expressions of the tectonic frame work. These arcuate belts are followed or cut at small angles by major arcuate fractures or lineaments which in some areas appear to control the location of igneous intrusive and extrusive rocks and ore deposits. I will discuss first the development of these regional geologic features, and then a possible relationship of ore districts with them.

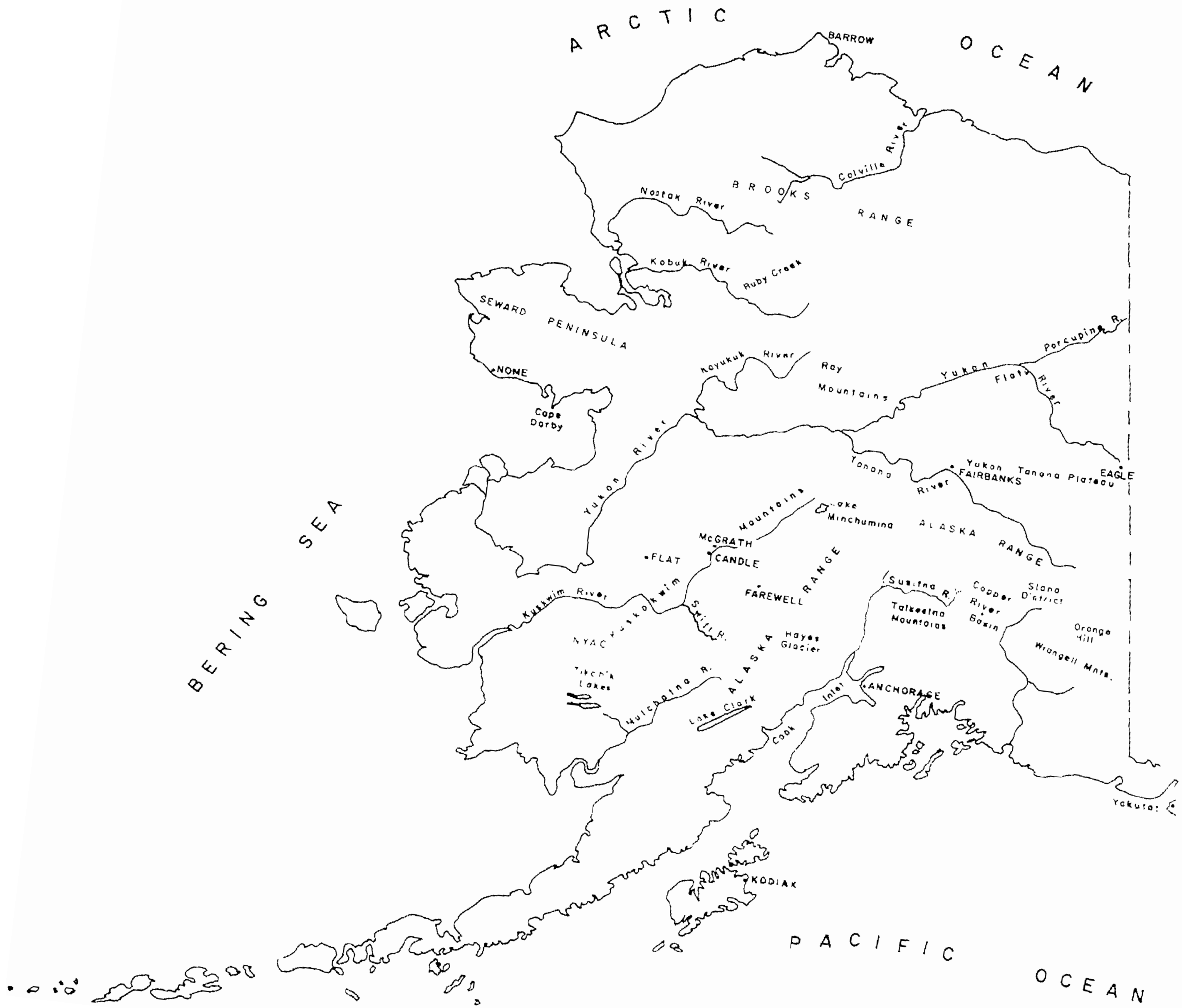
The whole of Alaska lies within a mobile belt that extends along the Pacific fringe of the North and South American continents. For most of its length this belt is the transition zone between the Pacific Ocean basin and the continental platforms and along it the crust has been more mobile than in either the ocean areas or on the continent. In recent years it has been shown, particularly by a number of Russian authors, that there is a rather definite succession of events in the history of the mobile belts in different regions. The following resumé of the development of an idealized mobile belt through one cycle of deformation consisting of three phases is taken largely from the Russian literature (Beloussov, 1962; Krasnyy, 1963; Matveyenko and Shatalov, 1963).

The Tectonic Cycle

Early Geosynclinal Phase

A cycle of deformation begins with an increase of crustal mobility over a large region. During this early geosynclinal phase there takes place subsidence and uplift of elongated geosynclines and geanticlines which are somewhat like waves on the sea. The areas of subsidence predominate and may be up to several tens of miles wide. Deep fracturing of the crust, often in the more mobile areas, results in lava flows and sheet intrusions of basic magma. Topographic relief is moderate with siltstone the principal sediment deposited, often interbedded with basic volcanic rocks. Little folding takes place. Toward the end of this phase the relief becomes even less and limestone may be widespread. In Central Alaska this early geosynclinal phase probably began in the Middle Devonian and continued to the end of the Triassic.

Figure 11 Reference Map of Alaska



Late Geosynclinal Phase

The late geosynclinal phase is marked by a general predominance of uplift over subsidence with orogeny taking place in those geosynclines with the thickest early phase deposits. This orogeny is termed inversion by Beloussov (1962) and is characteristically accompanied by folding, metamorphism, granite intrusion, and uplift over large areas in the geosyncline. He has called these uplifted early geosynclines in the mobile belt central uplifts. They are compensated by subsidence in marginal troughs which may begin as marine troughs and end as intermontane troughs as the uplift of the entire region progresses. If the inversion of the geosynclines is well developed, these marginal troughs may finally overlie the margins of the original geosyncline giving a complete reversal of the topographic features. Inversion may not be carried to completion, however, particularly along the continental margin, in which case granite intrusion, metamorphism, and uplift are not so well developed. During inversion, large wedges of clastic material eroded from the rising land area are deposited in the marginal troughs. Much of Alaska is underlain by Mesozoic clastic wedges of this type flanking areas of older rock. In Alaska the late geosynclinal phase persisted from the Jurassic until early Tertiary time.

Young Platform Phase

The young platform phase begins when block faulting takes the place of folding as the principal means of deformation. This consolidation of the folded belts may take place at different times in different places when block uplifts and basins are superimposed on the earlier folded structures. Deep fractures formed at this time are responsible for narrow belts of igneous intrusions and extrusions. This is a continental period which, in Alaska, has lasted from the early Tertiary to the present.

The geosynclinal evolution that has been described applies to the area on the oceanward side of the mobile belt. This is the true or eugeosyncline. Near the continental platform, geosynclinal subsidence is slower and is unaccompanied by volcanism so that limestone, sandstone, and shale are the normal sediments, and the inversion is not usually accompanied by granite intrusion or metamorphism. This is the miogeosyncline, which represents a gradation between the platform and the eugeosyncline.

In general, during both early and late phases of geosynclinal development, rapid warping of the crust leads to the formation of deep fractures which give rise to igneous activity. After consolidation, in the young platform stage, igneous activity accompanies deep fracturing without warping, often with block movements.

Tectonics of Alaska

Development of Geosynclines and Central Uplifts

In Alaska fossiliferous early Paleozoic rocks crop out sporadically in and around the central uplifts as far south as the Alaska Range. These rocks are largely limey and shaley sediments without volcanics and, with some exceptions, are typical of miogeosynclinal sediments deposited along the relatively stable continental margin. Beginning in Devonian time this shelf became more mobile, and in the Goodnews Arch, post-Devonian rocks changed from limestone to mainly impure

Figure 12

YOUNG PLATFORM

VOLCANICS

GRANITE

LATE PHASE

CLASTIC WEDGE

IGNEOUS ROCKS

INVERSION

EARLY PHASE

MIOGEO

EOGEO

BASEMENT

MIOGEO

EOGEO

SP Seward Peninsula
BR Brooks Range
RGA Ruby Geanticline
GN Goodnews Arch
AR Alaska Range
T Talkeetna Mts
YT Yukon - Tanana Plateau
W Wrangell Mountains

clastic rocks and volcanics. On the northern flank of the Yukon-Tanana plateau Upper Devonian limestone is interbedded with volcanics, and along the south side of the Brooks Range Middle Devonian carbonates are succeeded by increasingly clastic Upper Devonian sediments. Thus, by late Devonian time, the shelf area as far north as the Brooks Range had disintegrated into a mobile volcanic province typical of the early phase of geosynclinal development. This rather sudden change probably represented an encroachment of crustal mobility and deep fracturing from an area south of the Alaska Range onto the Shelf. The areas along and north of the Brooks Range remained relatively stable until Mesozoic time.

The most complete section of early geosynclinal phase sediments is found in the Goodnews Arch. Here from Mississippian to Triassic time an estimated 10,000 feet of marine sediments were deposited, largely siltstone but associated with chert and limestone and, particularly in the late Paleozoic and Triassic, much greenstone. On the southern slopes of the Alaska Range, in the Wrangell Mountains, and along Cook Inlet, Upper Paleozoic greenstone and Upper Triassic limestone indicate the extension of the early geosynclines into the area. The lack of clastic rocks indicates the low relief during this period.

Further north, metamorphic rocks are common in the cores of the central uplifts and are a great source of confusion in the interpretation of the geologic history. These metamorphics were usually dated as older than the oldest nonmetamorphosed sediments by the early mappers. The latest Geologic Map of Alaska (compiled in 1954) shows these rocks to be predominantly pre-Devonian Paleozoics, except for the Birch Creek schist which is shown as lower Precambrian.

The Birch Creek schist and associated gneiss which underlies a great area in the Yukon-Tanana plateau has long been dated as Precambrian. This was done on the basis of metamorphism and differences in lithology of the quartz mica schist relative to the Cambrian and Ordovician rocks which crop out locally near the margins of the metamorphic area. In earlier days it was reasonable to assume that the great mass of schist was older than the surrounding rocks which were unmetamorphosed. However, this simple conclusion does not satisfactorily relate the known facts when the region is considered from a tectonic viewpoint. I would like to suggest a reinterpretation of the facts.

Along the northern part of the Yukon-Tanana plateau the upper Paleozoic rocks are a eugeosynclinal assemblage containing much chert and greenstone. To the northeast across the Canadian border there is a change in facies -- the rocks of the same age are miogeosynclinal without any volcanics. Thus, during the latter half of the Paleozoic, the present northern boundary of the Yukon-Tanana plateau appears to have been the northern limit of a eugeosynclinal basin. The rocks along the northern edge of this basin have been unaffected by metamorphism due to lack of deep burial. Further south the basin underwent inversion during the Mesozoic with consequent regional metamorphism, folding, granite intrusion, and uplift. These metamorphosed eugeosynclinal rocks constitute the Birch Creek Schist.

This interpretation of the origin of the Yukon-Tanana central uplift offers a simple explanation of the facts and is consistent with the history of better-studied regions outside of Alaska. From this point of view the belt of Devonian basic and ultra basic intrusives that cuts the Birch Creek schist is seen as part of the basic igneous activity typical of the early phase of geosynclinal development. The regional metamorphism and granite intrusion are part of inversion, gneisses being early granites emplaced before the end of folding while nonfoliated granites were intruded after folding. As a result of uplift during inversion a clastic wedge was shed northward into the Kandik area during the Cretaceous.

In the Ruby geanticline and the Brooks Range the early mappers dated the metamorphic rocks as older than the oldest fossil-dated sediment, usually with some evidence of unconformities. The implication is that the metamorphic rock was the basement on which later sediments were laid down, the metamorphism having taken place at some early, perhaps Precambrian, date.

Recent detailed studies made in the metamorphic belt along the southern Brooks Range by Brosgé and Reiser (1962) indicate that the metamorphic rocks are of Upper Devonian age, younger than the oldest sediments, which are Middle Devonian limestone. The metamorphics clearly cannot be the basement.

This metamorphic belt along the southern Brooks Range was the site of a narrow east-trending upper Paleozoic eugeosyncline trough. Other mapping by the USGS indicates that this trough was flanked immediately to the north by a parallel miogeosyncline with an eroding highland located still further north. Inversion of this eugeosyncline during Jurassic time resulted in a reversal of relief, with clastic wedges being shed onto the adjacent areas, north and south. The parallel with the Yukon-Tanana plateau is striking.

The Ray Mountains, south of the Brooks Range, also appear to be an upper Paleozoic eugeosyncline which was inverted during the Mesozoic.

The Seward Peninsula is another of these metamorphosed central uplifts. Unmetamorphosed shelf limestone and shale of early to middle Paleozoic age in the northwest part are flanked on the southeast by metamorphic rocks whose lithology was originally rather similar except for a larger proportion of clastic rocks and basic igneous rocks. No fossils have been found in the metamorphic rocks and their age is conjectural. In the metamorphic area both early foliated and late nonfoliated granitic rocks are present. This area was the site of a Paleozoic geosynclinal trough which underwent Mesozoic inversion, metamorphism, granite intrusion, and uplift. The history of the Seward Peninsula is closely analogous to that of the Brooks Range.

The interpretation of the early tectonic history of these areas has been partly on the basis of their later inversions and clastic wedges shed as a result of inversion. This approach can be applied to the Aleutian Range-Talkeetna Mountains-Wrangell Mountains belt, hereafter referred to as the Talkeetna geanticline, which is another metamorphic-igneous belt flanked on both sides by Mesozoic clastic wedges which extend, with interruptions, from Kodiak Island to Yakutat and beyond on the south side and from the Nutzotin Mountains to the Mulchatna River (north of Lake Clark) on the north side. The clastic wedges, at least, suggest that this is a single belt interrupted by the Copper River and Susitna River Basins, an upper Paleozoic geosyncline inverted during the Mesozoic.

Rocks of the early phase geosynclinal trough ranging in age from Mississipian to Triassic crop out along the belt in a number of places. They are particularly well exposed in the Wrangell Mountains, also in the northern section of the Copper River Basin, and sporadically in the northern Talkeetna Mountains.

The rocks in the northern Copper River basin were warped up along with the Talkeetna geanticlinal uplift. Subsequently during Cretaceous time the southern Copper River basin subsided, possibly as a compensation for the uplift of the Talkeetna Mountains, and was filled with Middle to Upper Cretaceous and Cenozoic sediments.

This analysis of the central uplifts indicates that they, and possibly the ranges along the Talkeetna geanticline, represent thick sedimentary and volcanic and volcanic accumulations deposited during upper Paleozoic time in geosynclinal troughs. These troughs were superimposed on lower Paleozoic limey shelf type sediments. These thick geosynclinal piles were folded, regionally metamorphosed, invaded by granite, and uplifted during middle Mesozoic time. As a result of this uplift, clastic wedges were deposited in adjacent areas during middle to late Mesozoic time.

This history indicates that the early Paleozoic sediments which crop out around the margins of the central uplifts are the basement rock, if such can be said to exist, and that the metamorphic rocks are younger products of Mesozoic orogenies rather than the oldest rocks, as they are still often mapped. Some of the margins of the central uplifts have, since upper Paleozoic time, been sharply differentiated from the surrounding areas which are now the sites of basins and clastic wedges, so that these margins are likely to be important tectonic junctions. There is a tendency for the central uplifts to behave as blocks with recurrent movements and igneous activity along these junctions.

Young Platform Stage

The Mesozoic clastic wedges were strongly folded during early Tertiary time, uplifted, and eroded to surfaces of low relief. After the folding had nearly ceased, these sediments, which generally do not contain interbedded volcanic rocks, were invaded by acidic and basic igneous rocks emplaced as shallow intrusives and extrusives. This igneous activity is the result of deep fracturing and indicates consolidation of the region into a brittle young platform. The age of the igneous rocks is only poorly known but the belts of granitoid stocks cropped out on the Late Tertiary erosion surface and were probably intruded during the Miocene.

At the end of the Tertiary the Mesozoic central uplifts were gentle hills surrounded by flats. The patterns of the major rivers were controlled by the locations of the hills. Thus the Yukon flowed along the northern edge of the Yukon-Tanana central uplift at Eagle, and after crossing the Yukon flats continued southwest along the edge of the Ruby geanticline and finally crossed the geanticline along the course of a major fault. The Kuskokwim cuts around the south end of the Ruby geanticline. Since late Tertiary time the lowlands underlain by clastic wedge deposits have been uplifted slowly enough to enable to rivers to maintain their courses across the mountains that were formed. Examples are the Kuskokwim River's course across the Kuskokwim Mountains, the Chisana across the Nutzotin Mountains and the Susitna's course through the northern Talkeetna Mountains. The late Tertiary erosion surface on which these rivers flowed has been preserved over large areas as accordant summit levels which stand up above a younger rolling surface which in turn stands above the basins, thus indicating two stages of uplift of the mountain blocks since late Tertiary time. These block uplifts are responsible for much of the present topography.

Tectonic Control of Ore Districts in Alaska

The three major ore deposits that have been found to date in Alaska are all near arcuate tectonic lineaments. Each is near the edge of one of the Mesozoic metamorphic-igneous belts of inversion. The Alaska Juneau Mine lies near the western edge of the Coast Range igneous-metamorphic belt that extends along the west side of the Coast Range batholith for several hundred miles. Kennecott lies along the southern margin of the Talkeetna geanticline, the site of much faulting and igneous activity. Ruby Creek lies near the southern edge of the southern Brooks Range metamorphic belt.

The control of granitic stocks by deep fractures and the preferential location of ore deposits near stocks along fractures seems to be indicated by the pattern of ore deposits in the Kuskokwim region. Certainly a more than average concentration of ore deposits occurs along these faults. The Iditarod fault in the Kuskokwim region is a major arcuate fracture of Tertiary age which has localized Tertiary volcanics and a number of granitic stocks with associated ore. The Flat, Nyac, and Candle placer camps, several quicksilver deposits, possibly the Goodnews Bay platinum placer, and some other smaller mining camps are located along this break. The Farewell fault, an apparently similar tectonic fracture approximately 70 miles southeast of the Iditarod fault has a number of intrusives and known mercury, lead, zinc, and gold deposits along it. The two best known deposits along the Farewell fault are in McKinley Park, in or near intrusive rocks.

One of the principal conclusions of early mappers for the U. S. Geological Survey was that the widely scattered placer camps in the Interior were related to granitic stocks. In many of the camps the ore minerals are gold, scheelite, cassiterite, stibnite, and cinnabar. These indicate temperatures of deposition ranging from high to low in a small area typical of telescoped deposits around shallow intrusives. The richest placer deposits have been due to stream concentration of many small veins, and to date no large lode deposits have been found in these camps. Placer camps on recurrently active major structures seem to offer the best possibilities for large lode deposits. An example of this is Kennecott. Here, along a major structural junction, a great copper deposit and a typical placer deposit with placer gold associated with a little galena and cinnabar are located near a granite stock. The intrusive is not generally considered to be the source of the copper at the Kennecott mine, but it is likely the two are related, at least by a common source on a common structure.

The concentration of the mineral deposits around the Wrangell Mountains along the faulted northeast and southwest sides provides a good example of the localization of ore along boundaries of tectonic blocks. The lack of visible control by major faults in these areas illustrates that the relation of tectonic fractures to ore deposits is not direct and simple. Willow Creek, on the southern edge of the Talkeetna central uplift, offers a somewhat more direct connection. In this district, gold deposits in quartz diorite are controlled by minor faults which parallel the major Castle Mountain fault along the southern edge of the uplift.

Postmagmatic ore deposits are thought to form when cooling intrusives are cut by faults at the proper time. Such juxtapositions of faulting and igneous activity should occur with greatest frequency along tectonic lineaments, particularly those at the margins of the central uplifts. The lineaments of particular interest for mineral deposits are those marked by belts of intrusives and extrusives. This igneous activity indicates that deep layers of the crust have been tapped by fracturing. Faulting at the surface along these zones may or may not be evident. Typically the igneous activity occurs in isolated centers just as ore districts are usually isolated centers. I believe that these isolated igneous centers along tectonic lineaments have significantly greater than average probability for ore deposits.

In assessing the ore possibilities of Interior Alaska, even using the possibly erudite methods of tectonic analyses, it is well not to overlook any clues. The mineral industry of Alaska has largely resulted from conditions during the Cenozoic which were particularly well suited for making concentrations of placer gold. Areas with only scattered small gold veins or with a little gold associated with base metal deposits may contain placer deposits. Both Ruby Creek and Kennecott have gold placers nearby. The areas around even small gold placer districts have a better than average probability for containing base metal deposits.

General criteria for ore favorability that have been mentioned here are: (1) areas along tectonic lineaments, (2) areas along linear igneous belts (intrusive and/or extrusive), (3) areas along margins of central uplifts, and more specifically, (4) areas around (small) granitoid intrusives along any of these belts, and (5) areas near placer gold deposits.

Conclusion

I have attempted to outline a coherent succession of tectonic events that have shaped the geology of Alaska since mid-Paleozoic time, stressing the development of the central uplifts as the major tectonic units in Interior Alaska. I have also emphasized the importance of deep crustal fractures as guides to ore, particularly those fractures localized along the margins of the central uplifts. I believe that tectonic thinking along the lines used here can give a useful sense of direction to exploration and regional geologic investigations in Alaska.

Examples of Favorable Areas, Based on Tectonic Characteristics

The north-trending igneous belt that separates the Seward Peninsula from the Koyukuk geosyncline contains a number of placer creeks. The pre-Cretaceous and Cenozoic volcanics and Mesozoic granitic intrusives indicate recurrent deep fracturing along the margin of the Seward Peninsula block; and placer deposits on a number of creeks indicates mineralization in the area. Platinum and base metals occur in some of the placers. Further west a parallel igneous belt trends north from Cape Darby. Here Mesozoic granitoids are intrusive into limestone-schist bedrock. Lead-silver mineralization including the Omilak deposit lies near this zone. The geology is somewhat similar to that of the southern Brooks Range metamorphic belt which contains the Ruby Creek copper deposit.

Southwest of Nyac where some placer gold has been found, the Iditarod fault zone contains several different kinds of intrusive and extrusive rocks, all of Tertiary age. Deep fracturing has evidently been recurrent in the area, and the possibility of finding economic deposits appears to be good.

The Farewell fault between Farewell and Swift River separates the early Paleozoic limestone from Cretaceous clastic wedge deposits. Within the last few years cinnabar has been found in the limestone and some placer gold is known in the area. Any granite bodies along this fault (there is at least one known)near the cinnabar would indicate favorable areas.

Further southwest along the Farewell fault in the Tikchik Lake region, scattered granite intrusives are centered around a large domal area. The fault cuts along one side of the dome and should provide local structures favorable for ore deposits.

Along the north side of the Talkeetna geanticline four small granitoid intrusives with associated molybdenum and/or copper are known. These are the Orange Hill copper-molybdenum deposit, north of the Wrangell Mountains; the molybdenum deposit on Long Lake in the Slana district; the molybdenum deposit at Portage Creek, north of the Talkeetna Mountains; and the Hayes Glacier molybdenum deposit, west of the Susitna lowland. The geology of the entire area is not too well known but the location is analogous to that of the porphyry copper and molybdenum deposits in British Columbia, and it seems possible that this may be a porphyry belt.

North of Lake Minchumina a belt of Cenozoic intrusives and extrusives extends in a northerly direction for approximately 60 miles. This igneous belt lies at the eastern edge of the metamorphic rocks of the Ruby geanticline and probably marks the location of a tectonic fracture along the margin of this old central uplift. Only a little placer gold has been found, perhaps due to the deep overburden in the creeks, and not much prospecting appears to have been done. This area is analogous to the igneous belt along the eastern margin of the Seward Peninsula and has a similar mineral potential.

<u>References</u>

Beloussov, V. V., 1962, Basic Problems in Geotectonics: New York, McGraw-Hill, 807 p.

Brosgé, W. P., Reiser, H. N., 1962, Geologic Map of the Chandalar Quadrangle, Alaska: U. S. Geological Survey Open File Report, OF-234

Krasnyy, L. I., 1963, Mobile Provinces and the Problems of Their Nomenclature: International Geology Review, v.5, p. 437-450

Matveyenko, V. T., Shatalov, E. T., 1963, Fractures, Magmatism and Mineralization in the Northeast of the U.S.S.R.: International Geology Review, v.5, p. 127-156

A Possible Guide to Metal Deposits in Alaska

by Charles F. Herbert, Deputy Commissioner
State Department of Natural Resources

Presented at the 1964 Alaska A.I.M.E.
Conference, College, Alaska,
March 20, 1964

In 1962 the value of metals produced by Alaskan mines was $8,916,000, equivalent to an average production of $15 per square mile of total area in the State. In that same year, the value of metals (exclusive of iron ore and minor metals) produced in the eleven western states of the old 48 was over one billion dollars, equal to an average production of $915 per square mile. In other words, metal production in the older western states is sixty times as great as in Alaska, after adjustment for the relative areas involved.

Since the geology and geography of the eleven western states and Alaska are similar, and since gold deposits in both areas demonstrate widespread mineralization, it seems certain that Alaska's mineral industry has scarcely scratched at the possibilities for greatly increased production of gold, silver, copper, lead, zinc, molybdenum, nickel, uranium, mercury, tin, and platinum. Deposits of these metals are known in Alaska, and simple arithmetic shows that the odds of developing mines are good.

The odds for finding base metal mines can be improved by taking advantage of work done by the gold prospectors who flooded the country some sixty years ago. Their indefatigable digging served to outline the mineralized areas, and it is interesting that the two most important copper deposits and the one important platinum deposit in Alaska, and the important silver district of Yukon Territory, are near to relatively unimportant gold placer deposits.

The attached sketch shows the large number of mines, mostly gold, in Alaska and parts of Yukon Territory and British Columbia. Patterns of mineralization are evident and it is probable that the better prospecting chances will be found near, parallel to, or along the extensions of the known mineralized belts.

We know from past experience in the old West that the largest base metal mines are rarely associated with the most productive gold placers. In fact that is true even of some of the larger gold lode mines. Consequently, the less important gold placers and smaller lode gold mines should not be dismissed as possible guides to lodes of gold or base metals. However, the number of small gold mines and prospects is so large that the task of investigating the possible areas near all of them is tremendous.

Fortunately, the task may be somewhat lessened by confining the search, originally at least, to areas where placer concentrates show the existence of other metals. It may be significant that the Kennecott copper deposits and the Ruby Creek copper deposit are near gold placers that contained both copper and silver nuggets. Other districts in which copper and silver nuggets have both been found, but in which no base metal mine has yet been discovered are:

Rampart District, especially Slate and Ruby Creeks.
Slana District near Grubstake and Ahtell Creeks.
Denali District on White Creek.
Chisana District on Bonanza, Bryan, and Chathenda Creeks.
Kenai District on Bear Creek.

Very probably this list is incomplete, and some of the old-timers could make additions to it.

Copper nuggets are rather common in the streams between the Nabesna River and the Canadian border, in the Chitina area, the Chistochina District, the upper part of the Delta River, on Sullivan Creek in the Tofty District, White River near Yakataga, and other places.

Lead minerals may be more common than has been suspected, since oxidized lead minerals are difficult to recognize and may be taken for barite, with which they often occur. A few of the places at which lead minerals have been recognized are:

Kantishna District on nearly all creeks.
Tanana District in the lower portion of Morelock Creek.
Rampart District on Hunter, Little Minook, and Troublesome Creeks.
Denali District on White Creek.
Circle District on Deadwood Creek.

In the Goodnews Bay District platinum was found in gold placers some twenty years before the discovery of the rich platinum placers, which contained very little gold. Other places at which platinum has been found are:

Koyuk District on Dime, Bear, and Sweepstakes Creeks.
Chistochina District on Slate Creek and the Chisna River.
Nabesna District on Platinum Creek.
Innoko District on Boob Creek.
Matanuska Valley on Albert and Alfred Creeks and on Metal Creek.
Beach placers at Yakataga and Lituya Bays.
Upper Delta River.
Livengood District on Lillian Creek.

Of course, platinum in a placer may signal the presence of a nickel lode somewhere in the area.

Some metals are not likely to appear in placer concentrates, as their minerals are especially subject to solution and disintegration. Copper is rarely found unless the original copper mineral has been oxidized to native copper; galena does not travel far from its source; sphalerite is rather easily decomposed and difficult to recognize; molybdenite is readily dispersed. However, the clay that is found near and in bedrock in nearly all placers absorbs and retains metal ions. Consequently, the tailings piles and dumps around old prospect shafts are excellent locations in which to find samples of clay which, with geochemical testing, will give information on the possible occurrence of base metals.

Gold mining to some degree has often been precedent to the discovery of large base metal mines. Within the current month (April, 1964) this relationship was dramatically illustrated when the Toronto Mining Exchange skyrocketed after the announcement that a huge, rich copper-zinc-silver deposit had been found only twelve miles from Timmins, Ontario, the heart of the old, great Porcupine gold mining district. In this presumably well-prospected area the newly-discovered orebody was found beneath a mere twenty feet of overburden.

There is a powerful argument for taking a new, hard look in and near Alaska's gold mining camps.

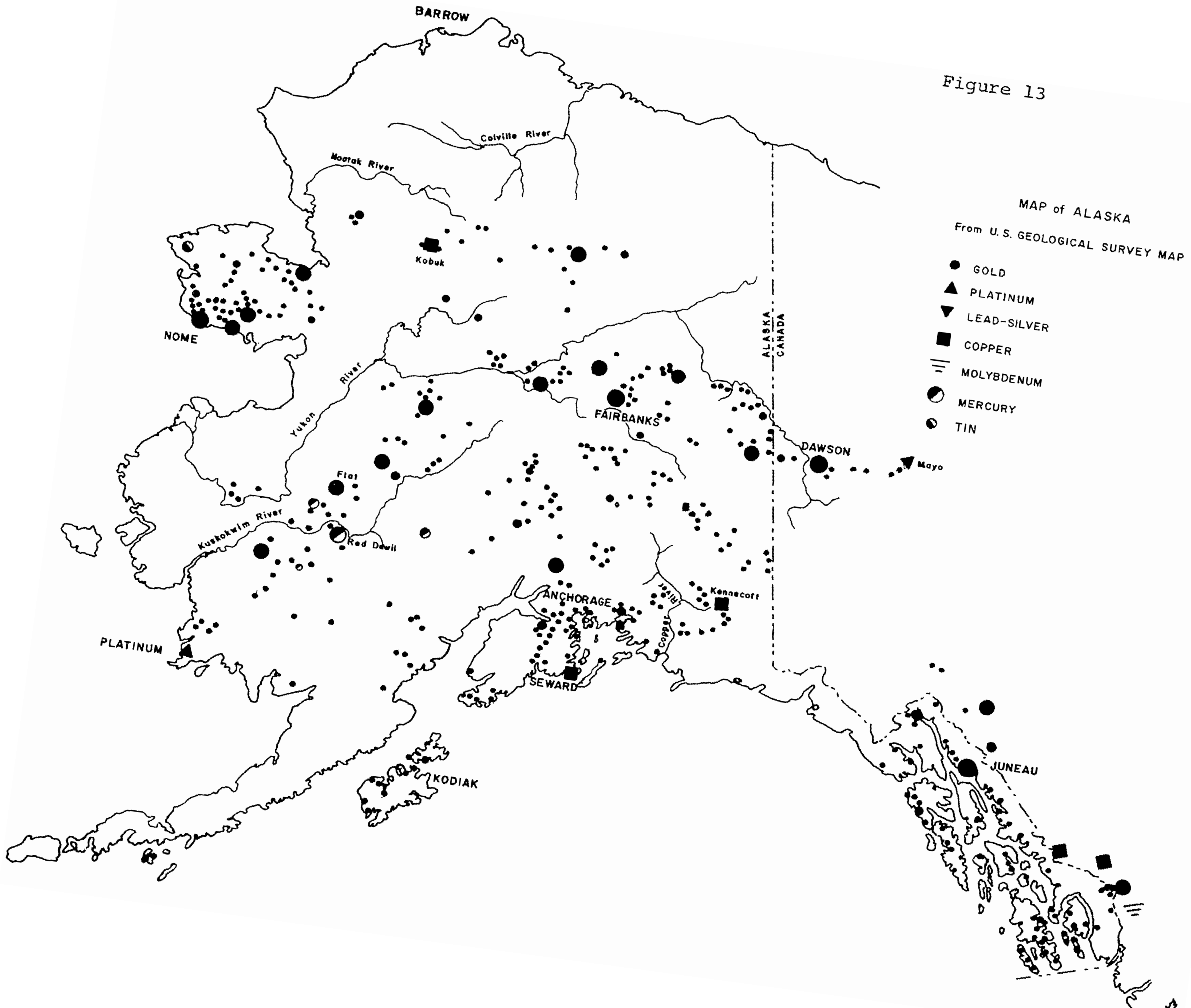

MAP of ALASKA
From U.S. GEOLOGICAL SURVEY MAP A
GOLD
PLATINUM
LEAD-SILVER
COPPER
MOLYBDENUM
MERCURY
TIN
BARROW
Colville River
Noatak River
Kobuk
NOME
Yukon River
FAIRBANKS
ALASKA
CANADA
DAWSON
Mayo
Flat
Kuskokwim River
Red Devil
ANCHORAGE
Kennecott
Copper River
PLATINUM
SEWARD
KODIAK
JUNEAU

Figure 13

DIVISION OF MINES & MINERALS

General

The Division of Mines and Minerals was created to aid and promote increased mineral exploration and production in the State of Alaska. It administers the laws with respect to mining and petroleum exploration and production and mine safety. It operates public assay laboratories for the purpose of aiding bona fide prospectors and miners with free assays and mineral identifications. It does the geological mapping and other functions of a State Geological Survey. It provides technical advice in the field and office on prospecting and mining problems. The Division conducts a continuing survey of the mineral resources and operations in the State and disseminates this information for the assistance of prospectors, miners, and petroleum operators. Oil and gas conservation regulations are administered and enforced. By law, the Division is required to foster and promote the best interests of the mining, minerals, and related industries of the State, and is also charged with the protection of investors in these industries. It maintains an active file or inventory of all known mineral deposits, mining claims, and mining claim owners. It provides the Division of Lands with necessary technical help and advice in mineral leasing and other related matters administered by that Division.

The Division of Mines and Minerals' authority and functions as delegated by the Commissioner of Natural Resources are found in Alaska Statutes, Titles 27 and 31.

Charts and tables on the following pages give a brief over-all view of the Division organization, personnel, functions, and a summary of work accomplished in 1964 and planned for 1965.

ORGANIZATION, FUNCTIONS, AND COSTS

DIRECTOR

ADMINISTRATION BRANCH	MINING BRANCH	METALLURGY BRANCH	PETROLEUM BRANCH	GEOLOGY BRANCH
		Personnel		
Administrative Ass't Minerals Analyst Secretary Office Manager Clerk Typist	3 Mining Engrs.	3 Assayers Assayer-Engineer	Petr. Geologist Petr. Engineer	3 Mining Geologists
		Functions		
Mineral records & Information Publishing Public inquiries Budget, finance, property & personnel	Prospect Examination geochem sampling & reports Safety inspections Public inquiries Technical advice & help to prospectors and miners	Ore assaying geochemical, & other analyses Mineral identification Ore testing Research	Conservation regulation Technical aspects of unitization & leasing regulations Public inquiries Care & release of well logs & Samples	Ore province evaluation Ore deposit investigations Economic geology reports & maps
		Location		
Juneau Anchorage	Juneau Anchorage Fairbanks	Anchorage Fairbanks Ketchikan	Anchorage	Anchorage
		Costs (FY 64-65 Appropriations)		
$64,120	$61,000	$65,900	$36,880	$62,100

Division Total: $290,000

SUMMARY OF WORK ACCOMPLISHED IN 1964

DIRECTOR

Supervision and administration of Division. Branch and field supervisory trips. Chairman of Alaska Oil and Gas Conservation Committee and Alaska Map Committee. Active member of American Mining Congress Public Lands Committee

ADMINISTRATION BRANCH

Accounting, budgeting, personnel, property, public information, publishing all reports and monthly bulletin (circulation 1980), 1665 claim location notices and 5166 affidavits processed, 6831 unpatented claims now on file, 278 visitors assisted.

MINING BRANCH

3 property examinations, geochemical investigation of 17 areas, 43 coal mine and 2 lode mine safety inspections, Prospector Assistance Program, assistance to Division of Lands on leasing, reports prepared, monthly bulletin, technical assistance to individuals and companies.

METALLURGY BRANCH

Received 3330 samples completed 8423 analyses & identification, assisted 2045 visitors, assisted in field.

Petroleum

Approved the drilling of all new wells, administered petroleum conservation regulations, made numerous well examinations, witnessed tests for discovery royalty purposes, inventoried and stored well samples for later research, compiled production and related statistics, gave technical advice to Division of Lands in leasing and unitization matters.

Geology

386 square miles of geology mapped, geologic reports prepared, earthquake mapping and geologic assistance, geochemical samples taken during geologic mapping, assistance given to visitors, information furnished to mining company geologists and prospectors.

Future Work

The Division will continue to assist and promote the mineral industries, and provide information to stimulate exploration. The mining engineers will continue to make geochemical surveys in connection with geologic mapping in addition to their regular work of mineral and prospect investigations.

Improvements are being planned for the assay laboratories and procedures which will allow better and more rapid service on the more important samples that come in and on other mineral and analytical problems that are submitted.

As related elsewhere in this report, oil and gas exploration is increasing rapidly and new production is assured. Continued interest is being shown in the Arctic Slope. The Petroleum Branch work load will increase with the growing industry as it expands in various parts of Alaska in addition to the Arctic Slope and the Cook Inlet Region.

The Geology Branch will continue its geologic and geochemical investigations into the mineral possibilities of selected promising areas and preparation of detailed reports for use by prospectors and exploration companies. Two of these areas will be extensions of those investigated in 1964 where further work was found to be advisable. These are the Slana District and the Broxson Gulch-Eureka Creek area.

Areas in which economic geologic investigations are tentatively planned are as follows:

Seward Peninsula*

Bluff (4), Sinuk River (3), Kugruk River (2) (Independence Creek).

Alaska Range & Interior

Slana District (14): continue mapping of quartz monzonite pluton area in search of ore deposit indications.

Nixon Fork area (6): copper, gold, geologic mapping and geochem.

Mentasta Mountains (15): continue reconnaissance study of diorite intrusive.

Yukon-Tanana Region: Overall mineral, geology, geochem, economic investigation and study.

Broxson Gulch-Eureka Creek (11): copper, nickel, geologic mapping and geochem.

Upper Chistochina (13): copper, nickel, gold, platinum, geologic mapping and geochem.

Paint River (17): copper, iron, geologic mapping and geochem.

Geochemical investigations: Rampart District (7), Kokomo Creek (8), Tanana River (9), Elliot Highway (8), Nenana Highway (9), Taylor Highway (16), Willow Creek (18), Glenn Highway (19).

Southeastern Alaska

Hollis-Twelvemile Arm (3): copper, lead, zinc, molybdenum, gold, geologic mapping.

Lemesurier Island (26): molybdenum, geologic mapping and geochem.

Geochemical investigations: Prince of Wales Island logging roads (31), Chichagof Island (27), and William Henry Bay (24). Revillagidedo Island logging roads (30).

*Numbers in parentheses refer to locations shown on map on Page 81 .

Areas of Investigations

The numbers listed below refer to those on the map on the opposite page. Locations of areas as indicated by the numbers are approximate.

1.	Bear Creek	Geologic mapping 1964 and prospect mapped.
2.	Independence Creek	Geologic mapping planned for 1965
3.	Kugruk River	Geologic mapping planned 1965
4.	Bluff	Geologic mapping 1964, more planned 1965
5.	Omilak	Geologic mapping 1964
6.	Nixon Fork	Geologic mapping planned 1965
7.	Rampart District	Geochemical investigations planned 1965
8.	Elliot Highway, Kokomo Creek, Chatanika River	Geochemical investigations made 1964 or planned for 1965
9.	Nenana Highway	Geochemical investigations planned 1965 and geologic mapping
10.	Richardson Highway	Geochemical investigations 1964
11.	Broxson Gulch-Eureka Creek, Rainy Creek	Geologic mapping planned 1965 Geologic mapping 1964
12.	Paxson	Geochemical investigation and geologic mapping 1964
13.	Upper Chistochina	Geologic mapping planned 1965
14.	Slana District	Geologic mapping 1964 and planned 1965
15.	Rock Creek, Mentasta Mountains	Geologic reconnaissance mapping 1964 & planned 1965

Figure 14


ALASKA
ARCTIC OCEAN
BROOKS RANGE
SEWARD PENINSULA
MT McKINLEY NATL PARK
ALASKA RANGE
ALASKA PENINSULA
GULF OF ALASKA
PACIFIC OCEAN
BERING SEA
Barrow
Pt Barrow
Colville
Pt Hope
Kotzebue
Kotzebue Sound
ARCTIC CIRCLE
Fort Yukon
Fairbanks
Nome
Norton Sound
St Michael
McGrath
Ruby
Bethel
Nunivak I
Bristol Bay
Kodiak
Shelikof Strait
Shumagin Is
Unimak I
Unalaska I
Dutch Harbor
Anchorage
Valdez
Cordova
Katalla
Yakutat
Mt St Elias
Haines
Juneau
Whitehorse
Dawson
Prince Rupert
Dixon Entrance
UNITED STATES
CANADA
YUKON
BRITISH COLUMBIA
SOVIET UNION
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
168° 164° 160° 156° 152° 148° 144° 140° 136°
INTERIOR—GEOLOGICAL SURVEY WASHINGTON, D.C. 1954
ALASKA, MAP C
500 Miles
500 Kilometers
R SALE BY U. S. GEOLOGICAL SURVEY, FEDERAL CENTER, DENVER, COLORADO OR WASHINGTON 25, D. C.

16.	Taylor Highway	Geochemical Investigations planned 1965
17.	Paint River	Geologic mapping planned 1965
18.	Willow Creek, Susitna River	Geochemical & magnetometer investigation 1964 and planned 1965
19.	Glenn Highway, Matanuska River	Geochemical investigation planned 1965
20.	Knight Island, Nellie Juan	Geologic mapping 1964
21.	Valdez	Geologic mapping and geochemical investigation 1964
22.	Skagway	Geochemical investigation 1964
23.	Lynn Canal	Prospect mapped & geochemical investigation 1964
24.	William Henry Bay, Berners Bay	Geochemical investigation 1964 & planned 1965
25.	Taku River	Geochemical investigation 1964 & planned 1965
26.	Lemesurier Island	Geological mapping and geochemical investigation planned 1965
27.	Chichagof, Baranof Island	Geochemical investigation planned 1965
28.	Gambier Bay	Geochemical investigation 1964
29.	Stikine River	Geochemical investigation 1964
30.	Revillagigedo Island	Geochemical investigation planned 1965
31.	Hollis - Twelvemile Arm area	Geochemical investigation 1964 & geologic mapping planned 1965

Prospectors Assistance Program

The total number of participants completing the program in 1964 was the same as in 1963, the first year of the program. A total of 19 applicants were approved by the screening boards for projects in 1964, which committed a total of $34,398.04. Of these 19 applicants, only 9 participated and completed their programs at a cost to the State of $9,495.28.

One participant actually mined a new prospect. Additional work by a prospector who made a discovery in 1963 resulted in new discoveries in the same area this year. One project by a geologist participating in the program yielded new geologic data. Probably the most important development under the program to date was the optioning of one of the new properties by a large mining company.

Members of the screening board were:

Aldon Gooch	-	State Assayer, Ketchikan
Robert Saunders	-	" Mining Engineer, Fairbanks
Willow Burand	-	" " " , "
Martin Jasper	-	" " " , Anchorage
William Race	-	" " " , Juneau
Dr. Donald Cook	-	College of Earth Science & Minerals Industries, University of Alaska
Dr. Robert Forbes	-	CESMI, University of Alaska
Leo Mark Anthony	-	" " " "
Roger Markl	-	" " " "

The following table presents data on this year's program.

1964 PROSPECTOR ASSISTANCE PROGRAM

Name	Locality Prospected	Man Days	Claims Staked	Samples Assayed	Cost of Travel	Cost of Food	Equipment & Misc.	Total Cost	Cost/Man Day	Cost to State
Julius Sirilo	Taylor Mtns.	100	2	38	$ 216.00	$ 272.06	$ 145.14	$ 633.20	$ 6.33	$ 474.90
Jim Fuksa	Kantishna	60	14	15		151.44	136.36	287.80	4.79	215.85
Ora P. Schoonover	Talkeetna	45	10	7	1200.00	314.05	88.08	1602.13	35.60	1201.60
B. Moser & A. Bauman	Flat	60	0	1	1204.11	268.34	230.45	1702.90	28.38	911.78
August Palm	Sitka	31	1	3	714.00	177.64	345.84	1237.48	39.92	928.11
Tury Anderson	Livengood	62	0	20	875.00	693.98	1334.00	2902.98	46.82	2177.23
Edward Durand	Slana	72	6	10	2097.00	392.62	640.28	3129.90	43.47	2347.43
Arne Murto	Rainy Pass	30	0	6	180.00	104.46	128.68	413.14	13.78	309.86
Bill Huff	Wrangell	60	0	26	990.00	117.65	130.38	1238.03	20.63	928.52
		520	33	126	$7476.11	$2492.24	$3179.21	$13147.56	$25.28**	$9495.28

Average**

LIST OF ALASKA MINING OPERATIONS ACTIVE DURING 1964

Name and address of Operator	Location of Mine & Recording District	Approx. Crew	Type of Operation*
Admiralty Alaska Gold Mining Co., Box 2642, Juneau	Funter Bay Juneau	2	Nickel-copper lode development
Aho, John 725 2nd Ave., Fairbanks	Fortymile River Fairbanks	2	Placer preparation
Ahwinona, Jacob & Sam Nome	E. Seward Peninsula Cape Nome	2	Prospecting
Alaska Exploration & Mining Co., Talkeetna	Bird Creek Talkeetna	1	Hydraulic
Alaska Horizons Co. Vic Fondy & Ray Jones Box 4931, Spenard	Treasure Creek Talkeetna	2	Testing ground with caisson
Alaska Mines & Minerals, Inc. Box 422, Anchorage	Red Devil Mine Kuskokwim	16	Property leased
Alaska Nickel Co. Fred Jenkins Box 2, Eagle	Eagle Bluff Fairbanks	2	Lode development
Alaska Portland Cement Co. Ltd. 136 Kentucky Street Petaluma, California	Foggy Pass Nenana	3	Limestone exploration
Alexander, Betty Nome	Quartz Creek Cape Nome	1	Nonfloat, development work
Amero, A.W. Chandalar	E. Fork Chandalar R. Fairbanks	1	Prospecting
Anderson, Ellis Chandalar	Tobin Creek Fairbanks	1	Small scale hand
Anderson, Tury & Associates Fairbanks	Fairbanks Fairbanks	2	Prospecting
Atlas Mines George J. Waldhelm Box 755, Nome	Dahl Creek Cape Nome	1	Nonfloat
Baker, V.G. Fairbanks	Jade Mountain Noatak-Kobuk	2	Jade lode and placer

*Types of operations are explained at end of list.

Basin Creek Mining Co. Herbert Engstrom Box 554, Nome	Basin Creek Cape Nome	2	Dredge
Kennecott Copper Corp. 161 E. 42nd Street New York 17, New York	Ruby Creek Noatak-Kobuk	50	Copper lode development
Bear Creek Mining Co. W 917 Mallon Spokane, Washington	Orange Hill Chitina	12	Exploration
Beckwith, Rea Box 119, Anchorage	Alaska general Several	3	Mineral investigations
Beshores, Paul & Associates Box 1161, Mollala, Oregon	Kugruk River Fairhaven	1	Nonfloat
Bierman, William Yakima, Washington	Slate Creek Chitina	2	Nonfloat
Bittner, Paul Central	Deadwood Creek Fairbanks	1	Hydraulic
Bliss, Patrick J. & Sons 129 E. 11th, Anchorage	Ungalik Creek Cape Nome	3	Nonfloat
Boedecker, Bill & Joines, Evert Hollis	Hollis Ketchikan	2	Prospecting
Bonanza Gold, Inc. East 15 Walton, Spokane	Prince of Wales Is. Ketchikan	4	Development
Bonnell, Frank 1057 W. 80th Street Los Angeles, California	Kantishna District Fairbanks	1	Lode Prospecting
Botts, Earl & Lyle Box 1465, Fairbanks	Timberline Creek Palmer	1	Stripping and trenching
Breseman, John W. Box 796, Pelican	Chichagof District Sitka	1	Prospecting
Brockway, John T. 1737 Glacier Avenue, Juneau	Baker Peak Sitka	1	Copper development
Bronson, Robert; France, Jack & Wilbur, Palmer	Old Brassel Property Palmer	2	Gold lode mining
Brown, Erwin General Delivery, Petersburg	Southeastern Alaska Several	1	Prospecting

Buck, William & Billum, Frank, Glennallen	Ahtell Creek Glennallen	2	Ag lode development
Burnette, Dewey & Hunter, Martha, Box 1995, Fairbanks	Crooked Creek Fairbanks	2	Nonfloat
Canyon Creek Mining Co. Jens Kvamme & Sons Akiak	Canyon Creek Kuskokwim	4	Hydraulic
Carr, G.W. Miller House	Miller Creek Fairbanks	2	Hydraulic
Casanoff, Jack Kiana	Klery Creek Noatak-Kobuk	1	Small scale hand
Casto, Steve 33 Mile, Haines	Porcupine Creek Haines	1	Small scale hand
Chambers, Wayne California	Bluff Nome	3	Dredge
Clement, Dick	Hayes Glacier area Anchorage	1	Molybdenum prospect
Cline, Harvey Cordova	Yakataga Beach Cordova	1	Small scale hand
Coffield, Lawrence Usibelli	Black Creek Talkeetna	1	Gold lode prospecting
Coleman, George Palmer	Independence Mine Talkeetna	1	Caretaking & Maintenance
College Road Peat Kushman Brothers 12 Timberland Dr., Fairbanks	College Road Fairbanks	2	Peat
Cook General Delivery, Fairbanks	70 Mile Creek Fairbanks	1	Prospecting
Cordero Mining Co. 131 University Avenue Palo Alto, California	White Mountain Kuskokwim	3	Property leased
Davis, Bon Box 45, Nome	Gold Run Cape Nome	1	Nonfloat

Davis Mines, Inc., Talbert E. Davis, 1511 Mary Ann, Fairbanks	Shovel Creek Noatak-Kobuk	2	Nonfloat
Degnan, Joseph A. Ophir	Mastodon Creek Mt. McKinley	2	Nonfloat
Delong, Ralph Nome	Coffee Creek Cape Nome	1	Hydraulic
Dickman, O.J. Teller	Gold Run Creek Cape Nome	4	Hydraulic
Duncan, Jason H. 944 Yellowstone Road Xenia, Ohio	Beauty Bay Seward	2	Gold lode
Eckers, Theron Kasaan	Kasaan Peninsula Ketchikan	2	Prospecting
Edgecumbe Exploration Co. C.T. & G.H. Morgan Box 758, Sitka	Silver Bay Sitka	2	Gold lode maintenance
Edwards, Herk & Miller, Vern Nome	Nome area Cape Nome	2	Prospecting
Emerick, Rollie; Brakefield, Erwin; Monroe, C.; Greathouse, C.R., Delta Junction	Alaska general Several	3	Prospecting
Empire Jade Co., Gene Joiner Kotzebue	Jade Creek Noatak-Kobuk	1	Jade recovery & cutting
Engstrom, Herb Nome	Basin Creek Nome	2	Dredge
Farland, Gene Nome	Koyana Creek Square Rock Mining Co. Cape Nome	1	Offshore prospecting
Fennimore, George & Associates Talkeetna	Yakataga Beach Cordova	2	Prospecting
Ferguson, Archie & Belobraidich, John, Kotzebue	Candle Creek Fairhaven	6	Nonfloat
Fern Gold Mining Co. 502 Columbia Building Spokane, Washington	Willow Creek Palmer	1	Gold lode development

Flat Creek Placers Fullerton Brothers Flat	Flat & Willow Creeks Mt. McKinley	3	Nonfloat
Foreman, Kenneth C.	Hollis Ketchikan	1	Development & drilling
Foster, Neal W. Box 279, Nome	Seward Peninsula Several	1	Lode prospecting
Foster, Neal Box 279, Nome	Hannum Creek Fairhaven	2	Nonfloat
Ghezzi, Alfred R. Box 1857, Fairbanks	3rd & 4th Districts Several	1	Prospecting
Gilbertson, George 314 Charles Street Fairbanks	Canyon Creek Fairbanks	2	Nonfloat
Gold Cord Mining Co. 2309 Lord Baranof Blvd. Anchorage	Fishhook Creek Palmer	2	Gold lode development
Goodnews Bay Mining Co. 422 White Building, Seattle Platinum	Salmon R. & tribs. Bethel	40	Platinum dredge & Nonfloat
Grant Mining Co. Frank C. Edgington Box 53, Tanana	Grant Creek Ft. Gibbon	2	Nonfloat
Hancock, K.S. Haines	Porcupine Creek Haines	1	Small scale hand
Hansen, Burnett F. Eagle	Ben Creek Fairbanks	2	Nonfloat
Hanson, Aage 1108 10th Avenue N. Seattle, Washington	Craigie Creek Talkeetna	1	Gold lode development
Hassel Mining Co. Harold Hassel Box 1071, Fairbanks	Ready Bullion Creek Fairbanks	2	Nonfloat
Havrilack, Harry Rampart	Ruby Creek Rampart	1	Nonfloat
Hawkins, W.A.; Eichner, Ken; Lillie, Angus, Ketchikan	Southeastern Alaska Several	1	Prospecting

Heiner, Larry Petersburg	Southeastern Alaska Several	1	Prospecting
Henton, Fred Mile 42, Seward Highway	Slate Creek Seward	1	Gold lode development
Herning, Harold	Candle	2	Nonfloat
Hersch & Herning, Harold Candle	Mud Creek Fairhaven	2	Nonfloat
Hill, Lloyd Star Route, Palmer	Grubstake Gulch Palmer	3	Soapstone mining
Holovics, Louis Manley Hot Springs	American Creek Manley Hot Springs	1	Hydraulic
Hogendorn, Jack Deering	Inmachuck River Fairhaven	1	Hydraulic
Holloway, Dorr; Juancorena, Mariano; Neubauer, Jack	Red Devil Property Kuskokwim	3	Mercury lode stripping
Huff, J.W. Box 837, Ward Cove	Groundhog Basin Wrangell	2	Prospecting
Idaho Bar Mining Co. Melnikoff, Kosta Rampart	Idaho Bar Rampart	1	Nonfloat
Johnson, Iver M. Fairbanks	Chisana District Fairbanks	2	Nonfloat
Kawolsky, Ignacey Nome	Charley Creek Cape Nome	1	Prospecting
Kelbar Company 1112 S. Cushman Tacoma	Duncan Canal Petersburg	3	Barite development
Keystone Mines, Inc. Box 630, Fairbanks	Wolf Creek Fairbanks	6	Lode gold
Kloss, Herman; Davis, Jack (K & D Lode) Sunset Cove	Sunset Cove Juneau	1	Gold-antimony lode development and prospecting
Knorr, Vincent Bettles Field	Mascot Creek Koyukuk	2	Nonfloat

Langlow, Jens Central	Switch Creek Fairbanks	1	Hydraulic
Lanning, Tony Manley Hot Springs	Eureka Creek Manley Hot Springs	1	Nonfloat
Lee Brothers Dredging Co. Box 208, Nome	Cape Creek Cape Nome	10	Tin development
Leonard, Harry B. Wiseman A.C. Mining Co.	Vermont Creek Fairbanks	1	Small scale hand
Leslie, Robert Box 1838, Fairbanks	Granite Creek Fairbanks	1	Placer development
Lie, Harold Kotzebue	Bear Creek Cape Nome	1	Prospecting
Lindquist, Hjalmer 133 N. Marion, Bremerton Washington, or Ophir	Beaver Rock & Ester Creeks McGrath	1	Nonfloat
Little Creek Mine Ivor C. Carlson Ophir	Ophir McGrath	2	Nonfloat
Little Squaw Mining Co. 309 Radio Central Building Spokane, Washington	Chandalar District Fairbanks	5	Gold lode development
Locke, Barney Wasilla	Sheep Mt. & Soda Cr. Anchorage & Nabesna Quads.	1	Copper Prospects
Long Creek Mining Co. Ash Richardson, Ruby	Long Creek Fairbanks	4	Nonfloat
Lucky Seven Mining Co. Walter E. Roman Box 141, Fairbanks	Fish Creek Fairbanks	3	Nonfloat
Lyman, Robert Lyman Mining Co, Red Devil	White Mountain Kuskokwim	3	Cinnabar production
Lynx Creek Mines Edgington, Frank C. Grant Creek Landing Tanana	Lynx Creek Ft. Gibbon		Nonfloat

McClure, Francis Schaefer; Schaefer, Norman 62 Copeland Avenue La Crosse, Wisconsin	Cinnabar Creek Kuskokwim	2	Mercury lode exploration
McCombe, R.S. Chicken	Lost Chicken Fairbanks		Assessment work
Manske, Dan Box 797, Fairbanks	Ingle Creek Fairbanks	1	Nonfloat
Martinson Brothers Nome	Kougarok River Cape Nome	5	Gold dredge
Marvel Creek Mining Co. Awe, Charles Aniak	Marvel Creek Bethel	3	Nonfloat
Mathews Mining Co. Box 2061, Fairbanks	Woodchopper Creek Fairbanks	5	Dredge
Meldrum, William Chicken	Stonehouse & Chicken Creeks Fairbanks	2	Stripping
Mendenhal, Ray & Evans, W.H. Box 811 Nome	Milroy Creek Fairhaven	2	Nonfloat
Miller, James; Lindgrin, Earl; Atwood, M.J.	Sheep Creek Fairbanks	3	Nonfloat
Minalaska, Inc. Magnuson Brothers, Ophir	Gaines Creek Mt. McKinley	1	Nonfloat
Mineral Basin Mining Corp. Moa, Arthur, Box 126 Hyder	Mt. View Property Ketchikan	2	Exploration (lode)
Minerals, Inc. W.W. Gilkey Box 1211, Juneau	Yakutat District Juneau	2	Beach placer investigations
Miscovich Brothers Otter Dredging Co. Flat	Otter Creek Mt. McKinley	6	Dredge
Moneta-Porcupine Suite 1502 325 Bay St., Toronto	Alaska general Several	12	Prospecting
Monte Cristo Mining Co R.W. Beck, Gakona	Slate Creek Chitina	5	Nonfloat

Auric Offshore Mining Co. Morgan, Milton F. & Novak, M.J., 5115 El Cajon Blvd. San Diego, California	Bluff Nome	4	Prospecting off-shore
Mrak, William Sutton	Grubstake Gulch Palmer	3	Nonfloat
Mt. Andrew Mining Co. Box 358, Ketchikan or 1011-1030 W. Georgia Street Vancouver 5, B.C.	Kasaan Peninsula Ketchikan	1	Iron & copper exploration
Mt. Parker Mining Co. A.F. Parker Box 2127, Juneau	Mt. Parker Mine Juneau	1	Gold lode maintenance
Nesland, Erling & Associates 2027 Airport Road, Fairbanks	Tramway Bar Fairbanks	2	Nonfloat
Newlun, O.H. Box 623, Ketchikan	Prince of Wales Island Ketchikan	1	Prospecting
New York-Alaska Gold Dredging Corp., 534 White Henry-Stuart Bldg., Seattle or Nyac	Tuluksak R., Calif Cr., Rock Cr. Bethel	14	Gold dredge
Novak, John 1780 Ocean Blvd. Coos Bay, Oregon	Bering Sea & Others Cape Nome	2	Offshore prospecting
Olive Creek Mines Carl Parker, Box 552 Fairbanks	Amy Creek & Olive Cr. Fairbanks	3	Nonfloat
Olson, Henry T. "Tiger" Taku Harbor	Juneau & Admiralty Districts	1	Prospecting
O'Neill Ventures William O'Neill 505 8th Ave., Anchorage	Dan Creek McCarthy	2	Development work
Pade, Otto Skagway	Skagway Skagway	1	Prospecting
Palmer, R.B. Box 1617, Fairbanks	Sourdough Creek Fairbanks	1	Prospecting
Pan American Petroleum Corp. P.O. Box 591 Tulsa, Oklahoma	Alaska Peninsula Iliamna	20	Iron Claims location

Pankratz, Fred; Doyle, Al Nome	Bering Sea & Beaches Cape Nome	4	Beach & Offshore prospecting
Pannick, Harry General Delivery, Fairbanks	Flume Creek Fairbanks	1	Nonfloat
Parker, Fred	Inmachuck River Fairhaven	3	Nonfloat
Pearson, Clayton T. & Grothe, Lenhard, Red Devil Mine	Lost River Cape Nome	5	Prospecting
Pederson, Steve, Box 685, Nome	Niukluk River	2	Dredge
Pekovich, W.S. Box 2642, Juneau	Port Snettisham Juneau	1	Iron lode development
Permanente Cement Co. Oakland, California	Kings River Palmer	2	Limestone exploration
Pieper, Paul Ketchikan	Kasaan Ketchikan	1	Prospecting
Pilgrim, Earl R. Box 1896, Fairbanks	Stampede Creek Fairbanks	2	Antimony lode Development
Pratt, Jack; Dube, Tony Suntrana	No Grub Creek Fairbanks	2	Nonfloat
Price, Stanton c/o Dean Goodwin Box 1262, Juneau	Windfall Harbor Juneau	1	Prospecting
Prince Creek Mining Co. Agoff, S.E. Flat	Prince Creek Mt. McKinley	4	Nonfloat
Purdy Brothers Chicken	Myers Fork Fairbanks	2	Nonfloat
Purkeypile, I.W. & Associates 320 - 3rd St. Hamilton Acres Fairbanks	Tonzona District Mt. McKinley	3	Lode prospecting
Quail Creek Mining Co.	Quail Creek Rampart	2	Nonfloat

Quitsch, William Valdez	Mineral Creek Valdez	1	Gold lode prospecting
Radovan, Martin McCarthy	Glacier Creek McCarthy	1	Copper lode prospecting
Redstone Mining Co. Carl Heflinger 409 Clara Street, Fairbanks	Livengood Creek Fairbanks	4	Nonfloat
Reed, Curtiss & Rybachek, Stanley, Triple R, Livengood	Wilbur Creek Fairbanks	2	Hydraulic
Renshaw, A.L. & Associates 2309 Lord Baranof Blvd. Anchorage	Willow Creek Palmer	2	Gold lode development
Rhode Island Creek Mines A.W. Pringle Manley Hot Springs	Rhode Island Creek Manley Hot Springs	3	Nonfloat
R.S. Richards & Associates Box 1817, Anchorage	N. Fork Kashwitna R. & Alaska Peninsula area	5	Copper, iron, gold lode
Ricks, Dean Fairbanks	Fairbanks District Fairbanks	1	Prospecting
Robinson, George F. Chicken	Wade Creek Fairbanks	1	Nonfloat
Rosander & Gates Ophir	Bear Creek Mt. McKinley	3	Nonfloat
Rosander & Reed Ophir	Yankee Creek Mt. McKinley	4	Nonfloat
Ruby Mining Company Asher B. Richardson 326 Boundry St., Fairbanks	Long Creek Nulato	2	Nonfloat
Shapley, George Craig	Tuxekan Island Ketchikan	1	Prospecting
Sheldon, Charlie Shungnak	Shungnak River Noatak-Kobuk	1	Jade placer
Shell Oil Co. Shell Bldg., 100 Bush St., San Francisco, California	Bering Sea Cape Nome	14	Offshore pros- pecting

Sherman, Mike Candle	Patterson Creek Fairhaven	1	Nonfloat
Sinclair Oil Co. Box 584, Anchorage	Alaska general Several	6	Prospecting
Sirilo, Julius Box 625, Bethel	Aniak District Kuskokwim	1	Prospecting
Slate Creek Mining Co., DeeRand, Edward H. Box 1564, Fairbanks	Slate Creek Fairbanks		Nonfloat
Smith, Bob Nome	Kougarok River Nome	2	Dredge
Smith, Pete & Associates Box 1660, Fairbanks	Steamboat Creek Fairbanks	2	Prospecting
Squaw Creek Mining Co. Jack Wilke, Chicken	Canyon Creek Fairbanks	1	Nonfloat
St. Amand, Loren	Midas Mine Valdez	1	Development
Standard Metals Corp. Box 1081, Ketchikan	Kendrick Bay Ketchikan	1	Development
Steears, Al Box 826, Ketchikan	Southeastern Alaska Several	1	Prospecting
Stelting, H.W. Box 19, Haines	Haines Haines	1	Prospecting
Stensland, A.H. Box 1985, Ketchikan	Helm Bay Ketchikan	1	Prospecting
Strandberg Mines, Inc. Box 2099, Anchorage	Eureka Creek Manley Hot Springs	3	Nonfloat
Stuver, Jules Flat	Moore Creek Mt. McKinley	2	Hydraulic
Sweepstakes Mine Charles Moon & Baldwin Box 371, Nome	Sweepstakes Creek Cape Nome	1	Nonfloat
T and T Mining Co. William Thomas Box 1464, Fairbanks or Rampart	Hunter Creek Rampart	1	Nonfloat, stripping

Taylor, Arley & Associates c/o Snitely Bros. Wenatchee, Washington	Eureka Creek Fairbanks	2	Nonfloat
Tetinek, Eugene Fortuna Ledge	Willow Creek Wade Hampton	1	Nonfloat
Titus, Jack; Cook, Fred Solomon	Shovel Creek Cape Nome	2	Small scale hand
Totem Exploration Co. Joe Blazek 317 Dock Street, Ketchikan	Southeastern Alaska Several	1	Prospecting
Tozer, James; Kuzminski, Robert; Kellog, Joseph; Ransom, Champe Box 34, Adak	Lost River area Cape Nome	4	Prospecting
Tweet, N.B. & Sons Teller	Kougarok River Cape Nome	6	Nonfloat, hydraulic
Ulrich, Henry Nome	Rock Creek Cape Nome	1	Small scale hand
Uotila, Gus Ophir	Birch Creek Nulato	1	Stripping
Uranium & Strategic Ore Development Co., Mr. Hammond Anchorage	Craigie Creek Talkeetna	2	Gold lode pros- pecting
U.S.S.R. & M. Co. Box 438, Nome	Nome District Cape Nome	4	Prospecting
U.S.S.R. & M. Co. Box 1170, Fairbanks	Hogatza River Ft. Gibbon	34	Gold dredge
U.S.S.R. & M. Co. Box 1170, Fairbanks	Mosquito Fork Fairbanks	15	Dredge
U.S. Steel Corporation	Alaska General Several	8	Development
Valdez Mines Ltd. W. Fillipek, President 10032 105th Street Edmonton, Alberta	Canyon Creek Chitina	8	Nickel-copper pros- pecting
Wackwitz, Charles & Fred Box 1595, Fairbanks	Bedrock Creek Fairbanks	2	Prospecting

Wall, Melvin Box 3256, Spenard	Valdez Creek Palmer	2	Placer development
Watson, Mrs. Ben Cape Yakataga	Yakataga Beach Cordova	2	Small scale hand
Weber, Glen Miller House	Porcupine Creek Fairbanks	3	Placer development
Weinard, Fred Candle	Mud Creek Fairhaven	2	Nonfloat
Weisner Trading Co. Ira Weisner, Rampart	Little Minook & Hoosier Creeks Rampart	4	Nonfloat
Weston, David Fairbanks	Dome Creek Fairbanks	1	Nonfloat
Wheeler, Vernon & Associates Box 14A, Wasilla	Grubstake Gulch Palmer	2	Gold lode development
Williams, Burton A. May Creek via Cordova	Rex Gulch McCarthy	1	Small scale hand
Willis, George Red Devil Alice & Bessie Mine	Parks Property Kuskokwim	1	Small mercury operation
Withrow, Alfred W. Bettles Field	Koyukuk River Fairbanks	1	Small scale hand
Wiurm, Andrew Box 491, Nome	Dome Creek Cape Nome	1	Hydraulic
Woodman, I.N. Box 573, Valdez	Tonsina Lake area Valdez	1	Prospecting
Worthington, John	Prince of Wales Island Ketchikan	2	Prospecting
Zaiser, Clarence Ruby	Greenstone Creek Nulato	2	Nonfloat

Zimin, Nick South Naknek	Alaska Peninsula & Bristol Bay District	1	Prospecting
Zukoev, James	Bonnifield District Nenana	1	Nonfloat

"Nonfloat" indicates mechanical placer gold operation using draglines and/or bulldozers to transport gravel to nonfloating washing plant, bedrock sluiceboxes, or elevated sluices.

"Hydraulic" indicates placer gold operation in which gravel is excavated and transported to sluiceboxes solely by water jets from hydraulic nozzles.

"Small scale hand" indicates placer gold operation in which gravel excavation and transportation is accomplished by hand or ground sluicing.

OIL AND GAS COMPANIES ACTIVE DURING 1964

Name and Alaskan Address of Company	Home or Regional Office	Type of Activity
Allied Chemical Corp.	P.O. Box 2120, Houston	Drilling
American Petrofina Expl. Co. P.O. Box 4-T, Anchorage		Geophysical field party
Atlantic Refining Company P.O. Box 59, Anchorage	P.O. Box 2819 Dallas	Geophysical field party
British American Oil Producing Co., 426 Eagle St., Anchorage	Mercantile-Dallas Bldg. Box 749, Dallas	Geophysical
British Petroleum Exploration Co. (Alaska), Inc.	620 5th Avenue New York City	Geologic field party geophysical, drilling
Cities Service Oil Company	Bartlesville, Okla.	Geologic field party
Colorado Oil and Gas Corp.	Box 749, Denver	Drilling, geophysical
Humble Oil & Refining Co. 326 H St., Anchorage	612 S. Flower St. Los Angeles, Calif.	Drilling, geophysical
Marathon Oil Company 259 W. Fireweed, Anchorage	550 S. Flower St. Los Angeles, Calif.	Geophysical, drilling
Mobil Oil Company Box 1734, Anchorage	612 S. Flower St. Los Angeles, Calif.	Geophysical, drilling
Pan American Petroleum Corp. 1829 E. 5th, Anchorage	Box 591, Tulsa	Geophysical, geologic field party, drilling
Phillips Petroleum Corp. Box 419, Anchorage	Bartlesville, Okla.	Geologic field party, geophysical, drilling
Pure Oil Company Box 1651, Anchorage	35 East Wacker Drive Chicago, Illinois	Geologic field party, geophysical, drilling
Richfield Oil Corp. Box 2241, Anchorage	555 S. Flower St. Los Angeles, Calif.	Drilling, geophysical, geologic field party
Shell Oil Company 5th & E St., Anchorage	Suite 1055 Dexter Horton Bldg. Seattle, Washington	Geologic field party, geophysical, drilling

Sinclair Oil and Gas Company Box 584, Anchorage	Box 521 Tulsa, Okla.	Geologic field party, geophysical, drilling
Skelly Oil Company Box 1314, Anchorage	Box 1650 Tulsa, Okla.	Geophysical, Drilling
James H. Snowden	750 W. 5th Street Fort Worth, Texas	Drilling
Standard Oil Co. of California Box 7-839, Anchorage	225 Bush Street Standard Oil Building San Francisco, Calif.	Production, drilling geologic field party, geophysical, refining
Superior Oil Company Box 1167, Anchorage	550 S. Flower St. or Box 3015 Terminal Annex Los Angeles, Calif.	Geologic field party, geophysical, drilling
Texaco, Inc. Box 664, Anchorage	3350 Wilshire Blvd. Los Angeles, Calif.	Geophysical, geologic field party
Union Oil Co. of California 2805 Denali, Anchorage	Union Oil Center Los Angeles	Drilling, Geophysical, production

ACTIVE COAL MINES, 1964

Name and Address of Operator	Location of Mines & Coal Field	Type of Operation	Approx. Crew
Alaska Matanuska Coal Co. (Paul Omlin) Box 13, Palmer	Premier Mine Matanuska Field	Strip	3
Evan Jones Coal Co. Box 619, Anchorage or Jonesville	Jonesville Matanuska Field	Strip	68
Mrak Coal Co. Box 16, Sutton	Near Eska Matanuska Field	Strip	32
Usibelli Coal Mines, Inc. Usibelli	Healy Creek Nenana Field	Strip	77
Vitro Minerals Corp. Box 1070, Fairbanks	Healy Creek Nenana Field	Strip	34
Yutan Const. Co. (Jas. A. Carroll) Box 1775, Fairbanks	Lignite Nenana Field	Strip	4

Note: Above data from DM&M records.

LIST OF REPORTS ISSUED BY THE DIVISION OF MINES AND MINERALS AND CORRESPONDING PRECEDING AGENCIES

*Report of the Mine Inspector for the Territory of Alaska to the Secretary of the Interior, fiscal year ended June 30, 1912.

*Report of the Mine Inspector for the Territory of Alaska to the Secretary of the Interior, fiscal year ended June 30, 1913.

*Report of the Mine Inspector for the Territory of Alaska to the Secretary of the Interior, fiscal year ended June 30, 1914.

*Report of the Territorial Mine Inspector to the Governor of Alaska for the year 1915.

*Report of William Maloney, Territorial Mine Inspector, to the Governor of Alaska for the year 1916.

*Report of the Territorial Mine Inspector to the Governor of Alaska for the year 1917.

*Annual Report of the Territorial Mine Inspector to the Governor of Alaska, 1920.

*Annual Report of the Territorial Mine Inspector to the Governor of Alaska, 1921.

*Annual Report of the Mine Inspector to the Governor of Alaska, 1922.

*Annual Report of the Mine Inspector to the Governor of Alaska, 1923.

*Report upon Industrial Accidents, Compensation and Insurance in Alaska for the biennium ending December 31, 1924.

*Report of the Territorial Mine Inspector, calendar years 1925-26.

*Report of cooperation between the Territory of Alaska and the United States in making mining investigations and in the inspection of mines for the biennium ending March 31, 1929.

*Report of cooperation between the Territory of Alaska and the United States in making mining investigations and in the inspection of mines for the biennium ending March 13, 1931.

*Mining investigations and mine inspection in Alaska, biennium ending March 31, 1933.

*Report of the Commissioner of Mines to the Governor, biennium ending December 31, 1936.

*Report of the Commissioner of Mines to the Governor, biennium ending December 31, 1938.

*Report of the Commissioner of Mines to the Governor, biennium ending December 31, 1940.

*Report of the Commissioner of Mines to the Governor, two biennia ended December 31, 1944.

*Report of the Commissioner of Mines, biennium ended December 31, 1946.

*Report of the Commissioner of Mines, biennium ended December 31, 1948.

*Report of the Commissioner of Mines, biennium ended December 31, 1950.

*Report of the Commissioner of Mines, biennium ended December 31, 1952.

*Report of the Commissioner of Mines, biennium ended December 31, 1954.

*Report of the Commissioner of Mines, biennium ended December 31, 1956.

*Report of the Commissioner of Mines, biennium ended December 31, 1958.

*Report of the Division of Mines and Minerals for the year 1959.

Report of the Division of Mines and Minerals for the year 1960.

Report of the Division of Mines and Minerals for the year 1961.

Report of the Division of Mines and Minerals for the year 1962.

Report of the Division of Mines and Minerals for the year 1963.

*Joesting, Henry R., Strategic Mineral Occurrences in Interior Alaska, Pamphlet No. 1, May 1942.

*Joesting, Henry R., Supplemental to Pamphlet No. 1 - Strategic Mineral Occurrences in Interior Alaska; Pamphlet No. 2, March 1943.

*Anderson, Eskil, Mineral Occurrences other than Gold Deposits in Northwestern Alaska: Pamphlet No. 5-R, May 1944.

*Stewart, R.L., Prospecting in Alaska (26-page pamphlet), December 1944. (Revised to November 1949).

*Glover, A.E., Industrial Minerals as a Field for Prospecting in Alaska, including A Glossary of Elements and Minerals (82-page booklet)March 1945. (Revised to May 1946).

*Anderson, Eskil, Asbestos and Jade Occurrences in the Kobuk River region, Alaska: Pamphlet No. 3-R, May 1945.

*Roehm, J.C., Some High Calcium Limestone Deposits in Southeastern Alaska: Pamphlet No. 6, March 1946. Mimeographed copies are available.

Proper Claim Staking in Alaska; Information Circular No. 1, May 11, 1964.

Rights of Canadians in Alaska under the Mining Laws; Information Circular No. 2, September 15, 1953.

Hand Placer Mining Methods; Information Circular No. 3, April 16, 1962.

*Alaska Uranium Information; Information Circular No. 4, March 15, 1955.

General Alaskan Mineral Information; Information Circular No. 5, February 10, 1964.

Alaskan Prospecting Information; Information Circular No. 6, May 27, 1964.

*Compulsory Assessment Work Affidavits; Information Circular No. 7, July 15, 1957.

Mineral Industry Consultants Available for Work in Alaska; Information Circular No. 8, December 18, 1964.

Dealers in Alaskan Rocks and Minerals; Information Circular No. 9, April 6, 1964.

Skin Diving for Gold in Alaska; Information Circular No. 10, November 5, 1964.

List of DM&M Publications; Information Circular No. 11, December 21, 1964.

Services of the Division of Mines and Minerals; Information Circular No. 12, November 20, 1964.

Dangers in Old Mine Openings; Information Circular No. 13, November 6, 1962.

Mining Laws Applicable in Alaska, Information Circular No. 14, July 10, 1964.

Race, William H., The Mineral Industry of the Kenai-Cook Inlet-Susitna Regions, 1962.

Report No. PE 85-22; Report on Preliminary Investigation of the Kings River Area Limestone Deposits, Anchorage Quadrangle, by Martin W. Jasper and Miro Mihelich, State Mining Engineers, January 1961.

Report No. PE 65-1; Report on the Mespelt Mine of Strandberg Mines, Inc., Nixon Fork District, Medfra Quadrangle, Alaska, by Martin W. Jasper, State Mining Engineer, February 1961.

Alaska's New Mining Law for State Lands, by James A. Williams, Director, State Division of Mines and Minerals, December 1961 (Reprinted from Mining Engineering Magazine).

Geology and Ore Deposits of Alaska, by Gordon Herreid, Geologist, State Division of Mines and Minerals, December 1961 (Reprinted from Mining Engineering Magazine).

Tectonics and Ore Deposits in Alaska, by Gordon Herreid, Mining Geologist, State Division of Mines and Minerals, Presented at the 1964 Alaska AIME Conference, College, Alaska, March 19, 1964.

A Possible Guide to Metal Deposits of Alaska, by Charles F. Herbert, Deputy Commissioner, State Department of Natural Resources. Presented at the 1964 Alaska AIME Conference, College, Alaska, March 20, 1964.

Map: Better-Known Mineral Deposits, Possible Petroleum Provinces, and Existing and Proposed Roads

Map: M.I. Report No. 194-1; A Preliminary Map of the Bedrock Geology of the Fairbanks Mining District, Alaska, by Robert B. Forbes and Jim M. Brown, Department of Geology, College of Earth Science and Mineral Industries, University of Alaska for the Division of Mines and Minerals, December 1961. Price: $1.00

Geochemical Investigations of Selected Areas in Southeastern Alaska, by C.F. Herbert and W.H. Race, November 1964. (27 pages plus numerous maps and tables) Price. $1.00.

Preliminary Report on Geologic Mapping in the Coast Range Mineral Belt, by Gordon Herreid. This report included in Annual Report of the Division of Mines and Minerals for the year 1962. No charge. Very limited supply.

Geologic Report #2: Bedrock Geology of the Rainbow Mountain Area, Alaska Range, Alaska; an M.S. thesis prepared by Larry G. Hanson of the University of Alaska in cooperation with the Division of Mines and Minerals. Price $2.00

Geologic Report #3: Geology of the Portage Creek-Susitna River Area, by Donald H. Richter, 1963. (2 large sheets) Price $1.00

Geologic Report #4: Geology and Mineral Deposits of the Denali-Maclaren River Area, Alaska, by M.A. Kaufman, May 1964. (19 pages plus large map) Price $1.00

Geologic Report #5: Geology of the Niblack Anchorage Area, Southeastern Alaska by Gordon Herreid, May 1964. (10 pages plus large map) Price $1.00

Geologic Report #6: Geology and Mineral Deposits of the Ahtell Creek Area, Slana District, Southcentral Alaska, by Donald H. Richter, May 1964. (17 pages plus large map) Price $1.00

Geologic Report #7: Geology of the Dry Pass Area, Southeastern Alaska, by Gordon Herreid and M.A. Kaufman, June 1964. (16 pages) Price $1.00

Geologic Report #8: Geology of the Paint River Area, Iliamna Quadrangle, Alaska, by D.H. Richter and G. Herreid, January 1965. Price $1.00

The Great Alaska Earthquake, March 27, 1964: May 19, 1964.

Mine Safety Regulations, 1963, from the Alaska Administrative Code.

Oil and Gas Conservation Regulations and Statute, 1964, from the Alaska Administrative Code, and Alaska Statutes.

*Out of Print. On file in certain public and university libraries.