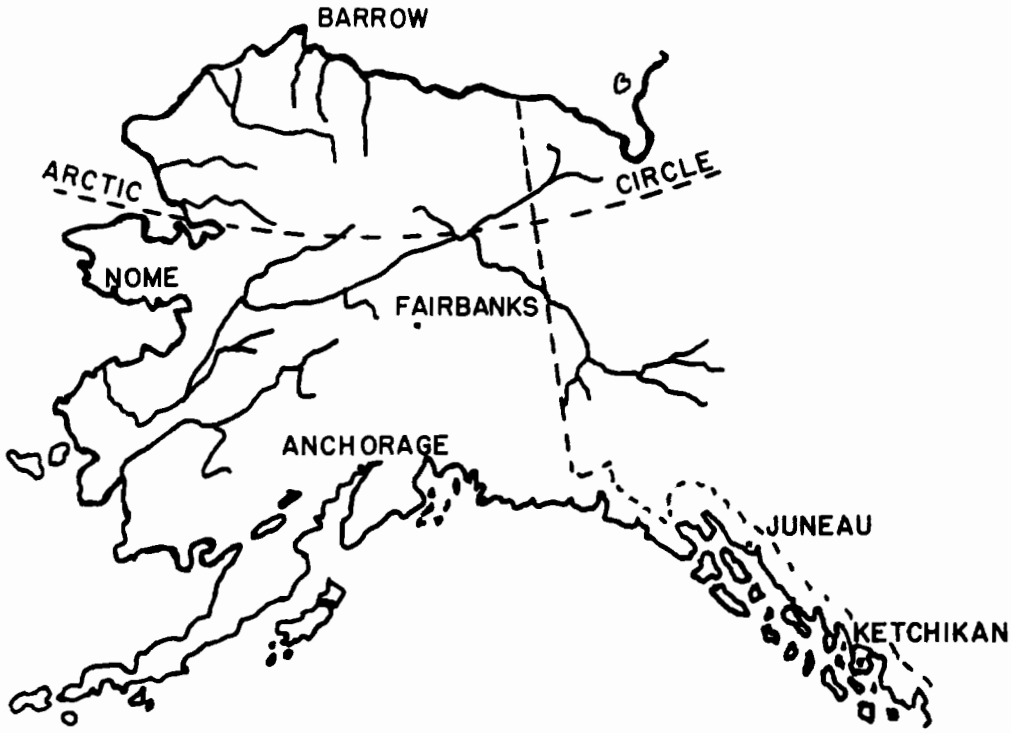
STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES



DIVISION OF MINES AND MINERALS

REPORT
FOR THE YEAR

1966

JUNEAU, ALASKA

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GEOLOGICAL SURVEY

STATE OF ALASKA

Walter J. Hickel - Governor

Department of Natural Resources

Phil R. Holdsworth - Commissioner

DIVISION OF MINES AND MINERALS

James A. Williams - Director

REPORT

FOR THE YEAR

1966

Juneau, Alaska

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December 31, 1966

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Juneau, Alaska 99801

Dear Sir:

It is a pleasure to transmit to you this Annual Report of the Division of Mines and Minerals covering the calendar year 1966. Summaries of mineral and petroleum production, exploration, and developments during the year are outlined. 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 and petroleum regulatory work are briefly described.

Each year continues to be more significant than the previous one for the Alaska petroleum industry. More exploratory drilling was done than before, and of 42 active wildcat wells, five came in as oil wells and two as gas wells. As a result of these successful wildcats and the drilling of development wells, several fields were extended. Alaska is now seventh among the States in oil reserves and eighth in gas reserves. At the close of the year, six offshore platforms were active in Cook Inlet, and three fields were connected with shore facilities by pipelines. More than $169 million was spent by the industry in Alaskan exploration, development, and construction, exclusive of marketing and sales activities. Oil and gas production increased to $50 million for the year.

A firm metal market, increasing exploration work by major mining companies, and increased inquiries from all quarters show that mining is reviving in Alaska.

Direct revenue to the State from minerals totaled more than $19 million in 1966. Better years lie immediately ahead.

This Division will continue to foster and assist the growth of the minerals industries.

Respectfully submitted,

James A. Williams

James A. Williams, Director
Division of Mines and Minerals
Pouch M, Juneau, Alaska 99801

CONTENTS

CONTENTS (Con't)

Tables, Figures and Maps

CONTENTS (Con't)

THE MINING INDUSTRY

Mineral Production

Table I presents a comparison of mineral production during 1965 and 1966. During 1966 total mineral production was estimated to be $84.9 million compared to $83.2 million in 1965, an increase of 2%. While sand and gravel production dropped from $34.5 million to $20.7 million, a decline of 40%, oil and gas production increased from $35.6 million to $50.2 million, a jump of 41%. Coal production is estimated to have varied little from the previous year. The cumulative total mineral production of Alaska is now $1,728,000,000.

Revenue to the State from mineral production and exploration, which includes royalties, filing fees, lease rentals, production taxes, and the sale of sand and gravel, amounted to approximately $19,500,000 in 1966. This does not include individual income taxes and business license taxes from the mineral industry and service groups.

Table I - Mineral Production in Alaska

	1965		1966 (1)	
	Quantity	Value (Thousands)	Quantity	Value (Thousands)
Antimony----short tons antimony content	1	1	7.7	3
Coal----------thousand short tons	893	6,095	900	6,100
Copper - short tons recoverable content	32	23	W	W
Gold----------thousand troy ounces	42	1,479	31	1,093
Lead-----short tons recoverable content	9	3	W	W
Mercury----------76-pound flasks	W	W	238	101
Natural Gas---------million cubic feet	6,254(2)	1,541	33,646 (2)	6,162
Peat----------short tons	1,967	16	W	W
Petroleum, crude-------thousand barrels	11,128 (3)	34,073	14,376 (3)	44,083
Sand and Gravel-----thousand short tons	30,266	34,367	17,556	20,713
Silver----------thousand troy ounces	8	10	16	20
Undistributed (4)		5,489		6,615
		$83,197		$84,890

(1) Figures for 1966 are preliminary and subject to revision.
(2) Includes only gas sold. An additional 5,189 (1965) and 8,008 (1966) million Cf of gas was used on leases for pressure maintenance and power, or was unavoidably lost. Please refer to Table XIII and other petroleum statistics for details.
(3) Includes only oil sold. Additional small amounts were produced during testing of new wells.
(4) Undistributed includes gem stones, platinum group metals, uranium ore, barite, clay, copper, lead, and peat.
W Withheld and included under "Undistributed" to avoid disclosing individual company confidential data.

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.

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

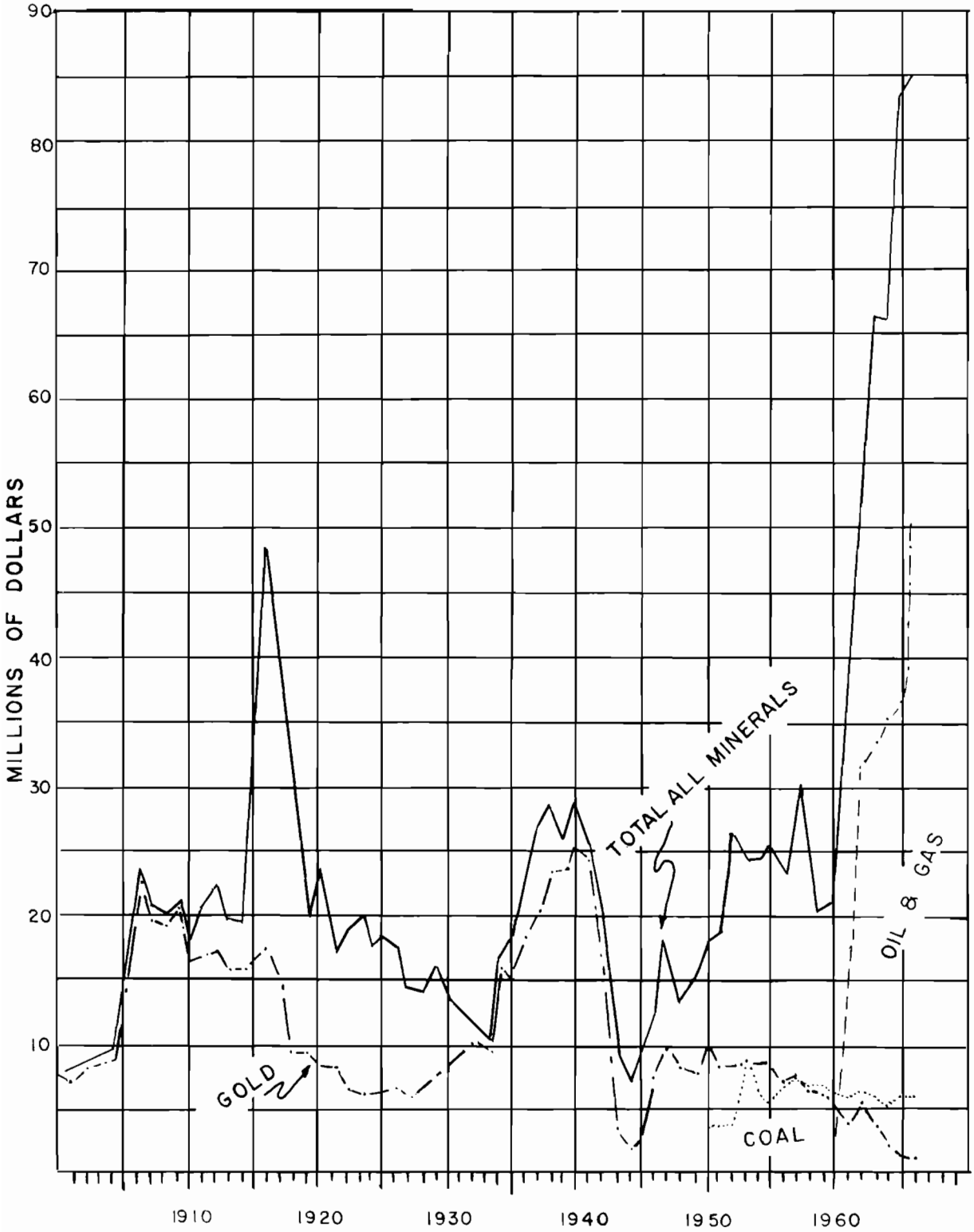
Year	Gold	Mercury	Coal	Oil and Gas	Total All Production (Millions)
1950	$ 10,125	$	$ 3,033	$	$ 17.9
1951	8,387		3,767		19.5
1952	8,420	6	5,779		26.3
1953	8,882	8	8,452		24.3
1954	8,699	277	6,442		24.4
1955	8,725	12	5,759		25.4
1956	7,325	853	6,374		23.4
1957	7,541	1,349	7,296		30.2
1958	6,525	774	6,931		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	2,045	95	5,008	35,490	66.1
1965	1,479	104	6,095	35,614	83.2
1966	1,093	101	6,100	50,245	84.9
	$104,662	$6,973	$102,410	$206,349	$645.6

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

Mineral	Quantity	Years
Total gold----------troy ounces	29,897,000	1880-1966
placer----------do----	20,987,000	1882-1966
lode----------do----	8,909,000	
Total silver----------do----	19,064,765	1906-1966
placer----------do----	2,545,000	1906-1966
lode----------do----	16,504,000	1900-1966
Copper----------short tons	690,011	1880-1966
Coal----------do----	18,889,000	1951-1966
Sand and gravel----------do----	153,923,000	1958-1966
Crude Petroleum----------42 gal bbls	50,849,000	1958-1966
Natural gas----------million ft^3	66,821	1948-1966
Stone----------short tons	10,893,000	1921-1966
Mercury----------76-lb flasks	34,838	1902-1966
Tin----------short tons	2,400	
Chromite (approx. 45% CR_2O_3) long tons	29,000	1917-1966
Tungsten short ton units WO_3	7,000	1916-1966
Antimony (approx. 53% Sb) short tons	3,423	1928-1966
Lead----------do----	25,000	1906-1966

(1) Except platinum, uranium, barite, and other commodity figures which are confidential. 1966 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 there.

Figure 1 - Annual Value of All Mineral Production - Alaska 1900 - 1965



Precious Metals

Gold production continued to decline and is expected to decline further unless some assistance in the form of a price increase or subsidy is forthcoming.

A 1 1/2 cubic foot dredge was moved during the year from Nyac to Marvel Creek by the Marvel Creek Mining Company and placed in operation. The U.S. Smelting, Refining and Mining Company operated its dredges on the Hogatza River in the Kuskokwim and Mosquito Fork of the Fortymile. Keystone Mines and Busty Belle Mines were active in the Fairbanks area. The total number of units as well as people engaged in placer mining are estimated to have remained the same during 1966.

Goodnews Bay Mining Company was again the only primary producer of platinum in the United States. It is expected to continue dredging near Platinum, Alaska during 1967.

There were 660 gold lode and placer claims staked during 1966 compared to 409 the previous year. Affidavits of annual assessment work were filed on 4497 claims compared to 4723 during 1965, indicating that while more claims were staked there were fewer held in good standing so overall interest in gold did not accelerate during the year.

Base Metals

Mercury production during 1966 was limited to several small-scale operations and is not expected to increase unless the Red Devil Mine is reactivated. Efforts to start a new exploration project at Red Devil are continuing. Robert Lyman mined the White Mountain Mercury deposit near McGrath, and several individuals engaged in developing prospects near Sleetmute produced a few flasks of mercury.

Antimony and lead in small amounts were shipped from the Fairbanks area and some copper concentrate was shipped from the McCarthy area where talus deposits were being mined.

Nonmetallics

A new barite mining operation was started during the year which resulted in approximately 50,000 tons of ore being shipped to Texas via ore carrier from Castle Island in Duncan Canal near Petersburg. Production is expected to continue through the next year and possibly longer.

Sand and gravel production decreased from $34.5 million to $20.7 million, reflecting the end of the earthquake reconstruction and less road construction.

Small amounts of jade and peat were produced for local markets.

The Kendrick Bay Uranium mine did not operate during the year because of the lack of a contract with mills under contract with the Atomic Energy Commission.

Coal

Coal production for the year is estimated to be 900,000 tons compared to 893,000 tons during 1965. The Nenana (Healy River) coal field was the most productive and supplied coal to military bases as well as for the Fairbanks market. A mine-mouth power plant was under construction near the field, and contracts were let for a 138,000 volt transmission line to Fairbanks. Operators in the Nenana field were Usibelli Coal Mine, Inc. and Vitro Minerals Corporation, while the Matanuska field was mined by Evan Jones Coal Company and Paul Omlin.

Interest in coking coal for export is still high. However, little development or testing occurred other than that accomplished by the U.S. Bureau of Mines. The Bureau drilled a promising area near the Kukpowruk River in northwest Alaska and intersected four coal beds between 50 and 200 feet in depth. Unweathered samples were taken for coking analyses and to learn more of the weathering of coal in permafrost areas. If these samples should indicate that the coal is self-coking, it will become more desirable. Surface samples have indicated in testing to date that the coal would produce satisfactory coke only if blended with other strong coking coal.

Prospecting and Exploration

Northwestern

It is estimated that $1,150,000 was spent in prospecting, exploration, and development in this area. Most of this was by Kennecott Copper Corporation and its exploration subsidiary Bear Creek Mining Company

Kennecott Copper Corporation at Bornite, Alaska reached a depth of 1070 feet and encountered water flooding, which is being overcome by cement and additional pumps. Lateral underground development of the copper ore body is programmed to be done from two levels during 1967. Transportation facilities are being readied for increased freight handling by barge and road.

Bear Creek Mining Company is exploring other ore bodies in the vicinity of Bornite and Kiana, and plans to continue the work.

Offshore prospecting permit areas were investigated in the vicinity of Nome and a great deal of research was done on sampling equipment for use in the area by Shell Oil Company. Martin Dredging, Inc., assembled and tested a ten-inch suction dredge on their offshore lands.

The Lee Brothers recovered several tons of tin while experimenting with tin saving equipment.

Rhiny Berg and crew prospected in the vicinity of the Kugruk River.

Bunker Hill Mining Company of Idaho drilled a lead-silver property on the Seward Peninsula and is expected to continue this program next year.

Mining claims staked in the Second Division during the year totaled 143.

Central

The Tennessee Corporation became the operating company on the Pass Creek copper deposit north of the Denali Highway that Moneta Porcupine Mines Ltd, and Dome Mines Ltd. have been investigating. Additional drilling and trenching were done. The work will probably continue.

Keystone Mines Inc. continued developing and production of its gold lode deposits near Fairbanks.

Hanna Mining Company took an option on the Buzby copper prospect on Wood River and plans to continue its program of general reconnaissance prospecting.

The old Liberty Bell gold mine in the Bonnifield District was drilled by United Geophysical Company for a Portland firm. Boyd Blair of Fairbanks is the property owner.

U.S. Smelting, Refining & Mining Company did some reconnaissance prospecting. Reconnaissance work was also done by Bear Creek Mining Company in Central Alaska.

Carl Springer, President, Highland-Bell Ltd. and a helicopter-supported prospecting crew looked for porphyry copper deposits in the White River area.

Phelps Dod ge Corporation of Canada Ltd., and several individuals prospected in the Slana area. It is estimated that approximately $200,000 was spent in the central region of Alaska.

Estimated expenditures for prospecting and exploration in this region is $80,000. This amount is accounted for by individuals and small local organizations rather than by larger company exploration.

Southwestern

Over a million dollars was probably spent on exploration and prospecting on the Alaska Peninsula and Lake Clark areas. Pan American Petroleum continued their minerals exploration program on a smaller scale. Sinclair Oil Company investigated several prospects staked in recent years by various prospecting groups.

St. Eugene Mining Company, a Falconbridge subsidiary, did additional geophysical and geological work at their large copper prospect north of Lake Iliamna on Kasna Creek. This is a very promising property, but a major concern is the lack of transportation.

In addition to these larger organized operations, several small groups were active in the Iliamna-Lake Clark area.

Western

Some prospecting was done in the vicinity of the Red Devil Mine where an effort is being made to start a new exploration project. A small amount of mercury was produced as a result of continued development of other prospects in the vicinity. It is estimated that less than $100,000 was spent in prospecting and exploration in this area.

Southeastern

Approximately $300,000 was spent in southeastern Alaska during 1966. There were 577 claims staked.

Cambridge Mining Corporation, Ltd., drilled the Seal Cove copper deposit on the south end of Gravina Island near Ketchikan.

Geo-X Surveys Ltd., drilled a copper show near the old Jumbo Mine on Hetta Inlet, Prince of Wales Island.

American Exploration and Mining Company drilled the Nunatak copper-molybdenum prospect in Muir Inlet in Glacier Bay National Monument.

James Walper staked 300 claims on McLean Arm on the southeast shore of Prince of Wales Island.

U.S. Steel Corporation drilled some of their iron placer ground near Klukwan north of Haines.

Bear Creek Mining Company and Anaconda American Brass Company both had geological and geochemical crews.

Several individuals representing various companies looked at old prospects.

General

It is estimated that a total of $2,645,000 was spent in Alaska during 1966 for hard-rock prospecting and exploration. This activity is expected to increase next year because most metal prices are firm and the grade of ore now considered economical for large scale mining is rapidly approaching the grade of several large copper-nickel deposits in south-

eastern Alaska. In addition to these possibilities, Canadian exploration companies active in recent years on the west coast of British Columbia are now appearing more frequently on this side of the border.

The U.S. Geological Survey spent approximately $3,500,000 in Alaska during the year. Its work consisted of geologic mapping, topographic mapping, water resource studies, earthquake studies, glacial investigations, and regulatory work pertaining to the conservation of oil, gas, and coal on federal land. In addition to these functions a new heavy metal investigation program was begun. The first area to be investigated under this program was the Glacier Bay National Monument, where an intensive geologic and geochemical investigation was made. This particular program is to be enlarged in other areas during the coming year. New U.S.G.S. publications pertaining to Alaska released during 1966 are:

Bulletin 1198-F, Phytoecology of a Greenstone Habitat at Eagle, Alaska, by H.G. Shacklette.

Bulletin 1202-C, Geology and Coal Resources of the Beluga-Yentna Region, Alaska, by F.F. Barnes.

Open File Report, Oil Yield and Chemical Composition of Shale from Northern Alaska, by H.A. Tourtelot and I.L. Tailleur.

Open File Report, Results of Stream Sediment Sampling in the Iliamna Quadrangle, Alaska, by B.L. Reed and R.L. Detterman.

Open File Report, Geologic Map and Stratigraphic Sections, Porcupine River Canyon, Alaska, by W.P. Brosge, H.N. Reiser, J.T. Dutro, Jr., and Michael Churkin, Jr.

Open File Report, Map of Geologic Materials, Anchorage and Vicinity, Alaska, by Earnest Dobrovolny and Henry R. Schmoll.

Open File Report, Outcrop/Geologic Maps of the Nuka-Etivluk Region, Northern Alaska, by I.L. Tailleur,B.G. Kent, Jr., and H.N. Reiser.

Open File Report, Strike-Slip Faults in Alaska, by Arthur Grantz.

Professional Papers 302-D, 398-A, 525-A & D, and 550-C, released during 1966 also contained short chapterspertaining to Alaska.

Professional Papers 542-C & D, 543-A & C, and 544 A & B, were released as separte publications as part of the Alaska Earthquake series.

The U.S. Bureau of Mines appropriation for fiscal year 1967 was approximately $492,000, all of which was earmarked for mineral industry and resource development investigations throughout Alaska. Subsurface samples were obtained at depths of 50 to 200 feet from a 20-foot thick seam of high-rank bituminous coal in the Kukpowruk River valley to determine the effects (if any) of permafrost and weathering on coking characteristics of the coal. Laboratory testing of the subsurface samples was in progress at years-end. Other field investigations included continuation of the examination and sampling of deposits of mercury in the Kuskokwim River Basin, nonmetallic industrial materials near Rampart, and a reconnaissance of selected lode and placer gold deposits throughout the State. Economic studies and laboratory services were provided as required in support of the mineral resource development program. Token surveys of the extent and effects of strip and surface mining and of the disposal of solid waste of the mineral industry in Alaska were made as a part of national studies of these problems. The Bureau staff also compiled statistics and other pertinent data for the annual Minerals Yearbook.

Reports pertaining to Alaska were relased by the U.S. Bureau of Mines as follows:

Open-File Report: "Investigation of the Purkeypile Prospects, Kuskokwim River Basin, Alaska", by R.P. Maloney and Bruce I. Thomas.

Open-File Report: "Investigation of the Nixon Fork Area, Kuskokwim River Basin Alaska", by Raymond P. Maloney.

Open-File Report: "Investigation of the Baily Copper Prospect, Willow Creek Mining District, South-Central Alaska", by Raymond P. Maloney.

Open-File Report: "Sampling and Coking Studies of Coal from Castle Mountain Mine, Matanuska Coal field, Alaska", by Robert S. Warfield, W.S. Landers, and Charles C. Boley.

Report of Investigations No. 6767: "Sampling and Coking Studies of Coal from the Kukpowruk River Area, Arctic Northwestern Alaska", by Robert S. Warfield, W.S. Landers, and Charles C. Boley.

Prospecting Costs

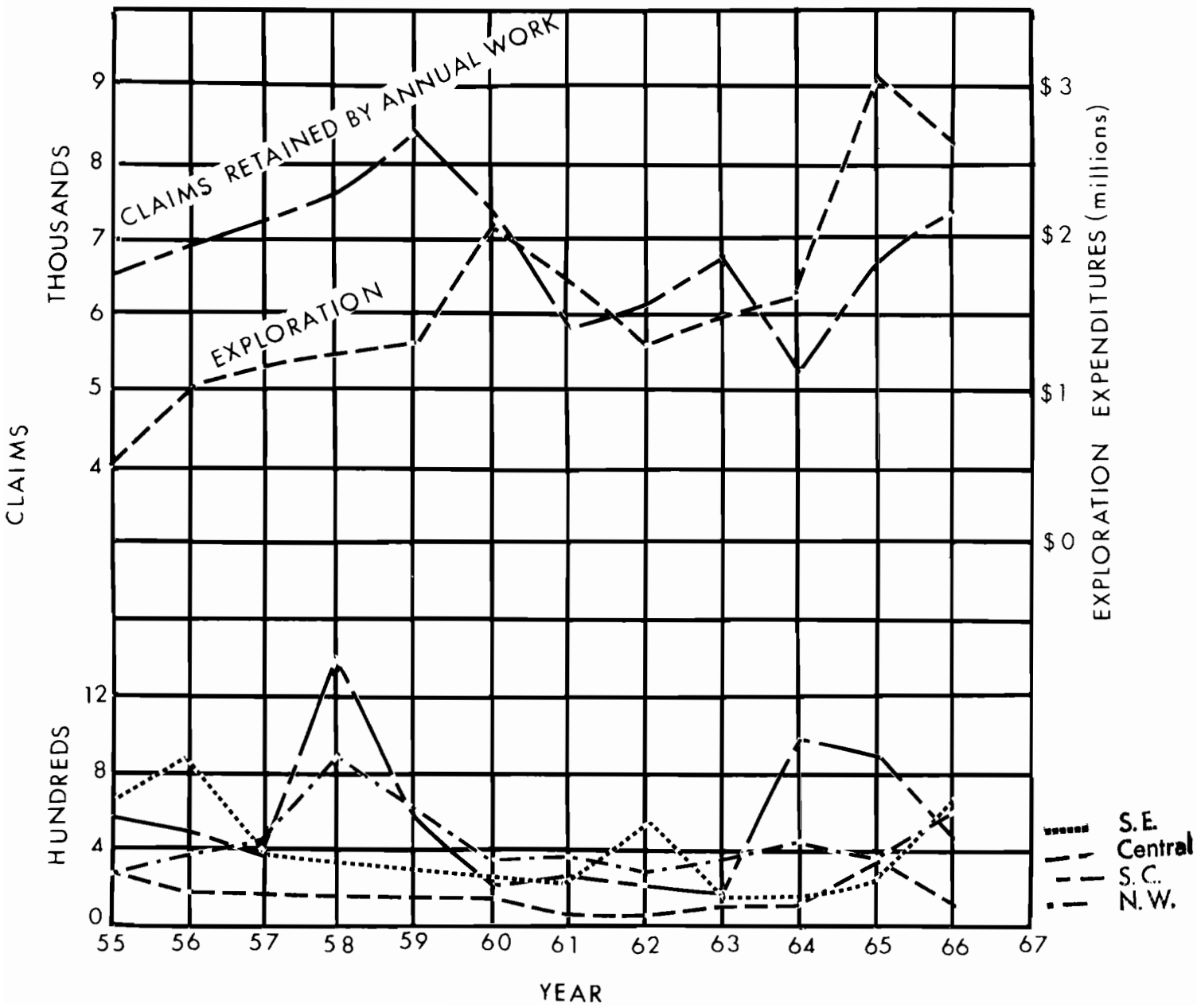
Prospecting costs derived from four years' expenses incurred by participants in the State Prospector Assistance Program averaged $20.15 per man day. A total of $63,193,74 was spent over the four year period covering 3136 man days. The cost to the State was less than 75% of the total. Cost distribution was as follows:

Transportation	$8.69 per man day
Food	3.72 " " "
Supplies	7.74 " " "
	$20.15

Transportation includes aircraft charter, helicopter charter, tracked vehicles and rubber tired equipment. Food costs include ordinary groceries as well as the dry pack camping packages. Supplies include tents, tools, equipment rental, fuel, and general supplies.

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

Figure 2 - Barometer of Exploration Activity



THE PETROLEUM INDUSTRY

Oil and Gas Exploration

(See Table V for specific details on wells and the list in the back of this volume for active companies)

This has been the most active year in Alaska's history of exploratory drilling. With the 38 wildcats that were spudded and the four that were drilling at the start of the year, there were 42 exploratory wells active during 1966. This exploration resulted in five oil wells, two gas wells, 25 dry holes, five suspended wells, and five wells still actively drilling at the close of the year. Of the 42 exploratory wells drilled, 19 were on upland locations and 23 were offshore operations in Cook Inlet.

The oil and gas discoveries were all in the Cook Inlet basin; the oil wells were offshore, and the gas wells drilled onshore on the west side of Cook Inlet. The oil discoveries were all located in the McArthur River and Trading Bay areas and appeared to be major extensions of these fields. The McArthur River Field was extended northeast and northwest when the Atlantic Richfield Company completed the #1 McArthur State and the #3 West Foreland Unit. The Union Oil Company of California completed a four mile stepout to the south at the #1-A Kustatan; and Pan American Petroleum Corporation was successful at the #1 North Redoubt State, a southeast extension. The McArthur Field promises to be one of the larger producing areas in Cook Inlet, and development is expected to begin in 1967.

Texaco, Inc. extended the Trading Bay Field northeastward when the #1 Trading Bay State was completed, and it accounted for one of the gas discoveries at the #1 Nicolai Creek. Standard Oil Company of California drilled and completed the other gas discovery at the #44-1 Ivan River.

The first exploratory drilling south of the Forelands in Cook Inlet waters started in 1966. The activity centered around Kalgin Island where Hunt Oil Company abandoned two wells and staked a location for a third one. Texaco abandoned the #1 Coal Bay State in Kachemak Bay, and the west side of Cook Inlet was tested without success by the Atlantic Richfield #1 Drift River State. Pan American suspended the #1 Redoubt Shoal State just south of the Forelands.

On the North Arctic Slope, Sinclair Oil & Gas Company abandoned the #1 Colville, Atlantic Richfield Company was preparing to abandon the #1 Susie Unit, and Union Oil Company of California was drilling ahead at the #1 Kookpuk. In the Bristol Bay Province, Great Basins Petroleum Company abandoned the #1 Ugashik while Cities Service Oil Company prepared the location for the #1 Painter Creek. The Atlantic Richfield Company abandoned the #2 Rainbow Federal in the Copper River basin.

Geophysical exploration was concentrated in the Cook Inlet, Bristol Bay, and Gulf of Alaska with some work being done in the Kuskokwim Bay area. Geological field parties were especially active in the lower Cook Inlet area.

Middleton Island in the Gulf of Alaska claimed the limelight in competitive lease sales. The range of prices for the offshore tracts around the island indicates that exploratory drilling can be expected soon.

Development Drilling and Production Activity

Twenty-three development wells were active during 1966 of which 21 were offshore operations in Cook Inlet. The development drilling resulted in ten oil wells, two gas wells, one suspended well, one dry hole, and nine wells still active.

Eight oil wells were completed in the Middle Ground Shoal Field and one oil well each in the Trading Bay and the Granite Point Fields. A gas well was completed in the Nicolai Creek Field and one in the Cook Inlet Field.

Noteworthy offshore progress was made in the construction of production facilities and pipelines. At the beginning of the year, there were only two active drilling-producing platforms with two development wells being drilled and one dual pipeline outlet to shore. At the end of the year, there were six active drilling-producing platforms, eight development wells drilling, and three fields connected to the shore with dual pipelines. There were about 14.5 miles of eight-inch pipeline under Cook Inlet at the start of the year, and now there are about 45.5 miles of eight-inch and 38 miles of ten-inch line. Since none of these added facilities contributed to 1966 production, there will be a marked increase in 1967 production. At least four more platforms are planned for 1967, and the McArthur River Field pipeline is scheduled for construction.

Automatic custody transfer facilities are metering 100 percent of the State's production at this time. Onshore storage and treatment facilities are being installed for each platform operation, and runs from these will be made through LACT equipment.

One sub-sea type completion has been made in the Inlet, but operations have been suspended pending installation of a platform for separation and metering of production.

Development drilling has indicated relatively high productive rates, and 1,500 barrels per day per well is not uncommon. Oil production is climbing rapidly as development wells are now being completed on a year-round basis from permanent producing platforms in Cook Inlet. Based on proved reserves, the State's stature as a major oil-producing state is assured. Of the 31 oil-producing states, Alaska now ranks 16th in oil production rate, seventh in reserves, and first in average production per well.

Outside of the Naval Petroleum Reserve, the State now has six oil fields, of which two are producing, and 13 gas fields with three in production. The industry is planning for five oil fields to be producing by the end of 1967, but gas production from additional fields is not anticipated until 1968 or 1969. The completion of a large ammonia and urea plant near Kenai, the construction of a generator facility at the Beluga River Field, and the finalization of a contract for the sale of liquefield natural gas will have a great impact on future gas production.

Production Summary

Total oil produced and sold during the calendar year 1966 was 14,376,482 barrels. Additional small amounts were produced during the testing of new wells. The daily production rate at the end of the year was approximately 51,500 barrels, which is a 63.4 percent increase over the rate at the end of 1965. Total gas production for the year was 41,654,546 MCF, of which 33,646,338, was sold, 5,181,835 used on the leases, and 2,626,372 unavoidably lost. The production from the principal fields was as follows:

Swanson River Field

Oil Production was 11,711,744 bbls., a 5.5 percent increase over 1965. This reflects the efficiency of the pressure maintenance program by gas injection.

Middle Ground Shoal Field

The oil production in the first full year of production amounted to 2,646,468 bbls.

in 1965. Development of this field will be accelerated when two more planned platforms are readied.

Kenai Field

Gas production for the year was 33,374,960 MCF, an increase of more than 550 percent over 1965. The main reason for this five-fold increase in production is the gas injection program at the Swanson River oil field, which used (rented) 25,443,412 MCF from the Kenai Field.

Sterling Field

Gas production was up 30.8 percent to a total of 157,490 MCF.

South Barrow Field

Gas production was 437,512 MCF, an increase of 18.2 percent over 1965.

Benefits to the State

The year's revenue to the State of Alaska from oil and gas lease rentals and royalty payments amounted to $11,297,983. Bonus payments for oil and gas leases were $7,153,332. Production and conservation taxes were estimated to be $500,000, making a total direct oil and gas income of about $19 million in 1966. The magnitude of other benefits to the State from the oil industry can be visualized by a perusal of Table IV on the following page.

Table IV

Summary of Petroleum Industry Statistics*

		1962	1963	1964	1965	1966
Drilling Permits Approved		38	25	15	39	64
Exploratory Wells Spudded		31	16	16	24	38
Development Wells Spudded		10	9	2	13	20
Wells Completed (Oil)		7	8	2	9	15
Wells Completed (Gas)		5	4	5	10	4
Wells Abandoned		21	15	15	7	24
Footage Drilled, Exploratory		290,976	135,248	177,110	187,135	383,972
Footage Drilled, Development		78,619	80,337	7,499	81,236	162,513
Total Footage Drilled		369,595	215,585	184,609	268,371	546,485
Average No. Active Rotary Rigs		10	7	6	7	14
Average Daily Oil Production		28,107	29,424	30,285	30,409	36,958
State O & G lease acreage in effect at year's end		1,370,652	1,590,392	1,727,972	3,018,200	3,428,143
Federal O & G lease acreage in effect at year's end		19,550,312	14,035,381	11,589,149	10,184,447	9,264,163
Federal payment of Oil and Gas lease rentals				$5,529,110	$3,425,393	$4,092,165
Federal payment of Oil and Gas lease royalty				$3,374,603	$3,266,396	$3,600,774
State Oil and Gas lease bonue				$5,511,769	$10,819,708	$7,153,332
State Oil and Gas lease rental				$1,250,536	$2,656,402	$2,663,482
State Oil and Gas lease royalty				$76,310	$96,233	$941,562
			TOTAL	$15,742,328	$20,264,132	$18,451,315
State Oil and Gas lease acreage issued (does not include transferred Federal leases)	Competitive		388,579	722,659	704,751	154,497
	Noncompetitive		143,353	116,970	205,692	203,880
	TOTAL	662,852	531,932	839,629	910,443	358,377
Federal Oil and Gas lease acreage transferred to State			86,127	6,413	16,520	355,503
Federal Oil and Gas lease acreage issued		683,246	996,616	2,609,714	2,083,010	1,814,989

*See previous reports for years prior to 1962

Summary of Petroleum Industry Statistics
(Continued)

	1960	1961	1962	1963	1964	1965	1966
Geologic Field Party Months	57.5	57.6	43	47	22	34	37.3
Seismic Crew Months	40.0	73.4	86.23	113	98	60	78.6
Gravity Crew Months	4.9	14.5	9.5	10	12	3	none
Magnetometer Crew Months					2	3	1

The following figures for 1966 are estimates which may vary considerably from actual amounts because many actual figures are not available at the time of compilation. Readers are referred to the Western Oil and Gas Association, 550 First National Building, Anchorage, Alaska, for detailed industry figures which will be available by the date this is published.

Exploration expenditures (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). (thousands)				$54,030	$61,000	$ 66,020	$ 66,400
Development drilling expenditures (thousands)				$ 4,635	$ 696	$ 5,261	$ 17,600
Production expenditures (including secondary recovery & platform construction in year of completion) (thousands)				$ 1,594	$ 1,758	$ 19,250	$ 55,800
Refinery construction & operation expenditures (thousands) (includes petrochemical plants & marine facilities)				$ 5,600	$ 2,200	$ 2,000	$ 6,520
Pipeline construction expenditures (thousands)						$ 9,550	$ 21,080
Total annual industry expenditures exclusive of marketing & sales activity (thousands)	$37,805	$42,405	$65,500	$65,859	$65,654	$102,081	$169,400
Full time year around employees of oil industry excluding marketing (not excluding all oil field construction activities)			613	655	671	708	829
Petroleum marketing personnel						1,508	1,599
Cumulative mileage low grade roads & seismic trails built by oil industry			885	1,185	2,245	2,908	3,214
Cumulative mileage heavy duty roads built by oil industry			331	370	374	389	447
Total crude throughput - Alaskan Refinery, barrels (thousands)				2,600	5,994	6,800	6,600

TABLE V

WELLS ACTIVE IN 1966

State Permit	Company	Well Name	Well No.	Location 1/4	Sec.	T.	R.	B&M	Date Spud	Date Comp.	Footage Drilled T.D.	Footage Drilled 1966	Status 12-31-66	Initial Production Bbls or MCF	Remarks
EXPLORATORY WELLS (includes stepout wells 1 mile or more from production)															
63-17	SOCAL	Naptowne U.	24-8	SW	8	6N	8W	S	1-9-66	4-27-66	15,226	15,226	P&A		
65-16	Wallace Mng. Co.	Wallace & Knutson	1-A	SW	23	17N	1W	S	6-17-65	5-1-66	6,146	2,644	P&A		
65-27	Texaco, Inc.	Nicolai Creek St.	1	NE	31	11N	12W	S	10-31-65	5-6-66	8,338	4,523	GSI	6,143 MCF	1/2" bean, TP 1147 psi, CP 1269 psi
65-29	Texaco, Inc.	Trading Bay St.	1	SW	34	10N	13W	S	8-11-66	9-27-66	9,104	9,104	OW-SI	576 B/D	31.2°, 1/2" bean, TP 120 psi
65-31	Sinclair Oil & Gas	Colville	1	SW	25	12N	7E	UP	11-12-65	3-8-66	9,930	6,638	P&A		
65-33	Texaco, Inc.	Coal Bay State	1	SE	8	6S	12W	S	11-17-66	11-30-66	4,013	4,013	P&A		
65-36	Pan Am	USA Edna Mae Walker	1	SE	35	1S	12W	S	11-25-65	4-1-66	16,300	7,198	P&A		
65-37	Atlantic Refg.	Lorraine State	1	NE	21	14N	4W	S	12-27-65	2-28-66	8,010	7,667	P&A		
66-1	Atlantic Refg.	Rainbow Federal	2	NW	1	8N	5W	CR	1-12-66	1-26-66	2,793	2,793	P&A		
66-4	Atlantic Refg.	Susie Unit	1	NE	22	2N	13E	UP	2-27-66		13,517	13,517	Testing		Susp. @10,100' 6-5-66-to 10-28-66
66-6	Austral Oil Co.	J.M. Needham et al	1	NE	7	17N	1E	S	4-1-66	5-7-66	6,004	6,004	P&A		
66-7	Trinity Canadian	Homesteader's	1	SE	15	5N	9W	S	4-11-66	9-3-66	13,890	13,890	Susp.		
66-8	Texaco, Inc.	Nicolai Creek	1-A	SE	30	11N	12W	S	3-11-66	4-28-66	9,302	5,417	P&A		(ST old #1 from 3885', then pg. & abandoned below 3680')
66-9	Union Oil Co.	Kustatan	1	SW	18	8N	13W	S	4-17-66	6-12-66	11,852	11,852	P&A		(Pg. 4600' and redrilled directionally as #1-A)
66-10	Pan Am	Tyonek St. 17588	1	SE	29	11N	11W	S	4-13-66	8-10-66	13,523	13,523	P&A		
66-11	Austral Oil Co.	Federal	1-3	SW	3	18N	1E	S					Loc.		Will not be drilled.
66-12	Pan Am	W. Foreland Unit	2	NW	15	8N	14W	S	5-25-66	9-14-66	11,948	11,948	P&A		
66-13	Pan Am	C. I. State 17591	1	SE	3	11N	10W	S	4-24-66	11-19-66	14,000	16,451	Susp.		Susp. until spring break-up
66-14	Pan Am	N. Redoubt St. 17579	1	NW	4	8N	13W	S	4-17-66	6-18-66	11,271	11,271	OW-SI	1,940 B/D	34.1° API, 48/64" bean, TP 230 psi
66-16	Shell Oil Co.	Forelands Channel St.	1	NW	30	8N	13W	S	4-21-66	6-23-66	11,786	11,786	P&A		
66-17	Great Basins Pet.	Ugashik	1	SE	8	32S	52W	S	6-17-66	8-25-66	9,476	9,476	P&A		
66-18	Hunt Oil Co.	Oldman's Bay	1	NW	2	3N	16W	S	6-3-66	8-18-66	12,485	12,485	P&A		
66-19	Pan Am	C. I. State 17593	1	SE	18	12N	9W	S					Loc.		
66-20	Atlantic Richfield	Middle River St.	1	SE	32	10N	13W	S	5-24-66	6-24-66	7,250	7,250	P&A		
66-21	SOCAL	Ivan River	44-1	SE	1	13N	9W	S	6-5-66	10-8-66	15,269	15,269	GSI	5,900 MCF	1/4" bean, TP 2975 psi
66-22	Pan Am	East MGS 18751	1	NE	16	9N	12W	S	6-12-66	11-27-66	14,634	14,634	Susp.		Susp. until spring break-up
66-23	SOCAL	Falls Creek Unit	2	NE	22	1N	13W	S	6-19-66	7-18-66	8,256	8,256	P&A		
66-25	Pan Am	C. I. 18741	2	NW	8	11N	9W	S	6-20-66	7-6-66	6,015	6,015	GSI	6,780 MCF	1/2" bean, TP 1140 psi
66-26	Atlantic Richfield	W. Foreland Unit	3	NE	19	9N	13W	S	6-24-66	8-15-66	9,768	9,768	OW-SI	1,608 B/D	34.4°, 48/64" bean, TP 215 psi
66-27	Texaco, Inc.	Trading Bay State	2	SE	27	10N	13W	S					Loc.		
66-28	Texaco, Inc.	Trading Bay State	3	SW	23	10N	13W	S					Loc.		
66-30	Union Oil Co.	Kustatan	1-A	SE	18	8N	13W	S	6-12-66	8-7-66	11,130	6,530	OW-SI	1,400 B/D	32.9°, 1.3% - 3/4" bean, TP 125 psi (Redrilled from 4600' in old #1)

TABLE V

WELLS ACTIVE IN 1966

State Permit	Company	Well Name	No.	Location 1/4	Sec.	T.	R.	B&M	Date Spud	Date Comp.	Footage Drilled T.D.	Footage Drilled 1966	Status 12-31-66	Initial Production Bbls or MCF	Remarks
EXPLORATORY WELLS (includes stepout wells 1 mile or more from production) (continued)															
66-31	Pan Am	North MGS 18745	1	SE	28	10N	12W	S	7-9-66	11-17-66	2,100	2,100	P&A		13 3/8" csg. parted, pg. and moved to 1-A
66-32	Atlantic Richfield	McArthur State	1	SW	15	9N	13W	S	7-11-66	9-14-66	10,255	10,255	OW-SI	1,440 B/D	36.2°, 0.2%, 3/4" bean, TP 175 psi
66-33	Shell Oil Co.	Forelands Channel	1-A	NE	30	8N	13W	S	6-24-66	8-23-66	12,951	5,851	Susp.		
66-34	Union Oil Co.	Kenai Unit	41-2	NE	2	5N	11W	S	9-14-66	9-28-66	5,736	5,736	P&A		
66-35	Pan Am	North MGS State 18745	1-A	NW	28	10N	12W	S	7-18-66	11-22-66	10,427	10,427	P&A		
66-37	Placid Oil	State 17580	1	NW	3	9N	12W	S	9-5-66	11-28-66	12,405	12,405	Susp.		Susp. until break-up
66-39	Hunt Oil Co.	Kalgin Island St.	1	SE	22	5N	15W	S	8-29-66	12-22-66	14,509	14,509	P&A		
66-40	Mobil Oil	Tower	1	NE	10	10N	12W	S	9-24-66	11-22-66	12,085	12,085	Susp.		Susp. until spring break-up
66-42	Shell Oil Co.	W. Foreland Unit	4	NE	36	9N	14W	S	9-2-66	11-7-66	11,160	11,160	Susp.		
66-43	Cities Service	Painter Creek	1	NW	14	35S	51W	S					Loc.		
66-45	Union Oil Co.	E. Trading Bay	1	NW	11	9N	13W	S	10-9-66	11-10-66	10,364	10,364	P&A		
66-46	Pan Am	Redoubt Shoal	1	NE	26	7N	14W	S	10-2-66	12-21-66	11,968	11,968	Susp.		Susp. until spring break-up
66-50	Atlantic Richfield	Drift River St.	1	SE	11	5N	17W	S	10-24-66	11-15-66	5,410	5,410	P&A		
66-54	Texaco, Inc.	Pt. Possession U.	1	SW	2	10N	7W	S	12-23-66		2,000	2,000	Drlg.		
66-59	Pan Am	Chuitna River St.	1	NE	15	12N	12W	S	12-12-66		3,836	3,836	Drlg.		
66-60	Marathon Oil Co.	Beaver Creek	1	SW	34	7N	10W	S					Loc.		
66-61	Union Oil Co.	Kookpuk	1	SW	19	11N	7E	UP	12-21-66		718	718	Drlg.		
66-63	Hunt Oil Co.	Kalgin Island St.	2	SE	19	4N	15W	S					Loc.		
66-64	Pennzoil Co.	Starichkof State	1	NE	33	3S	15W	S					Loc.		
									TOTAL EXPLORATORY FOOTAGE -			383,972			
DEVELOPMENT WELLS															
65-35	Shell Oil Co.	Middle Ground Shoal	A-32-14	NE	14	8N	13W	S	11-28-65	2-16-66	10,241	193	POW	633 B/D	37.3° API, 30/64" bean, TP 600 psi
65-38	Pan Am	MGS State 17595	5	SW	30	9N	12W	S	12-17-65	12-28-66	11,128	9,728	POW	U-633 B/D L-248 B/D	37.0°, 40/64", TP 125# 36.5°, 24/64", TP 140#
66-2	Shell Oil Co.	Middle Ground Shoal	A-34-14	SE	14	8N	13W	S	1-26-66	4-14-66	11,480	11,480	POW	1,168 B/D	35.5°API, 34/64" bean, TP 360
66-3	Pan Am	MGS State 17595	6	NW	31	9N	12W	S	1-28-66	6-13-66	7,400	7,400	POW	1,680 B/D	37.0° API, 74/64" bean, TP 210
66-5	Pan Am	MGS State 17595	7	SW	31	9N	12W	S	4-7-66	8-19-66	9,445	9,445	POW	U-1,410B/D L-201 B/D	37.0°, 64/64", TP 110# 37.0°, 64/64", TP 100#
66-15	Shell Oil Co.	Middle Ground Shoal	A-13-1	SW	1	8N	13W	S	4-15-66	6-27-66	10,850	10,850	POW	U-1,552B/D L-871 B/D	37.1°, 100/64", TP 145# 36.0°, 64/64", TP 80#
66-24	Pan Am	MGS State 17595	8	SE	36	9N	13W	S	8-21-66		10,314	10,314	Testing		
66-29	Shell Oil Co.	Middle Ground Shoal	A-11-1	NW	1	8N	13W	S	6-28-66	9-25-66	13,238	13,238	POW	U-883 B/D L-1,028B/D	37.0°, 128/64", TP 100# 37.2°, 128/64", TP 90#

TABLE V

WELLS ACTIVE IN 1966

State Permit	Company	Well Name	Well No.	Location 1/4	Sec.	T.	R.	B&M	Date Spud	Date Comp.	Footage Drilled T.D.	Footage Drilled 1966	Status 12-31-66	Initial Production Bbls or MCF	Remarks
DEVELOPMENT WELLS (continued)															
66-36	Pan Am	Tyonek St. 17586	1	NE	36	11N	12W	S	8-13-66	9-24-66	8,920	8,920	OW-SI	2,637 B/D	43.0° API, 48/64" bean, TP 545 psi
66-38	Texaco, Inc.	Nicolai Creek U.	2	NW	32	11N	12W	S	9-21-66	10-23-66	5,011	5,011	GSI	3,760 MCF	32/64" bean, TP 630 psi, Pg. to 3540'
66-41	Atlantic Richfield	Middle River St.	2	SW	18	9N	13W	S	8-31-66	10-21-66	10,295	10,295	P&A		
66-44	Shell Oil Co.	Middle Ground Shoal	A-11-12	NW	12	8N	13W	S	10-1-66	11-24-66	9,375	9,375	POW	1,480 B/D	37.2° API, 128/64", TP 95 psi
66-47	Union Oil Co.	Trading Bay St.	A-1	NE	4	9N	13W	S	10-2-66	10-17-66	3,486	3,486	Susp.		
66-48	SOCAL	Ivan River U.	23-12	SW	12	13N	9W	S	10-15-66		11,288	11,288	Testing		
66-49	Union Oil Co.	Trading Bay St.	A-2	SE	4	9N	13W	S	10-18-66	12-8-66	6,669	6,669	OW-SI	555 B/D	31.0° API, 22/64" bean, TP 340 psi
66-51	Pan Am	MGS St. 17595	9	SE	31	9N	12W	S	11-15-66		9,143	9,143	Drlg.		
66-52	Pan Am	Granite Pt. St. 17587	3	SW	30	11N	11W	S	11-11-66		7,488	7,488	Drlg.		
66-53	Shell Oil Co.	Middle Ground Shoal	A-33-1	SE	1	8N	13W	S	11-27-66		8,425	8,425	Drlg.		
66-55	Mobil Oil	Union-Mobil St.	31-13	NE	13	10N	12W	S					Loc.		
66-56	Mobil Oil	Union-Mobil St.	31-14	NE	14	10N	12W	S	12-24-66		672	672	Drlg.		
66-57	Pan Am	Granite Pt. St. 18742	3	NE	12	10N	12W	S	12-20-66		2,379	2,379	Drlg.		
66-58	Union Oil Co.	Trading Bay St.	A-3	SE	3	9N	13W	S	12-9-66		3,863	4,675	Drlg.		Pg. back from 1272' to 460'. Redrilled.
66-62	Pan Am	Granite Pt. St. 17587	4	SE	30	11N	11W	S	12-22-66		2,039	2,039	Drlg.		
										TOTAL DEVELOPMENT FOOTAGE -		162,513	(includes 812' of redrilled footage)		
										GRAND TOTAL -		546,485			

Table VI

Oil Production By Months

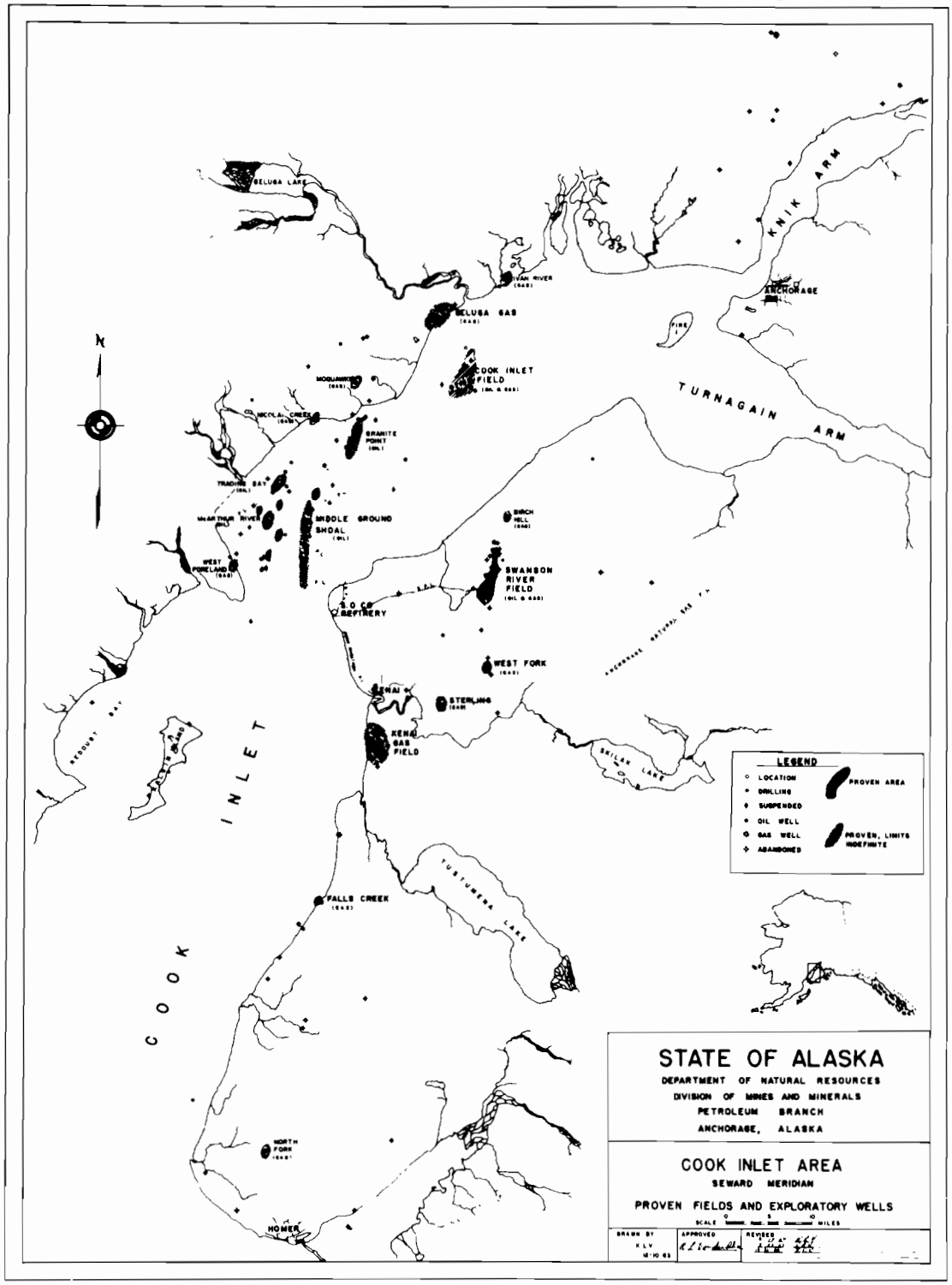
Year	Month	Oil Prod. Month-Bbls.	Oil Prod. Year-Bbls.	Cumulative Oil Prod.-Bbls.	Number of Wells
SWANSON RIVER FIELD					
Oil Produced prior to 1963				17,365,954	
1963	Jan.	943,556			44
	Feb.	812,837			46
	Mar.	894,241			46
	Apr.	862,546			46
	May	892,244			49
	June	866,712			54
	July	907,343			53
	Aug.	896,308			53
	Sept.	886,777			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
1965	Jan.	944,032			55
	Feb.	849,306			55
	Mar.	940,920			53
	Apr.	911,939			53
	May	942,537			53
	June	914,406			51
	July	930,389			51
	Aug.	946,856			48
	Sept.	912,001			51
	Oct.	942,602			52
	Nov.	914,089			52
	Dec.	950,687	11,099,404	50,259,194	50
1966	Jan.	943,027			50
	Feb.	854,246			48
	Mar.	944,497			49
	Apr.	915,799			48
	May	944,597			48
	June	912,806			48
	July	941,873			46
	Aug.	960,439			47
	Sept.	929,940			48
	Oct.	1,076,526			48
	Nov.	1,116,210			46
	Dec.	1,171,784	11,711,744	61,970,938	41

Oil Production by Months

Year	Month	Oil Prod. Month-Bbls.	Oil Prod. Year-Bbls.	Cumulative Oil Prod.-Bbls.	Number of Wells
MIDDLE GROUND SHOAL FIELD					
1965	Nov.	1,185			1
(corrected)	Dec.	26,012	27,197	27,197	3
1966	Jan.	50,408			4
	Feb.	101,018			5
	Mar.	27,394			5
	Apr.	4,933			6
	May	196,475			7
	June	153,794			7
	July	282,644			11
	Aug.	345,392			11
	Sept.	300,572			13
	Oct.	367,861			13
	Nov.	391,441			15
	Dec.	424,897	2,646,468	2,673,665	15
GRANITE POINT FIELD					
1966	No wells on production				
TRADING BAY FIELD					
1965	July	*1,684	1,684	1,684	1
1966	No wells on production				
McARTHUR RIVER FIELD					
1965	No wells on production				
1966	No wells on production				
1966 Total			14,358,212	64,646,287	

* Oil from tests saved and sold.

Figure 3


BELUGA LAKE
KNIK ARM
BELUGA GAS
COOK INLET FIELD
ANCHORAGE
TURNAGAIN ARM
GRANITE POINT
TRADING BAY
MIDDLE GROUND SHOAL
SWANSON RIVER FIELD
S.O.C.O. REFINERY
WEST FORK
KENAI
STERLING
KENAI GAS FIELD
KNIK ARM
COOK INLET
FALLS CREEK
TUSTUMENA LAKE
NORTH FORK
HOMER
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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
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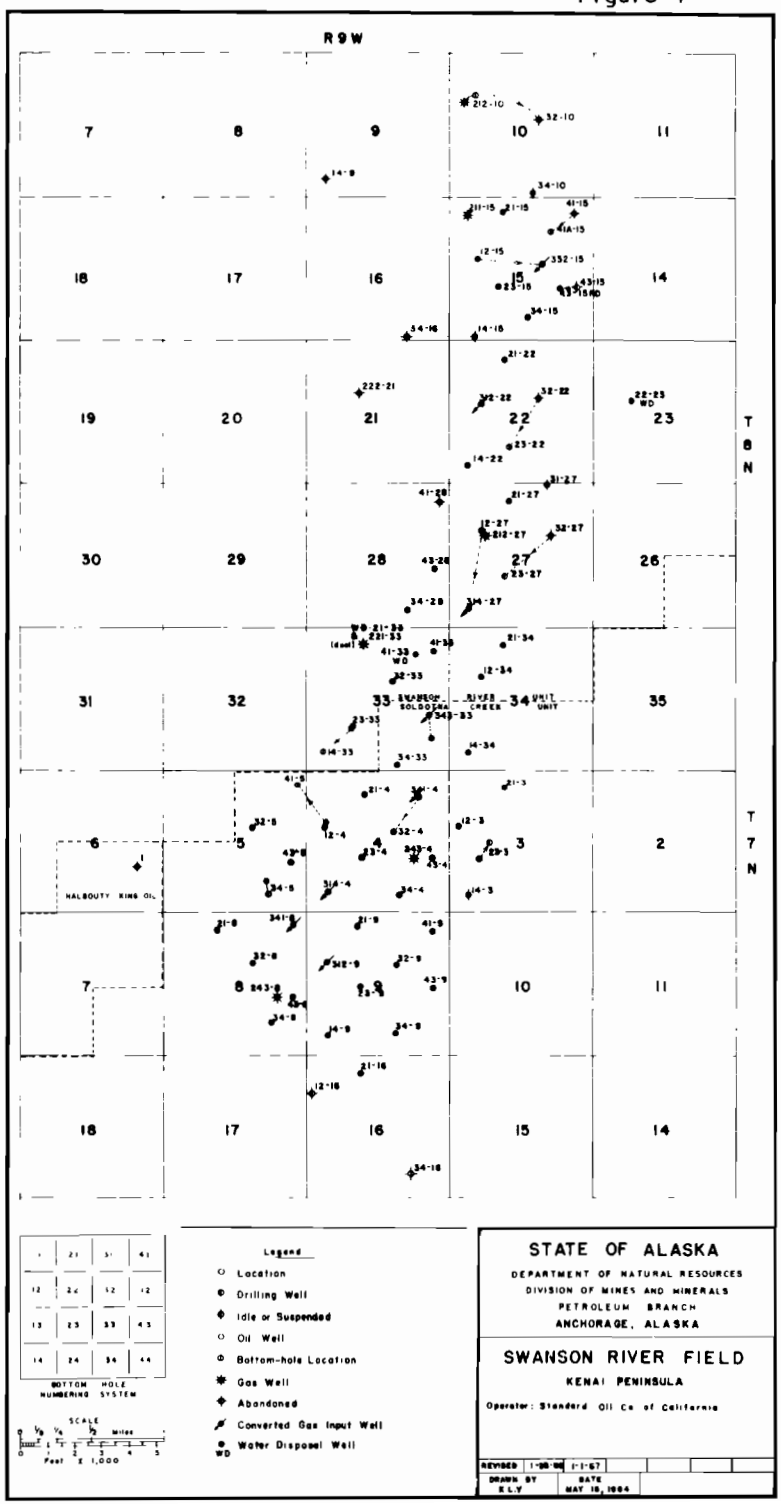
DRAWN BY
APPROVED
REVISED

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 - 3000'-5,800'
Deepest Test	SCU 22A-32 - 14,796'
Wells	
Oil - Flowing	29
Gas Lift	12
Shut-in	7
Gas - Producing	0
Snut in	6
Salt Water Disposal	2 (one is dual - gas producer, shut-in, and disposal)
Gas Injection - Active	7
Idle	1
Production Data - 1966	
Oil Production	11,711,744 bbls.
Water Production	2,068,068 bbls.
Gas Production - with oil	5,622,493 MCF (base 14.65 psi)
Gas Production - gas wells	740,126 MCF " " "
Cumulative Production 12/31/66	
Oil	61,970,938 bbls.
Water	5,869,923 bbls.
Gas - with oil	30,673,962 MCF (base 14.65 psi)
Gas - gas wells	11,839,353 MCF " " "
Reservoir Data - Hemlock Zone	
Initial Reservoir Pressure	5,650 psi
Reservoir Pressure 12/31/66	4,550 psi
Saturation Pressure	1,000-1,400
Oil Gravity	30.0°-37.8° API
Temperature	180°F
Net Pay Thickness	8'-300'
Porosity	18-26%
Permeability	0-3,275 Mds.
Connate Water	40%
Original Formation Vol. Factor	1.12
Gas-Oil Ration	139-753 SCF/STB
Participating Area	6,245 acres

Figure 4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SWANSON RIVER UNIT
SOLDOTNA CREEK UNIT
HALBOUTY KING OIL
BOTTOM HOLE NUMBERING SYSTEM
SCALE
Miles
Feet X 1,000
Legend
Location
Drilling Well
Idle or Suspended
Oil Well
Bottom-hole Location
Gas Well
Abandoned
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
Operator: Standard Oil Co of California
REVISED
DRAWN BY
K.L.Y
DATE
MAY 18, 1964

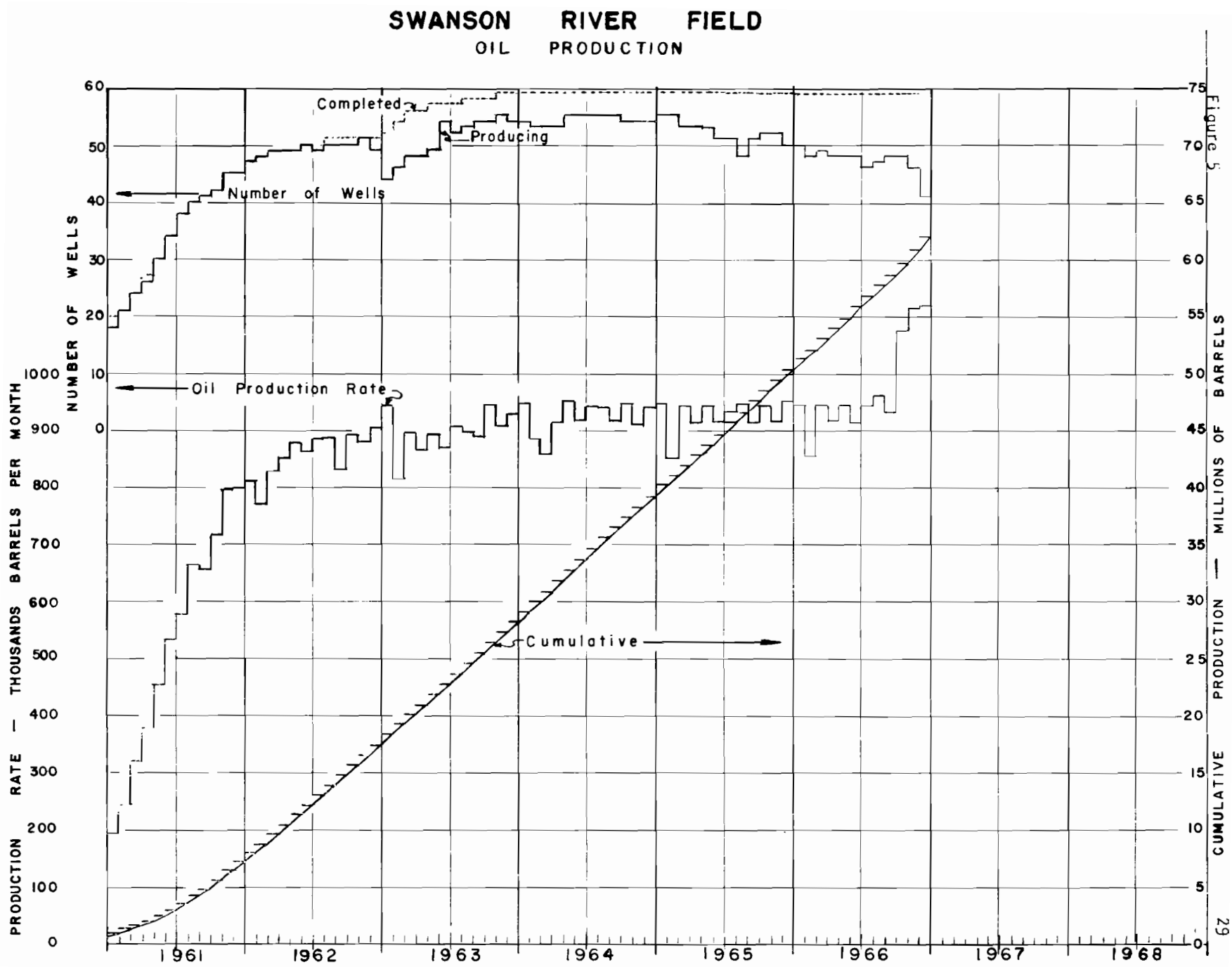

SWANSON RIVER FIELD
OIL PRODUCTION
Completed
Producing
Number of Wells
Oil Production Rate
Cumulative
NUMBER OF WELLS
PRODUCTION RATE — THOUSANDS BARRELS PER MONTH
CUMULATIVE PRODUCTION — MILLIONS OF BARRELS
1961
1962
1963
1964
1965
1966
1967
1968

Figure 5

Table VIII A

Swanson River Field
Individual Well Oil Production Statistics

Swanson River Unit

Oil Production

Well No.	Comp. Date	1960	1961	1962	1963	1964	1965	1966	Cumulative
SRU 34-10*	10-1-57	21,264	59,933	29,227	1,918	1,043	1,062		217,854
12-15	10-5-60	21,387	34,327	45,426	104,164	90,296	145,544	173,511	614,655
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	32,290	44,157	502,650
23-15	4-5-61		107,040	146,300	123,448	143,904	199,350	196,130	916,172
32-15*	10-24-59	108,308	186,776	162,708	124,600	128,923	76,815	17,254**	819,748
34-15	8-4-61		66,800	123,776	45,810	43,725	17,438	9,271	306,820
41A-15	12-9-62			6,647	136,024	116,995	109,079	166,957	535,702
43-15	11-1-61		2,675	19,181	29,234	22,469	17,283	15,886	106,728
12-22	8-11-62			75,395	224,733	195,084	190,382	45,795**	731,389
14-22	2-2-63				27,900	23,581	25,934	25,116	102,531
21-22	1-3-62			135,195	65,423	78,025	37,851	49,591	366,085
23-22	3-9-60	32,581	120,145	86,685	52,411	103,032	49,748	84,056	528,658
12-27*	11-30-59	62,540	183,713	164,195	110,420	92,678	134,354	107,264	862,447
14-27	6-14-60	6,582	238,272	312,415	270,366	305,697	261,587	12,927**	1,407,846
21-27	5-5-61		119,571	232,324	194,880	233,780	256,526	380,810	1,417,891
23-27	2-5-61		98,751	66,458	88,721	76,064	107,093	101,509	538,596
31-27*	10-26-58	9,231	40,032	16,666	12,718	2,399	1,902		177,003
34-26	5-16-63				51,160	87,008	67,478	83,719	289,365
43-26	7-22-61		83,914	173,245	201,821	209,299	195,884	202,393	1,066,556
14-33	6-11-62			65,473	119,161	185,039	225,494	174,234	769,401
23-33	6-10-61		37,452	44,818	50,644	111,367	104,910	162,372	511,563
32-33	8-25-60	36,655	195,087	294,175	227,676	195,219	212,035	267,245	1,428,092
41-33	3-12-61		182,225	363,453	247,490	319,533	290,963	337,440	1,741,104
12-34	10-21-60		142,787	160,764	175,760	200,189	233,854	383,159	1,296,513
21-34	3-25-63				141,416	178,252	212,493	282,303	814,464
TOTALS SRU		298,548	1,986,377	2,895,398	2,937,445	3,213,542	3,207,349	3,323,099	18,084,102

* Produced prior to 1960 - Total 222,344 bbls.
**Converted to gas injection wells

Table VIII B

Swanson River Field
Individual Well Oil Production Statistics

Soldotna Creek Unit

Oil Production

Well No.	Comp. Date	1960	1961	1962	1963	1964	1965	1966	Cumulative
SCU 12-3	3-23-61		201,629	241,286	163,195	257,984	161,443	222,425	1,248,162
14-3	8-2-61		66,962	127,862	111,475	86,680	3,618	5,748	402,345
21-3	1-10-62			253,530	199,238	123,737	181,022	195,677	953,254
23-3	11-12-63				13,452	70,841	27,018	16,010	127,321
12-4	4-8-61		206,870	315,308	448,589	337,381	375,646	485,699	2,169,493
14-4	8-13-60	63,768	305,632	406,899	474,979	433,066	288,242	5,108*	1,997,694
21-4	11-5-61		29,605	215,841	255,905	286,564	328,064	377,862	1,493,841
23-4	6-1-61		175,004	370,777	472,517	375,279	439,947	504,484	2,338,008
32-4	6-5-60	74,003	317,492	398,596	425,710	381,621	335,942	491,669	2,425,033
34-4	11-26-60		246,747	355,595	437,873	387,460	418,123	517,342	2,363,140
41-4	3-21-60	97,543	301,962	280,253	*				679,758
43-4	5-14-61		181,890	330,931	327,105	317,238	339,799	330,536	1,826,499
32-5	3-16-62			29,946	67,290	102,183	85,880	54,551	339,750
34-5	10-9-61		30,817	262,993	420,163	343,194	538,278	375,809	1,971,254
41-5	9-20-61		41,594	116,075	102,833	173,845	119,476	369,247	923,070
43-5	5-28-61		91,504	127,021	219,725	233,669	285,977	369,227	1,327,123
21-8	2-5-63				164,964	260,072	260,038	1,888	686,962
41-8	5-14-61		119,506	355,493	87,270*				562,269
32-8	2-22-61		130,883	194,030	204,460	242,599	347,609	470,841	1,590,422
34-8	1-26-62			76,666	105,205	162,007	151,421	166,656	661,955
43-8	7-24-61		161,965	154,901	120,657	153,302	106,952	198,451	896,228
12-9	10 9-60		275,247	236,586	*				511,833
14-9	10-26-60		181,998	195,332	314,525	292,351	368,675	488,640	1,841,521
21-9	7-19-61		137,997	353,661	390,562	411,971	471,527	402,019	2,167,757
23-9	7-17-61		115,333	331,927	341,006	215,240	260,544	245,718	1,509,768
32-9	1-16-61		185,766	282,033	373,733	387,757	457,009	466,487	2,152,785
34-9	11-8-61		26,014	194,171	259,224	285,562	227,058	340,128	1,332,157
41-9	6-11-61		118,240	260,815	288,681	277,325	100,998	103,800	1,149,859
43-9	7-5-63				83,926	164,747	4,127	14,922	267,722
21-16	7-8-63				110,491	281,106	242,731	314,278	948,606
34-33	11-12-60	4,137	261,661	243,842	227,676	256,625	320,377	368,870	1,703,188
43-33	3-8-61		164,602	290,258	260,721	233,723	374,104	146,859*	1,470,267
14-34	12-23-60		243,004	361,114	329,369	306,201	270,410	337,695	1,847,793
Totals SCU		259,451	4,340,124	7,363,712	7,802,519	7,840,330	7,892,055	8,388,646	43,886,837
Totals SRU		296,546	1,986,377	2,895,398	2,937,445	3,213,542	3,207,349	3,323,099	18,084,102
Prior to 1960									
Field Totals	222,344	557,999	6,326,501	10,259,110	10,739,964	11,053,872	11,099,404	11,711,745	61,970,939

* Converted to gas injection well

Table VIII C

Middle Ground Shoal Field
Individual Well Oil Production

Well NO.	Comp. Date	1965	1966
Pan American Petroleum Corp. - Upper Sands			
17595 #5	11-20-66		32,291
17595 #6	6-13-66		204,316
17595 #7	8-9-66		147,487
Total Upper Sands			384,094
Pan American Petroleum Corp. - Lower Sands			
18746 #1	Test	1,185	
17595 #5	11-20-66		4,702
17595 #7	8-9-66		8,313
Total Lower Sands		1,185	13,015
Total Pan American Petroleum Corp.		1,185	397,109
Shell Oil Company - Upper Sands			
A-32-11	9-17-65	16,602	203,551
A-13-1	6-27-66		171,465
A-11-1	9-25-66		73,051
Total Upper Sands		16,602	448,067
Shell Oil Company - Lower Sands			
A-43-11	6-20-65	1,156	508,314
A-23-12	11-26-65	8,254	147,611
A-32-11	9-17-65		63,693
A-32-14	2-16-66		362,254
A-34-14	4-14-66		426,586
A-13-1	6-27-66		155,095
A-11-1	9-26-66		82,413
A-11-12	11-24-66		55,326
Total Lower Sands		9,410	1,801,292
Total Shell Oil Company		26,012	2,249,359
Total Upper Sands		16,602	832,161
Total Lower Sands		10,595	1,814,307
Field Total		27,191	2,646,468

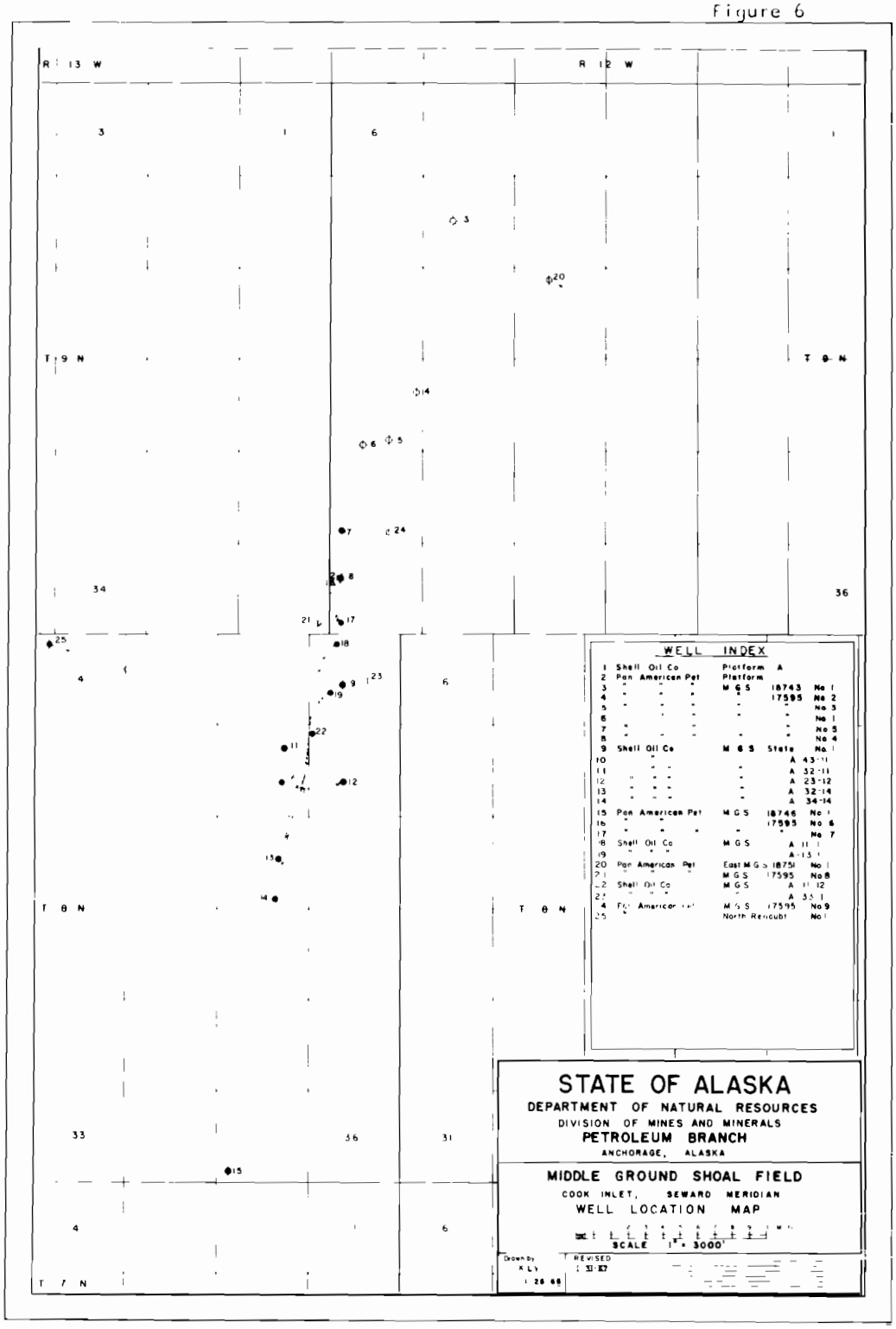
Table IX

Middle Ground Shoal Field
Cook Inlet, Alaska

Shell Oil Company and
Pan American Petroleum Corporation, Operators

Location	T8 & 9N - R12 & 13W, Seward Meridian
Discovery Well	Pan American Pet. Corp. MGS 17595 No. 1
Discovery Date	June 10, 1962
Producing Formation	
Oil	Middle Kenai Zone - 5,500'-6,200' Lower Kenai Zone - 7,100'-8,900'
Deepest Test	Pan American Pet. Corp. MGS 17595 No. 3 11,179'
Wells	
Oil - Flowing	7 (incl. 6 duals)
Shut-in	1
Gas - Shut-in	1
Production Data - 1966	
Oil Production	2,646,468 bbls.
Water Production	45,312 bbls.
Gas Production - with oil	1,198,386 MCF (base 14.65 psi)
Cumulative Production 12/31/66	
Oil	2,673,665 bbls.
Water	45,312 bbls.
Gas - with oil	1,208,791 MCF (base 14.65 psi)
Reservoir Data	
Initital Reservoir Pressure	3,655 psi
Reservoir Pressure 12/31/66	3,447 psi (est.)
Saturation Pressure	1,500 ± psi
Oil Gravity	36.0°-37.0° API
Temperature	160°F
Net Pay Thickness	170'-550'
Porosity	7-25%
Permeability	2-200 Mds.
Connate Water	35%
Original Formation Vol. Factor	1.17 (est.)
Gas/Oil Ratio	453 cf/bbl.

Figure 6


R 13 W
R 12 W
T 9 N
T 8 N
T 7 N
WELL INDEX
1 Shell Oil Co Platform A
2 Pan American Pet Platform
3 " " " M G S 18743 No 1
4 " " " " 17595 No 2
5 " " " " " No 3
6 " " " " " No 1
7 " " " " " No 5
8 " " " " " No 4
9 Shell Oil Co M G S State No 1
10 " " " A 43-11
11 " " " A 32-11
12 " " " A 23-12
13 " " " A 32-14
14 " " " A 34-14
15 Pan American Pet M G S 18746 No 1
16 " " " 17595 No 6
17 " " " " " No 7
18 Shell Oil Co M G S A 11 1
19 " " " A-13 1
20 Pan American Pet East M G S 18751 No 1
21 " " " M G S 17595 No 8
22 Shell Oil Co M G S A 11 12
23 " " " A 35 1
24 Pan American Pet M G S 17595 No 9
25 North Rencubt No 1
STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINES AND MINERALS
PETROLEUM BRANCH
ANCHORAGE, ALASKA
MIDDLE GROUND SHOAL FIELD
COOK INLET, SEWARD MERIDIAN
WELL LOCATION MAP
SCALE 1" = 3000'
Drawn by K L Y
1 28 68
REVISED
1 31-87

MIDDLE GROUND SHOAL FIELD

OIL PRODUCTION

Figure 7

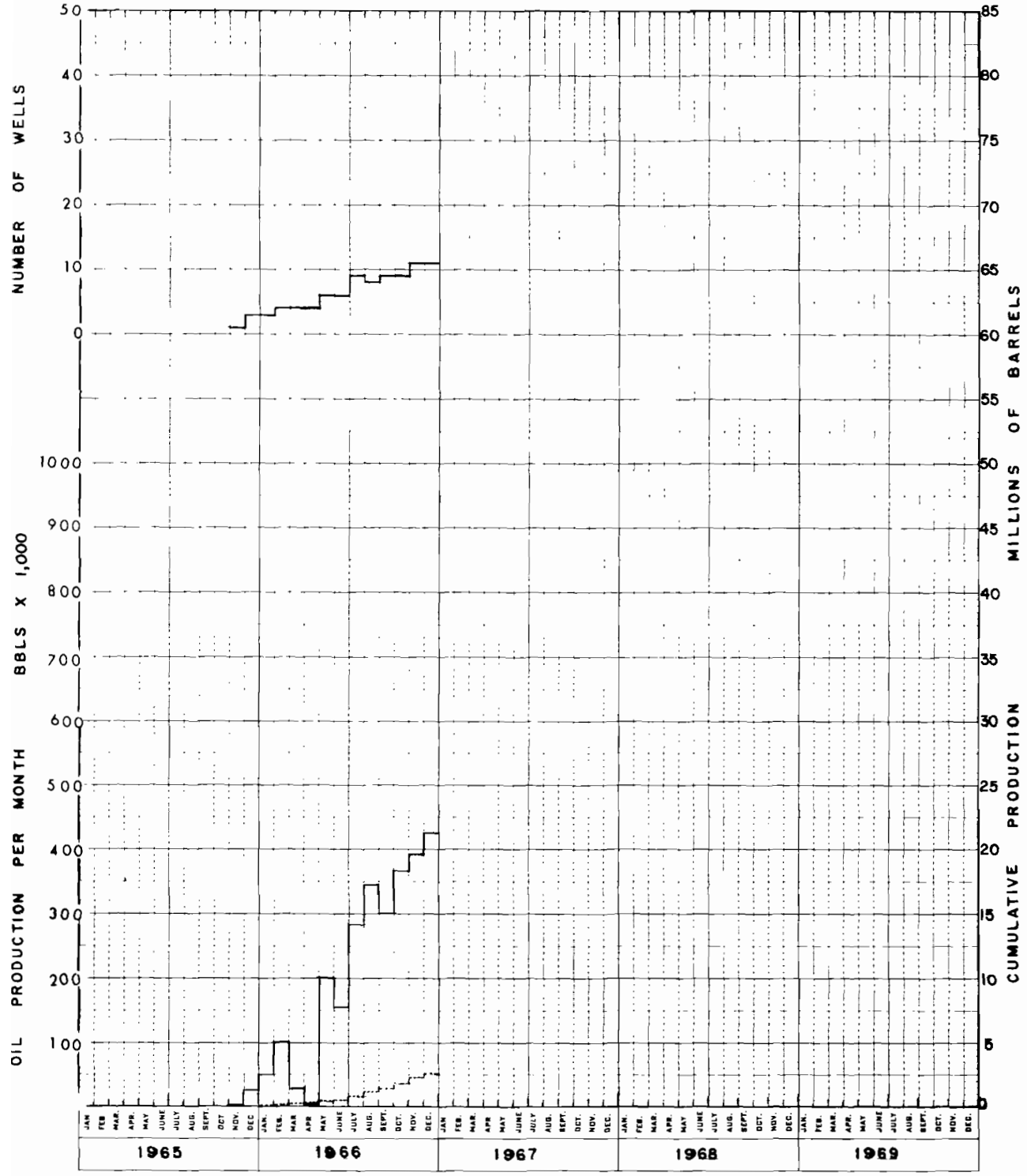


Table X

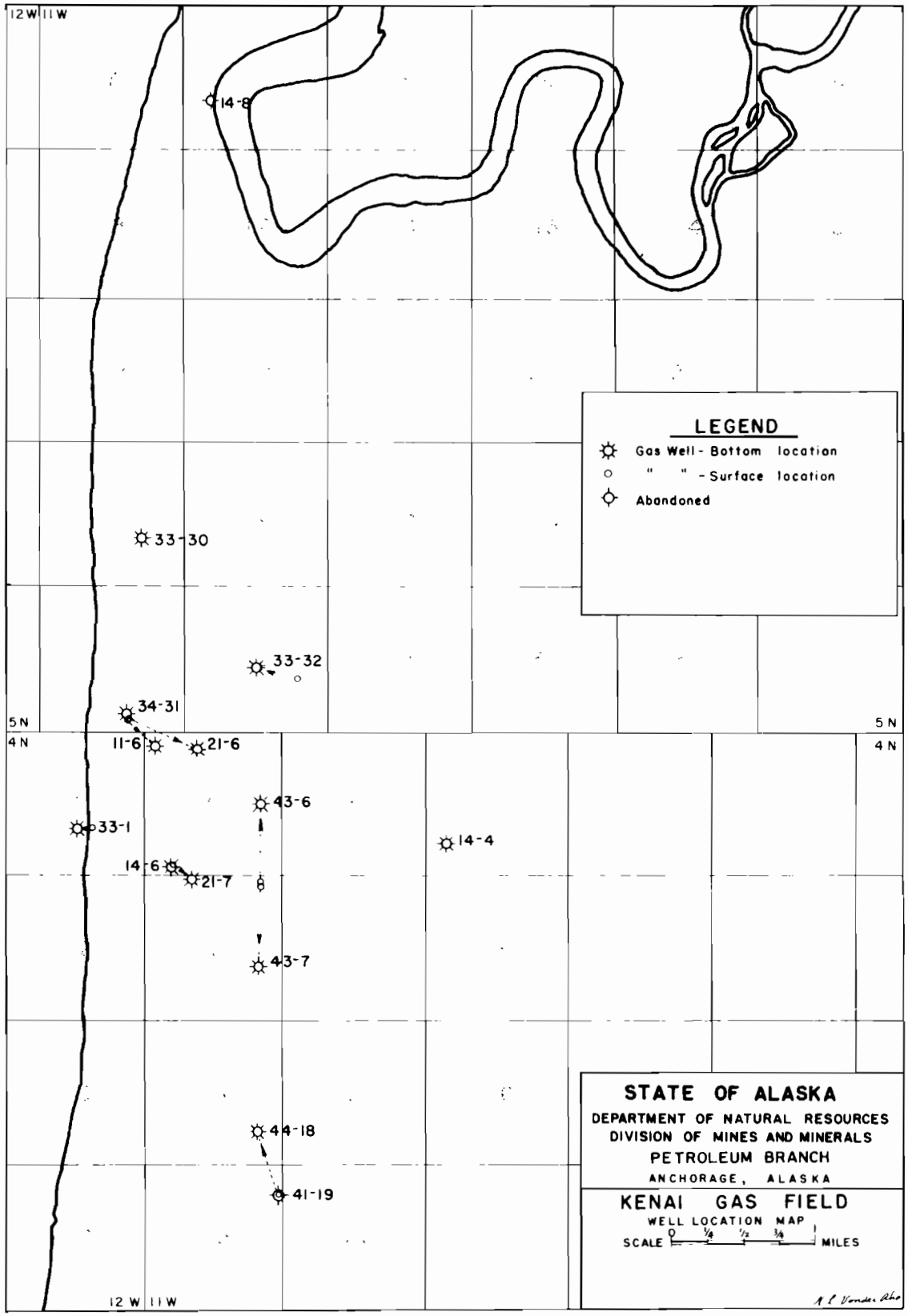
Kenai Gas Field
Kenai Peninsula, Alaska

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	10 (incl. 6 dual)
Shut-in	2
Reservoir Data	
Initial Reservoir Pressure	1,900-2,400 psi
Average Reservoir Pressure	1,735-2,110 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	1,460,175	1,692,367
1963	3	2	0	3,105,539	4,797,906
1964	4	2	0	4,493,170	9,291,076
1965	6	6	0	5,985,342	15,276,418
1966	10	2	0	33,374,960	48,651,378


12W 11W
14-8
33-30
33-32
34-31
11-6
21-6
43-6
33-1
14-4
14-6
21-7
43-7
44-18
41-19
5N
4N
12 W 11W
LEGEND
Gas Well - Bottom location
" " - Surface location
Abandoned
STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINES AND MINERALS
PETROLEUM BRANCH
ANCHORAGE, ALASKA
KENAI GAS FIELD
WELL LOCATION MAP
SCALE 0 1/4 1/2 3/4 1 MILES

KENAI GAS FIELD

GAS PRODUCTION - MCF

Figure 9

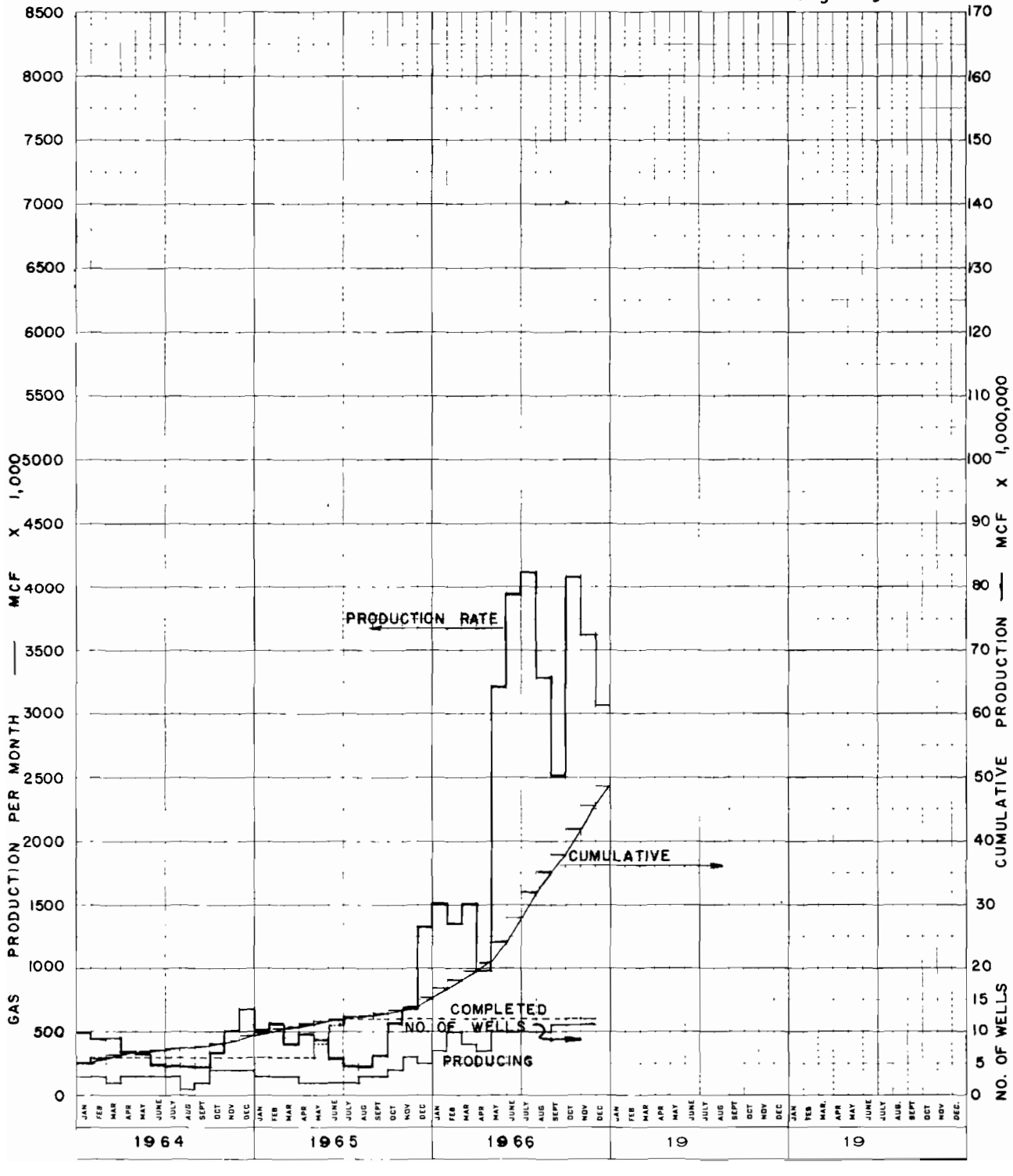


Table XI

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 5,250 - 54' (Perforations)
Deepest Test	No. 23-15 - 14,332'
Wells	
Producing	1
Shut-in	1
Reservoir Data	
Initial Reservoir Pressure	2,200-2,300 psi
Average Reservoir Pressure	2,200 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
1965	1	1	0	120,319	249,612
1966	1	1	0	157,490	407,102

Figure 10

STERLING GAS FIELD

KENAI PENINSULA, ALASKA

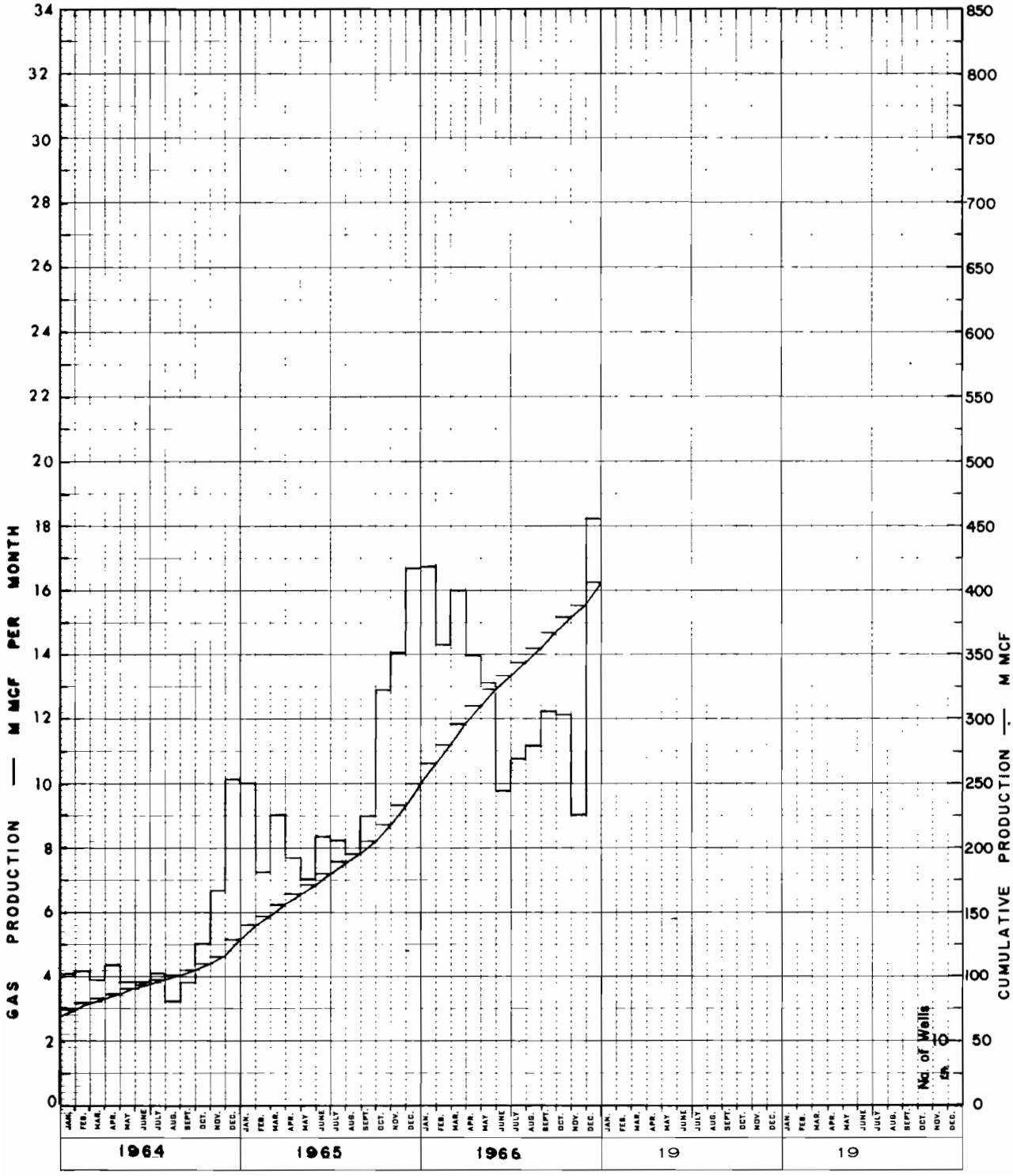


Table XII

Swanson River Injection Project
Injection Statistics*
Gas Injection Started November, 1962

Date	Number of Injection Wells		MCF Injected In Month	Cumulative MCF Injected
1962, Nov.	1		32,710	32,710
Dec.	2		219,450	252,160
Total 1962			252,160	
1963, Jan.	2		298,399	550,559
Feb.	2		315,833	902,392
Mar.	3		524,071	1,426,463
Apr.	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
Aug.	3		647,810	4,399,743
Sept.	3		572,192	4,971,935
Oct.	3		624,597	5,596,532
Nov.	3		495,749	6,092,281
Dec.	3		475,999	6,568,280
Total 1963			6,316,120	
1964, Jan.	3		511,221	7,079,501
Feb.	3		460,168	7,539,669
Mar.	3		510,089	8,049,758
Apr.	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
Aug.	3		443,101	10,582,914
Sept.	3		410,716	10,993,630
Oct.	3		394,426	11,388,056
Nov.	3		351,715	11,739,771
Dec.	3		308,203	12,047,974
Total 1964			5,479,694	
1965, Jan.	3		353,917	12,401,891
Feb.	3		315,422	12,717,313
Mar.	3		389,707	13,107,020
Apr.	3		382,206	13,489,226
May	3		381,402	13,870,628
June	3		350,010	14,220,638
July	2		351,765	14,572,403
Aug.	3	Rented Gas	344,363	14,916,766
Sept.	3	from	338,299	15,255,065
Oct,	3	Kenai Field	346,351	15,601,416
Nov.	3	66,694	369,694	15,971,110
Dec.	3	586,844	799,280	16,770,390
Total 1965		653,538	4,722,416	

Table XI (Cont.)

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

Date	Number of Injection Wells	MCF Injected in Month	MCF From Kenai (Included)	Cumulative MCF Injected
1966, Jan.	3	829,566	608,664	17,599,956
Feb.	3	736,005	569,023	18,337,961
Mar.	4	823,429	655,995	19,161,390
Apr.	4	787,191	620,189	19,948,531
May	7	2,659,654	2,590,235	22,608,235
June	8	3,740,258	3,427,843	26,348,493
July	8	3,791,150	3,610,169	30,139,643
Aug.	7	3,098,176	2,769,813	33,237,819
Sept.	6	2,219,674	1,970,614	35,457,493
Oct.	6	3,598,170	3,265,019	39,055,663
Nov.	7	3,073,221	2,746,074	42,128,884
Dec.	7	2,693,009	1,974,681	44,821,893
Total 1966		28,051,503	24,808,319	

* All gas in this table at pressure base of 15.025 psi 60°F

SWANSON RIVER FIELD

GAS PRODUCTION AND INJECTION

Figure 11

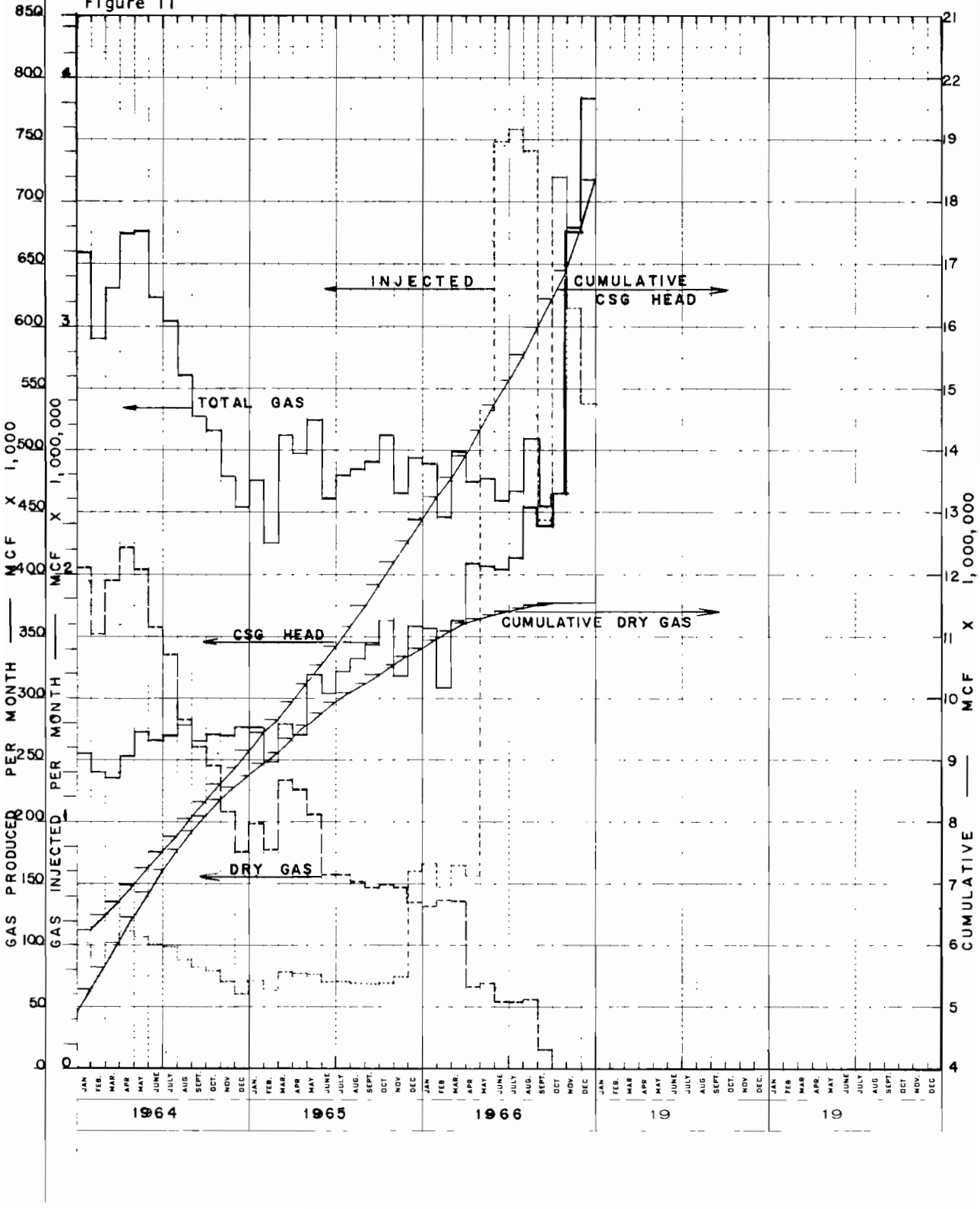


Table XIII

GAS PRODUCTION
At Pressure Base 14.65 psi 60°F

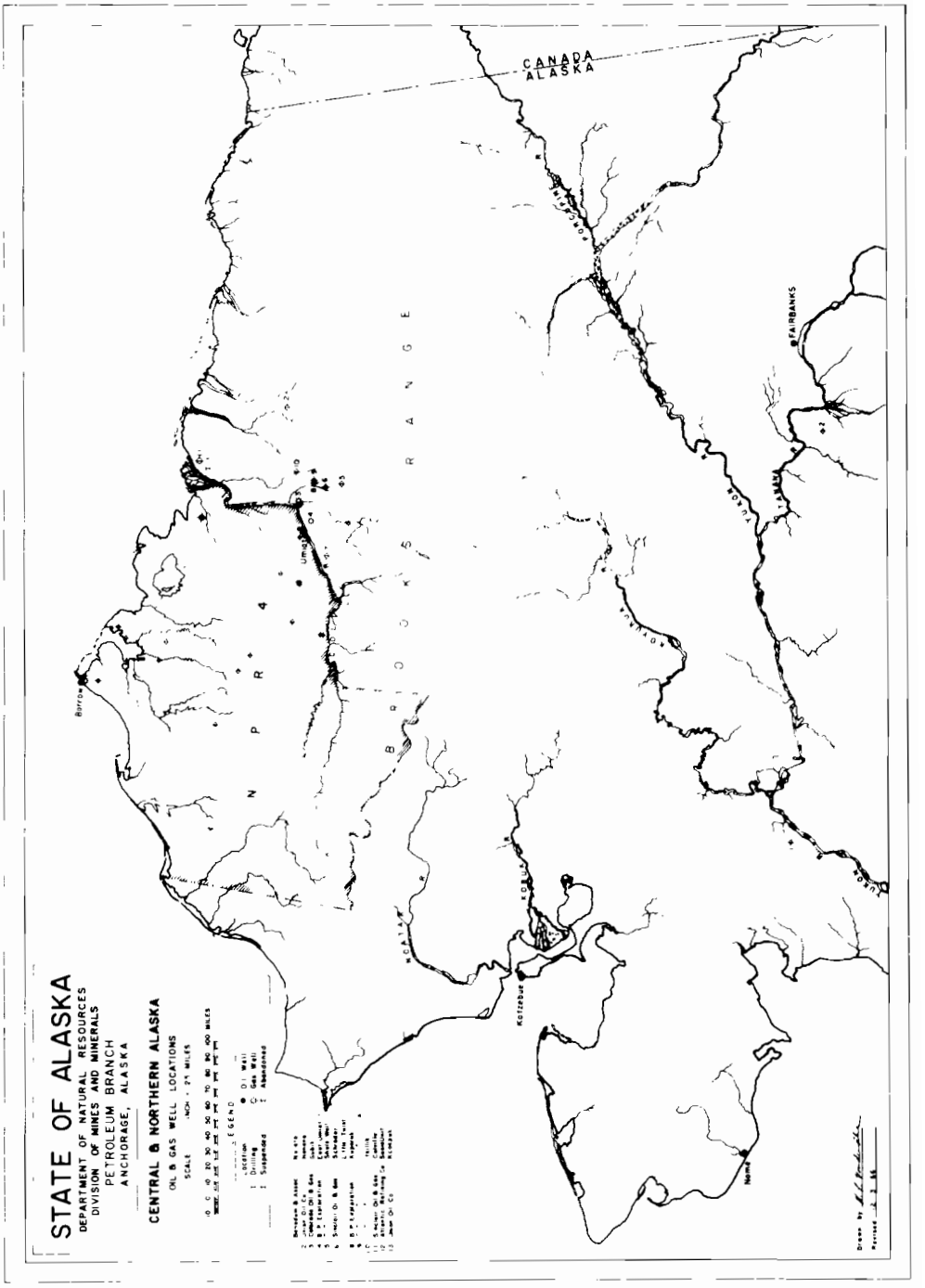
Year	Csg. Hd. Hemlock Z.	Dry Gas Kenai Z.	Total	Blown or Lost	Used	Sold	Injected
SWANSON RIVER FIELD							
Prior to 1959	5,643	0	5,643	5,643			
1959	27,292	0	27,292	26,493	799		
1960	99,175	20,266	119,441	59,835	58,042	1,564	
1961	1,293,258	0	1,293,258	1,035,070	213,636	44,552	
1962	1,914,052	157,134	2,071,186	1,476,214	497,690	97,282	258,615
1963	2,608,012	4,837,506	7,645,518	323,346	7,210,984	111,188	6,477,813
1964	3,233,236	3,943,078	7,176,314	632,552	6,417,723	126,039	5,619,974
1965	3,631,448	2,141,243	5,972,691	821,700	5,025,373	125,618	4,843,310
1966	5,622,493	740,126	6,362,619	1,494,406	4,749,546	118,667	28,769,613
TOTAL	18,834,609	11,839,353	30,673,962	5,875,259	24,173,793	624,910	45,969,325
NOTE: Lease gas injected is also included in "Used" but "Injected" column not included in "TOTAL".							
KENAI FIELD							
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	10	10,382	3,095,147	
1964		4,493,170	4,493,170	1,156	6,297	4,485,717	
1965		5,985,342	5,985,342	14,858	27,192	5,943,292	
1966		33,374,960	33,374,960	7,170	65,424	33,302,366	
TOTAL		48,651,378	48,651,378	24,488	118,317	48,508,573	
STERLING FIELD							
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	
1965		120,319	120,319	1,300	878	118,141	
1966		157,490	157,490	2,640	1,345	153,505	
TOTAL		407,102	407,102	4,455	2,893	399,754	
MIDDLE GROUND SHOAL (Hemlock and Kenai Zones)							
1965	10,405		10,405	10,405			
1966	1,198,386		1,198,386	1,198,386			
TOTAL	1,208,791		1,208,791	1,208,791			

Table XIII (Cont.)

GAS PRODUCTION
At Pressure Base 14.65 psi 60°F

Year	Csg. Hd. Hemlock Z.	Dry Gas Kenai Z.	Total	Blown or lost	Used	Sold	Injected
BELUGA RIVER FIELD							
1963		13,538	13,538		13,538		
1964		136,937	136,937		136,937		
TOTAL		150,475	150,475		150,475		
BIRCH HILL FIELD							
1965		65,331	65,331	65,331			
FALLS CREEK FIELD							
1966		18,982	18,982	18,982			
NORTH FORK							
1966		104,595	104,595	104,595			
TOTAL - ALL FIELDS							
1966	6,820,879	34,396,153	41,217,032	2,826,179	4,816,315	33,574,538	28,769,613
CUMULATIVE - ALL FIELDS							
	20,043,400	61,237,216	81,280,616	7,301,901	24,445,478	49,533,237	45,969,325

Figure 12


STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINES AND MINERALS
PETROLEUM BRANCH
ANCHORAGE, ALASKA
CENTRAL & NORTHERN ALASKA
OIL & GAS WELL LOCATIONS
SCALE INCH = 24 MILES
LEGEND
Location
Drilling
Suspended
Oil Well
Gas Well
Abandoned
CANADA
ALASKA
N P R 4
BROOKS RANGE
Barrow
Umiat
Kotzebue
Nome
FAIRBANKS
YUKON

STREAM SEDIMENT ANOMALIES BELOW A COPPER PROSPECT IN THE PASS CREEK AREA, HEALY QUADRANGLE, ALASKA

by

Arthur W. Rose

Introduction

The Pass Creek copper prospect was discovered in 1963 and reported on by Kaufman (1964). Although stream sediments were collected as part of Kaufman's project, the analyses were all by field methods for readily extractable heavy metals and copper, and the details of the analytical work were not published. In order to compare the results downstream from this known copper deposit with samples collected elsewhere in Alaska, two days were spent collecting a new set of samples from the vicinity of the deposit. These samples have been analyzed for total copper, lead, zinc, molybdenum, and readily extractable copper and heavy metals.

Geology and Mineralogy

At the Pass Creek prospect, gossan containing limonite, malachite, azurite, and chalcopyrite is present in a zone of "fragmental material" about 30 feet thick. The mineralized zone is at an elevation of 4,600 feet, almost at the top of a thick sequence of basalts overlain by a great thickness of phyllite, argillite, and minor limestone. A diorite pluton has intruded the sediments about a mile north of the prospect. A sample across 33 feet of mineralized rock contained 2.9% copper (Kaufman, 1964). The prospect has been explored by trenching, drilling, and sluicing of overburden by Moneta Porcupine Mines Ltd. and its successor, Tennessee Corporation. Chalcopyrite and pyrite were the main sulfide minerals observed. Topography in the prospect area is steep and rugged, but the larger valleys are broad and gently sloping because of glacial erosion.

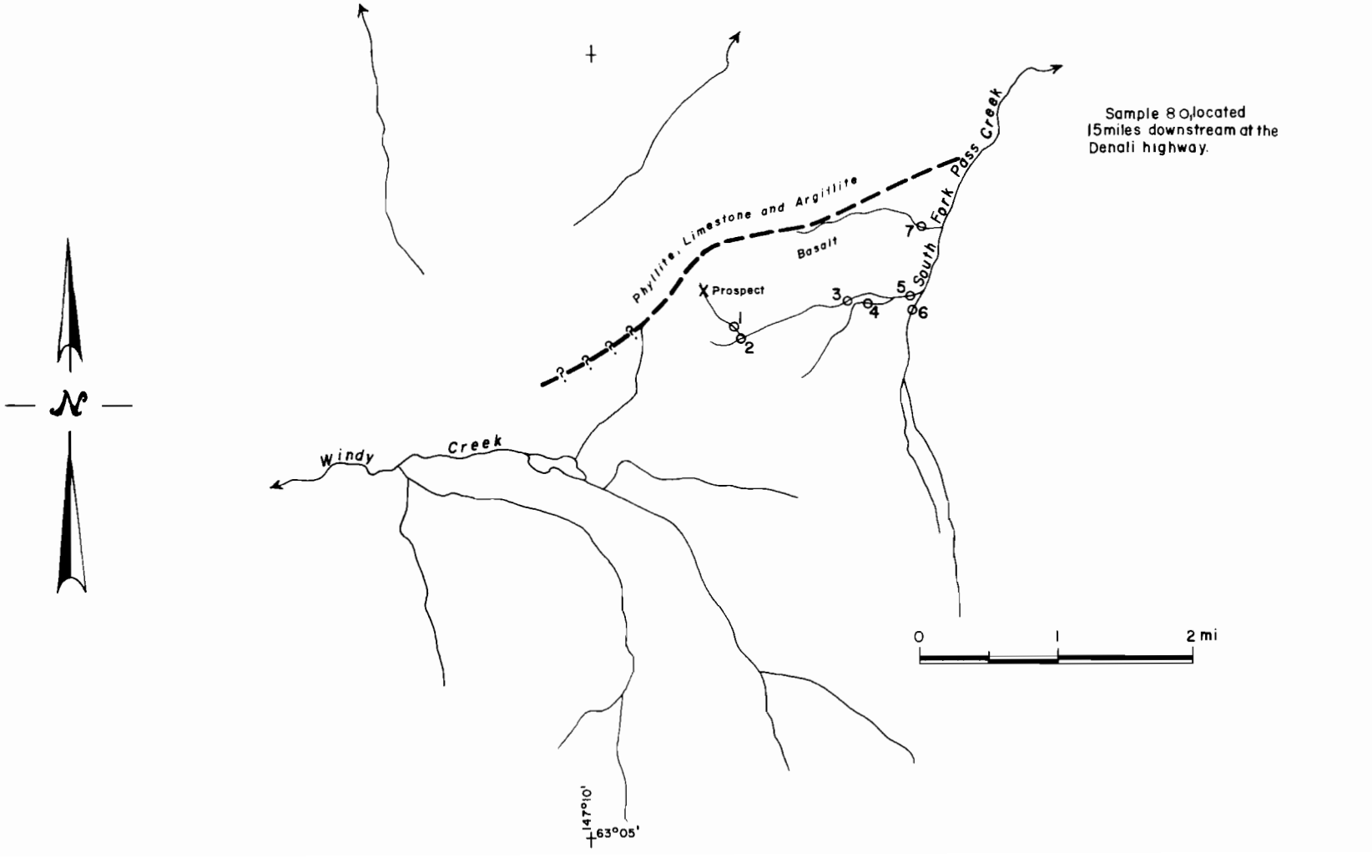
Geochemistry

As a result of the sluicing operation, copper-rich material from the surface of the deposit has been carried downstream and is easily recognizable a mile downstream. Sediments from the present stream channel obviously would give results much different from pre-discovery conditions. To avoid this "contamination", samples were collected from abandoned stream channels that showed no evidence of flow since the sluicing was started. Samples 3 and 5 were from old channels partly overgrown by grass, and may have suffered minor leaching from incipient soil-forming processes, but are believed to be closely representative of the pre-discovery stream sediments. Sample 1 is from a bench in the stream channel about two feet above the present channel.

Results are listed in table 1. Sample 1, about 1,500 feet below the deposit, is strongly anomalous in copper (720 parts per million). Samples 3 and 5, a mile to a mile and a half below the deposit, are approximately at the "background" of presumably unmineralized streams in the area (170-190 ppm copper). However, streams draining the same basalt unit elsewhere in the region have background values of 100 ppm or less, suggesting that the Pass Creek area may constitute a regional high in copper content. At any rate, it appears that at a distance of a mile downstream it would have been difficult to pick out the prospect drainage from others in the area using the total copper content.

The deposits show up somewhat better in the readily-extractable metal content using the methods of Hawkes (1963), but the anomaly still is not striking. Values for readily-extractable copper (citrate buffer at pH 2) decline from about 175 ppm 1,500 feet from the prospect to 56 and 70 ppm a mile and a half downstream, compared to local background that is apparently 20 to 40 ppm. These values are on sieved and dried samples. Initial field values for readily-extractable copper on the wet unsieved samples are considerably higher on the anomalous samples, and lower on the background

Figure 1. Location of stream sediment samples near Pass Creek Copper Prospect Central Alaska Range



samples.

The values for readily-extractable heavy metal content (zinc, lead, and copper) extracted at about pH 8.5 by the procedure of Hawkes (1963) are somewhat more definitive. Values calculated as copper decline from 55 ppm just below the deposit to 33-38 ppm a mile farther downstream, compared to a background of 10-20 ppm. As with copper, values before drying and sieving are higher for the anomalous samples and lower for the background samples

Table 1. Geochemical data on stream sediments

A. Samples downstream from prospect

Map No.	Field No.	Copper	Zinc	Lead	Molybdenum	Readily extractable Heavy Metal*	Readily extractable Copper (field)	Readily extractable Copper (lab)
1	6E378	720	130	10	2	55 ppm (10 ml)	18 ml	175 ppm
2	6E380	190	150	10	3	11 ppm (2 ml)	17 ml	56 ppm
3	6E383	180	85	5	4	38 ppm (7 ml)	12 ml	49 ppm
5	6E386	170	90	10	4	33 ppm (6 ml)	0 ml	70 ppm
8	6E398	90	110	10	1	17 ppm (3 ml)	17?ml	28 ppm
B. Other samples								
4	6E384	170	100	10	5	17 ppm (3 ml)	0 ml	35 ppm
6	6E388	190	85	10	3	17 ppm (3 ml)	4 ml	21 ppm
7	6E389	110	125	10	3	17 ppm (3 ml)	0 ml	42 ppm

Analyses for total copper, zinc, lead, and molybdenum by Rocky Mountain Geochemical Laboratories. Analyses for readily extractable metals by procedures of Hawkes (1963), calculated to ppm copper by comparison with standard solutions.

*ppm value calculated as copper

Conclusions

A relatively small copper deposit in basalts in the southern foothills of the Alaska Range produces a strong total copper anomaly (720 ppm) in stream sediments 1,500 feet downstream, but values 1 1/2 miles downstream are near the local background (170-190 ppm). However, the sediment 1 1/2 miles downstream is distinctly anomalous in readily extractable copper and heavy metals, but the readily-extractable procedures were found to give different results depending on the history, treatment, and processing of the samples, making interpretation difficult.

A relatively small vein deposit about 25 miles farther east (KM deposit) produced a weak anomaly in total copper and readily extractable heavy metals about 3/4 mile downstream (Rose, 1965). From these two examples it is concluded that moderate to large base metal deposits in this terrane can be easily detected by stream sediment geochemistry, but close sampling is needed to detect the smaller deposits.

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THE PRODUCTIVE MINERAL DEPOSITS of SOUTHEASTERN ALASKA*

by

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Utah Construction and Mining Company, Vancouver, B.C.

ABSTRACT

The metal production of Southeastern Alaska since 1900 total over one quarter billion dollars at present day prices. It was largely derived from the lode gold mines between 1900 and 1944. Since 1944, the only significant production has been from one small uranium deposit on Prince of Wales Island.

The more important mineral deposits include occurrences of gold, copper, iron, nickel, silver-lead-zinc, tungsten, and uranium. These deposits occur as contact metamorphic replacements, fissure veins, vein stockworks, concordant replacements, segregations in ultrabasic intrusives, and in shear and fracture zones.

Most of the gold deposits occur in the metamorphosed Mesozoic sedimentary and volcanic belts along the southwest contact of the Coast Range intrusions and along the west coast of Chichagof Island. The copper deposits largely occur on Prince of Wales Island as contact metasomatic replacements in early Paleozoic sedimentary and volcanic rocks near small Mesozoic intrusives. Magnetite is commonly associated with these copper deposits. Large low-grade iron deposits occur in ultrabasic igneous rocks of probable Mesozoic age in the eastern part of the area, whereas the nickel deposits are associated with ultrabasics of probable Tertiary age in the northwestern part of the area. The silver-lead-zinc deposits of the Hyder district occur as veins in the Mesozoic Coast Range Intrusions. Lead-zinc deposits in the vicinity of Wrangell occur in Mesozoic metamorphic rocks intruded by Coast Range quartz diorite. Tungsten occurs in some of the Chichagof Island gold veins and in the silver veins of the Hyder district. The principal uranium occurrences are centered in and around a granite boss near the south end of Prince of Wales Island. This intrusive is of late Triassic or early Jurassic age and intrudes a larger mass of quartz monzonite and granodiorite of early Paleozoic age.

Most of the mineral deposits of southeastern Alaska are believed to be related to the major intrusive, metamorphic and deformational sequence which extended from late Triassic to mid-Cretaceous time.

INTRODUCTION

The purpose of this paper is to examine the relationship between the more important mineral deposits of Southeastern Alaska and their tectonic environment. Information for this paper has been compiled from library research, and from fieldwork in the southern part of the region.

Physical Features

Southeastern Alaska comprises roughly 40,000 square miles, extending from 54°30' to 60° North and from 130° to 140° West. It consists of the mainland and the Alexander Archipelago which includes more than 1000 islands and accounts for about one-third of the land area. The largest islands are Prince of Wales, Kupreanof, Baranof, Chichagof and Admiralty. (Fig. 13-1).

The dominant topographic feature is the Coast Mountain Range which occupies most of the narrow northwest-trending strip of mainland. It is a complex of irregular glacier-covered mountain masses which in places rise to 10,000 feet. The foothills rise abruptly from sea-level and are penetrated by numerous northeast-trending fiords. The St. Elias Mountains occupy the coastal belt of southeastern Alaska to the southwest of the Coast Range, north of 58° latitude. They rise to over 15,000 feet and all are capped by glaciers.

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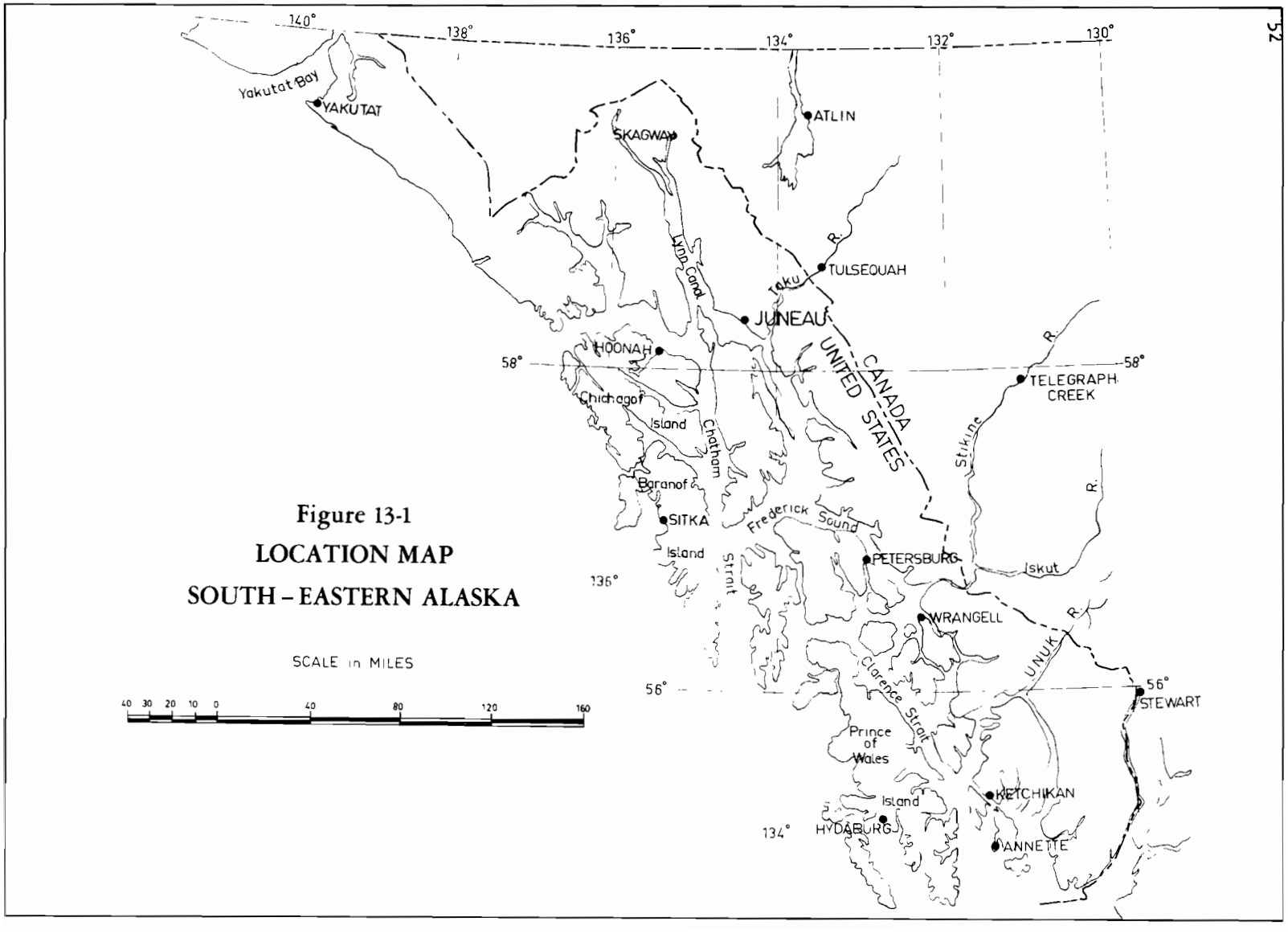


Figure 13-1

LOCATION MAP

SOUTH – EASTERN ALASKA

The island ranges are in general more subdued than the mainland mountains but rugged ranges are present particularly on Baranof Island where the peaks rise to more than 5000 feet.

The climate of southeastern Alaska is mild and wet. Snowfall is heavy in the mountains and inland areas, but generally light below 1500 feet elevation near the coast and on the islands. The average total annual precipitation for southeastern Alaska is 98 inches but this ranges from 16 inches in the northwestern part to almost 300 inches in the southeastern part. The average annual temperature is about 43°F with the average extremes ranging from 10° to 85° F.

Forest cover is extensive up to elevations of 2500 feet. Probably over 50% of the land area is covered by timber, brush, grass, humus and muskeg.

It can be said that the climate, dense vegetation, and rugged terrain are the major obstacles to prospecting and exploration in this region.

History

The first recorded mineral location in southeastern Alaska was made in 1867 on a copper deposit on Prince of Wales Island. The Windham Bay and Holkam Bay gold placers were discovered in 1869 and yielded a total of $40,000 in the next two years (19). The first lode mining in the region was at the Stewart gold mine, 14 miles southeast of Sitka on Baranof Island.

In 1880, Joe Juneau and Richard Harris discovered gold at the mouth of Gold Creek at the present site of the city of Juneau (19). This led to the lode gold discoveries northeast of Gastineau Channel, and on Douglas Island, and subsequently at Berners Bay and Eagle Harbour. These gold mines were operated fairly continuously from 1885 to 1944.

In 1898 the Porcupine gold placers northwest of Haines were discovered. They have a recorded production to 1930 of over $1,000,000. Gold was discovered on Annette Island in the Ketchikan district in 1892. Most of the gold deposits in the Ketchikan district were discovered between 1897 and 1898.

In 1897, the Prince of Wales copper deposits were prospected and production began about 1905. Copper smelters were established at Hadley on Kasaan Peninsula and at Copper Mount on Hetta Inlet. The Kasaan Peninsula and Hetta Inlet copper mines were operated until 1920.

The Rush and Brown mine in the Salt Chuck area of Prince of Wales Island was discovered in 1900 and mined between 1906 and 1923. The Salt Chuck mine was operated from 1907 to 1920, 1924 to 1926, and intermittently from 1935 to 1941.

Gold and silver were discovered in the Hyder area about 1901. The Riverside mine was operated from 1925 to 1927 as a lead-silver-gold mine, and from 1941 to 1946 as a tungsten mine.

In 1905 the Chichagof gold lode was discovered and the resulting gold mines operated from 1905 to 1938. The Apex and El Nido gold veins on Chicagof Island were discovered in 1920 and these mines operated until 1939.

The nickel deposits of Chichagof and Baranof Islands were discovered between 1911 and 1922, but no production has been recorded for these deposits.

The Kendrick Bay uranium deposits were discovered in 1955, and the Ross-Adams mine was operated intermittently until 1964.

PRODUCTION

The total recorded lode mineral production of southeastern Alaska to date at present metal prices is in excess of $250,000,000 (19).

The production by metals has been as follows:

Gold	6.2 million ounces
Silver	3.3 million ounces
Copper	37 million pounds
Lead	48.3 million pounds
Uranium	600,000 pounds
Zinc	111,000 pounds
Platinum group metals	14,000 oz.

The productive mines and districts in southeastern Alaska are shown in Figure 13-2, with the total production indicated by the size of the circle and the principal metal indicated by symbol.

1. Gold

Gold has been the principal mineral product of the region. The largest gold producer was the Alaska-Juneau mine (at Juneau) which recovered $80,000,000 in gold, silver and lead from 1893 to 1944, from the milling of 88,500,000 tons of ore with an average grade of 0.0432 oz. of gold per ton.

In the same area, on Douglas Island, the Treadwell group of mines between 1885 and 1922 produced a total of $67,500,000 in gold and silver from the milling of 28.8 million tons of ore with an average value of $2.35 per ton.

The Chichagoff and Hirst-Chichagof mines of Klag Bay on the west coast of Chichagof Island produced over $20,000,000 in gold between 1905 and 1938.

Smaller gold producers shown in Figure 13-2 include:

i) The Apex, El Nido, and Cobol gold mines at the northwest end of Chichagof Island
ii) Berners Bay and Eagle River districts, northwest of Juneau
iii) Hawk Inlet-Funter Bay district on Admiralty Island
iv) Windham Bay district, southeast of Juneau
v) Ketchikan district
vi) Hollis district on Prince of Wales Island
vii) Golden Fleece and Valparaiso mines, Prince of Wales Island

2. Copper

The only copper production in southeastern Alaska has been from Prince of Wales Island. The mines on Kasaan Peninsula produced about 13,000,000 pounds of copper, 7000 ounces of gold and 56,000 ounces of silver from about 450,000 tons of ore between 1906 and 1918 (50). This production was largely from the Mamie, Mt. Andrew and It mines.

The Hetta Inlet area, principally the Jumbo mine produced about 10,000,000 pounds of copper from 125,000 tons of ore mined between 1907 and 1923 (50).

The Salt Chuck mine produced over 5,000,000 pounds of copper and an estimated 10,000 ounces of palladium from 300,000 tons mined between 1907 and 1941.

Smaller copper producers on Prince of Wales Island include: the Khayyam mine at the south end of McKenzie Arm, and the Cymru mine on the North Arm of Moira Sound.

3. Silver-Lead-Zinc

Silver-lead-zinc production exclusive of that produced as a by-product by the Juneau gold mines has been extremely small. The riverside mine at Hyder, between 1925 and 1927, and the Moonshine mine on the south arm of Cholmondeley Sound, between 1900 and 1910, have produced minor quantities of silver, lead, and gold.

4. Tungsten

Between 1941 and 1945 about 10,000 tons of tungsten ore was produced from the Riverside mine at Hyder.

5. Uranium

The Ross-Adams mine has produced about 30,000 tons of ore grading about one percent U_3O_8 between 1955 and 1964 (12).

6. Non-metallics

In addition to the metallic minerals, there has been a significant production of nonmetallics in Southeastern Alaska. These include limestone, marble and gypsum, as well as sand and gravel.

GEOLOGY

Figure 13-3 is a generalized geologic map of southeastern Alaska. Paleozoic sedimentary and volcanic rocks occupy a substantial part of the Alexander Archipelago extending from Prince of Wales Island northward into the Glacier Bay-Lynn Canal region. These beds are mainly of Ordovician, Silurian and Devonian age. Carboniferous sediments are also present in places along this belt. The Paleozoic sediments include conglomerate, sandstone, chert, greywacke, shale and limestone. The Paleozoic volcanics consist of andesitic and basaltic flows together with tuffs and agglomerates. These rocks have been metamorphosed to greenstone schist, slate, and quartzite of the Wales group on the southern end of Prince of Wales Island and on Annette and Duke Islands.

The Mesozoic sedimentary and volcanic rocks are exposed in two narrow northwest-trending belts. One extends along the mainland coast from Pearse Canal to Lynn Canal. The other belt covers Baranof Island and the west coast of Chichagof Island and extends northwest into the Fairweather Range. The Mesozoic sediments include conglomerate, sandstone, shale, limestone, greywacke and tuff and the volcanics are largely andesite flows and breccia.

The Mesozoic rocks have been metamorphosed along the west edge of the Coast Range intrusives in a narrow belt extending southeast from Juneau to Behm Canal. This is the Wrangell-Revillagigedo belt of metamorphic rocks. The metamorphics include gneiss, schist, marble and phyllite, with the metamorphic grade decreasing westward away from the intrusive contact.

The Mesozoic rocks of the western belt have been metamorphosed on Baranof and Chichagof Islands in places to low and medium grade schists.

Tertiary sediments and volcanic flows are present on Revillagigedo, Zarembo, Kupreanof, Kuiu and Admiralty Islands and along the mainland coast northwest of Icy Point. The sediments include conglomerate, sandstone, and shale with thin coal seams. The Tertiary volcanics include rhyolite, andesite and basalt flows. Recent lava flows from Mt. Edgecumbe cover the south half of Kruzof Island.

The Paleozoic and Mesozoic rocks have been intruded by the Coast Range intrusive complex and associated outliers. These intrusions in southeastern Alaska have been dated as mid-Cretaceous from limited lead-alpha measurements(27). However, in other localities the Coast Range batholith ranges from late Triassic to early Tertiary from potassium-argon dating (24). These intrusions include granodiorite, quartz diorite, and diorite.

The stock of quartz monzonite and quartz diorite on the south end of Prince of Wales Island is considered from potassium-argon dating to be Ordovician and is intruded by a granite boss of Late Triassic or early Jurassic age (23). The intruded sediments are shown here as Devonian but are evidently considerably older.

Younger granodiorite intrusives of probable Tertiary age occur on Kupreanof, Baranof and Chichagof Islands and on the mainland north of Cross Sound (1).

The sediments were deformed by two fold systems. The axis of major folding trends northwester-

Fig. 13·2 SOUTH EASTERN ALASKA PRODUCTIVE MINES

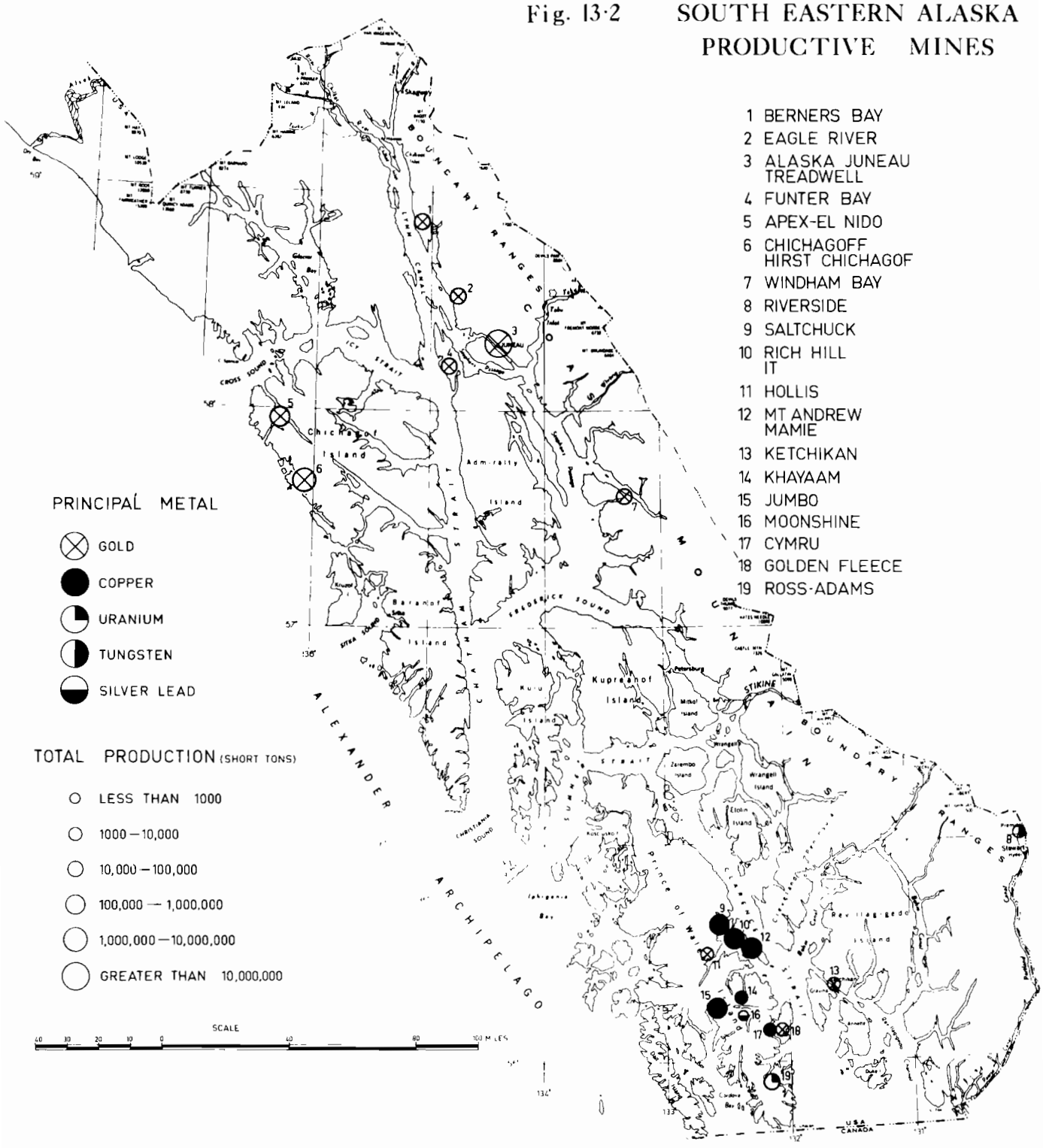
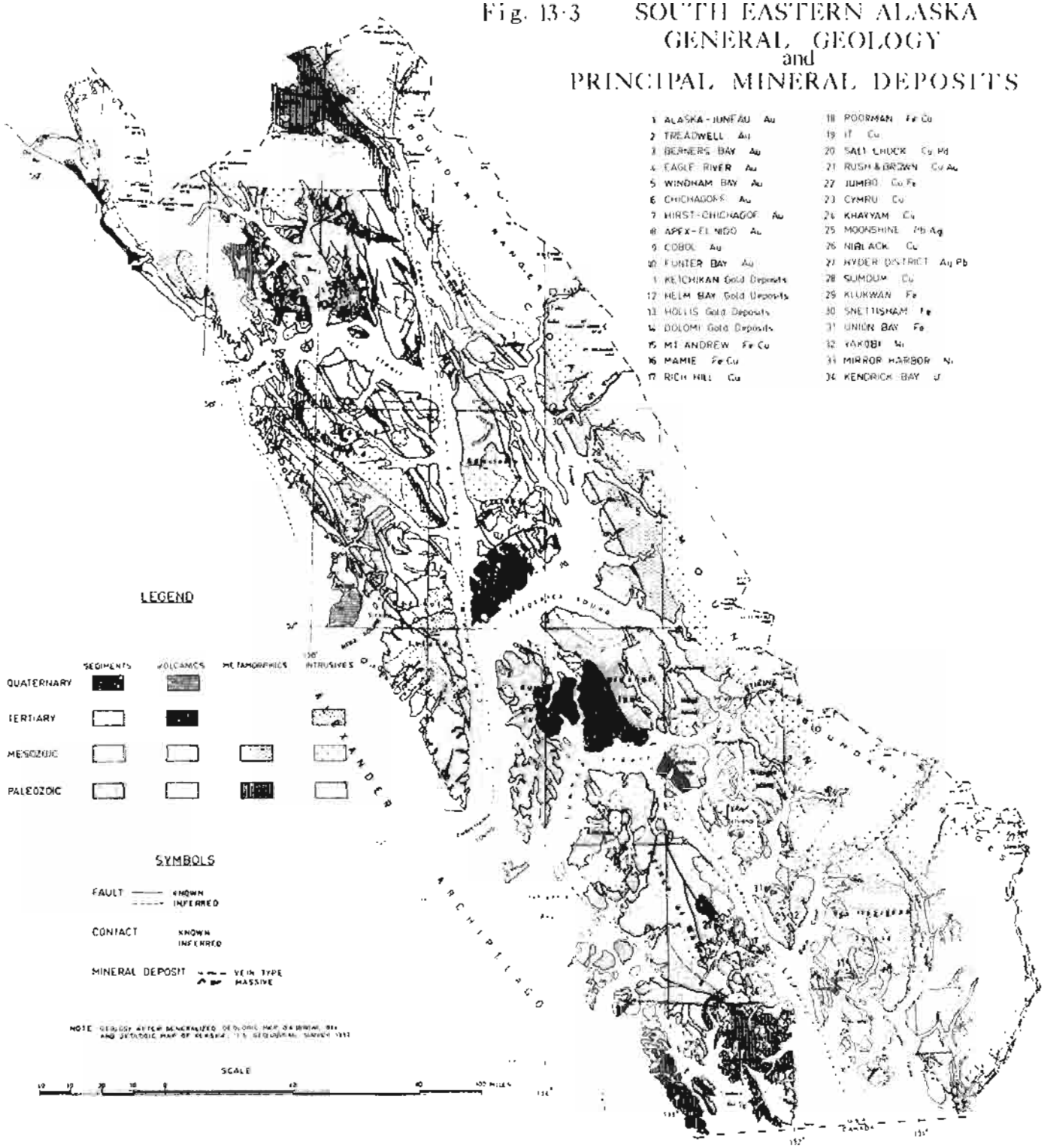


Fig. 13-3 SOUTH EASTERN ALASKA
GENERAL GEOLOGY
and
PRINCIPAL MINERAL DEPOSITS



UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ALASKA

COMPILED FROM ALL AUTHENTIC SOURCES

Scale

ALASKA MAP A

EDITION OF 1967
REPRINTED 1969

BETTER-KNOWN MINERAL DEPOSITS, POSSIBLE PETROLEUM PROVINCES,

ALASKA STATE DIVISION OF MINES & MINERALS

LEGEND

- ANTIMONY
- BERYLLIUM
- CHROMITE
- COAL
- COPPER
- GOLD - SILVER
- IRON
- LEAD - ZINC
- MERCURY
- MOLYBDENUM
- NICKEL
- OIL - GAS FIELD
- PLATINUM
- SULFUR
- TIN
- TUNGSTEN
- ROAD
- RAILROAD
- POSSIBLE OIL PROVINCE

ARCTIC OCEAN
BEAUFORT SEA
BERING SEA
BRISTOL BAY
GULF OF ALASKA
PACIFIC OCEAN
ALEUTIAN ISLANDS
NOME
FAIRBANKS
ANCHORAGE
KODIAK ISLAND
YUKON TERRITORY
YUKON-TANANA UPLAND
SEWARD PENINSULA
NORTON SOUND
ALEUTIAN ISLANDS
ANDREANOF ISLANDS
NEAR ISLANDS

ly; whereas the minor folds trend northeasterly. This major folding as well as the major regional metamorphism occurred during the Mesozoic orogenic episode.

The Archipelago and mainland coastal area are cut by numerous high-angle faults of north and northwest trend (1). These faults form many of the main waterways; such as, Chatham Strait, Clarence Strait, Peril Strait-Lisianski Inlet, Cholmondeley Sound-Trocadero Bay, and Kasaan Bay.

MINERAL DEPOSITS

The more important mineral deposits of southeastern Alaska are shown on Figure 13-3 superimposed on the regional geology. They include gold, copper, nickel, iron, silver-lead-zinc, tungsten, and uranium occurrences.

1. Gold

The gold deposits are mainly in the Mesozoic metamorphic and volcanic rocks in proximity to the larger granitoid intrusives. They are conveniently grouped as the Juneau, Chichagof and Ketchikan gold belts, and individually occur as veins, vein systems and stockworks in intrusive, metamorphic and volcanic rocks.

Juneau Gold Belt The Juneau gold belt extends over 100 miles S 30°E from Berners Bay at the north end to Windham Bay at the south end (Fig. 13-3). It coincides with the contact between the Coast Range intrusions and the Mesozoic sediments and volcanics. The latter are termed the Wrangell-Revillagigedo metamorphics. The Coast Range intrusions in the vicinity of Juneau have been dated as early Mesozoic by the lead-alpha method on zircon (27).

The Berners Bay gold district includes at least ten properties--the most important being the Kensington and Comet mines. The mineralization consists of pyrite, chalcopyrite, galena and gold, in quartz, which occurs as individual veins and stockworks of intersecting veins in the Jualin diorite stock. The veins and stringers strike northwesterly and dip moderately steeply to the northeast. One orebody at the Kensington mine was reported to be 160 feet long by 80 feet wide with a vertical range of over 800 feet (6,9.).

The Eagle River gold deposits are about 20 miles to the southeast of the Berners Bay district. These deposits are vein systems, consisting of numerous quartz veinlets in slates and phyllites, with the veins roughly parallel to the rock foliation (9).

The Alaska-Juneau mine is just east of Juneau along the belt of Mesozoic metamorphic rocks. The Alaska-Juneau vein system consists of numerous parallel quartz stringers from several inches to several feet wide, with little strike length individually. These veinlets occur in phyllite, slate and amphibolite and trend northwesterly, parallel to the schistosity. The veins dip northeast, and consist of quartz and (or) calcite with variable amounts of pyrite, galena, sphalerite and chalcopyrite. Herreid (17) believes that the veins are closely related to the development of the Mesozoic metamorphic belt in which the major folding is isoclinal along northwest-trending axes. The minor folds in this belt plunge steeply northeast down the nearly vertical beds. Two ages of quartz have been definitely recognized: 1) veins, closely related to the metamorphism, that are parallel to the foliation, and may have been exsolved from the country rock; 2) barren transverse veins that follow cross-joints. Herreid (17) suggests that the ore minerals occur in quartz veins intermediate in age between the major northwest folding and the development of northeast-trending joints. He concludes that the ore veins are controlled by the minor folding and plunge steeply to the southeast. The sulphide-bearing quartz veins are further localized along amphibolite-phyllite contacts.

The Treadwell gold deposits on Douglas Island, about one mile west of Juneau were operated as four separate mines, although all of these mines were developed along one vein structure, at least 3500 feet long (9). The mineralization is in well-fractured dikes of albite diorite with the fractures filled by veinlets of quartz and calcite with minor pyrite, pyrrhotite, galena, sphalerite, chalcopyrite and arsenopyrite. The albite diorite dikes cut slate, phyllite and interbedded amphibolite. The favorable zone is at least 3000 feet wide and three miles long.

In the Funter Bay-Hawk Inlet district there are two sets of quartz veins--a transverse system

cutting the moderately steeply-dipping foliation of the schist and phyllite at a steep angle; and a conformable system, parallel to the schistosity. The transverse veins strike northeasterly and dip northwest or southeast, whereas the conformable veins strike northwesterly. Gold occurs in association with pyrite, pyrrhotite and galena. The veins are generally quite persistent and in places show widths in excess of 20 feet. The gold values are generally low and the quartz veins show comb structure with drusy openings. (6,9).

Chichagof Gold Belt

The Chichagof gold deposits are limited to the Chichagoff and Hirst-Chichagof mines in Klag Bay and Apex-El Nido camp on Lisianski Strait. The Chichagof gold veins are parallel with, and relatively close to, the major northwest-trending fault which transects Chichagof Island from Chatham Strait to Cross Sound, extending through Peril Strait and Lisianski Inlet. This general area is also transected by numerous felsitic dikes of northwest trend. The Chichagoff and Hirst-Chichagof veins fill well-defined fault fissures in Mesozoic slate and greywacke. They strike northwesterly and dip steeply southwest and are remarkably persistent along strike. The ore shoots consist of auriferous sulphides irregularly distributed through the quartz (29,32).

The Apex and El Nido veins occur near the center of a large diorite stock. These are fault fissure veins which branch from a large northeast-trending vertical fault that bisects the angle between the two veins. The Apex vein extends N 50° E into both amphibolite and diorite and varies in dip from 30° to 80° to the northwest. The El Nido vein is entirely in diorite, strikes N 70° E and dips steeply southeast. These are branching veins and the ore shoots occur at the vein junctions. Gold occurs with pyrite, arsenopyrite, and minor amounts of galena, sphalerite and chalcopyrite. Aplite dikes occur along the fault zones and the quartz veins generally occur on either or both sides of them (36).

There has been limited development on several other gold prospects in this area; e.g., the Goldwin and Cobol properties. These also are on northeast-trending fault fissures in diorite and quartz diorite--but the veins are not nearly so persistent as the Apex-El Nido system (36).

Ketchikan Gold Belt

In the Ketchikan district gold-bearing quartz veins have been worked at Helm Bay on the north end of Gravina Island and on the south end of Revillagigedo Island. These veins occur in the Mesozoic metamorphic complex near intrusive contacts and trend northwest, in alignment with the foliation, and dip steeply northeast. They are in both metamorphic and intrusive rock and are cut by younger northeast-trending "transverse" veins. The better mineralization evidently occurs at vein intersections. The gold is accompanied by sulphides (2,6).

On Prince of Wales Island, some gold was mined in the Dolomi area, largely from the Golden Fleece and Valparaiso mines. These deposits are apparently quartz vein fillings of sheared fractures in Devonian limestone. The veins trend both northeast and northwest with rather flat dips and are quite lenticular. The gold occurs in association with tetrahedrite and pyrite (2).

In the Hollis area between Twelve Mile Arm and Kasaan Bay, numerous quartz fissure veins have been developed in Devonian (?) slate, argillite, and graywacke, and in quartz diorite. These veins strike northwest and northeast and have a steep but variable dip. The veins are small and the gold is associated with sulphides. There is some thought that the gold may be, in part at least, Tertiary in age (38, 44, 49).

2. Copper

All of the important presently known copper deposits in southeastern Alaska are on Prince of Wales Island, and most of them are on Kasaan Peninsula.

The copper deposits of Kasaan Peninsula are chiefly of the contact metasomatic type and, as such, are mostly small and irregular. The largest deposits on the peninsula are in the Mount Andrew-Mamie area.

The Mt. Andrew, Stevenstown and Mamie copper-iron deposits occur along the south side of a

fault which strikes east and dips steeply to the north. These deposits occur in the Kasaan greenstone north of a large body of diorite. The greenstone consists largely of porphyritic and massive andesite, of possible Mesozoic age, with included Paleozoic sediments. The andesites are believed to represent thick sills in the sedimentary - volcanic sequence (46). This assemblage was later folded and fractured prior to the intrusion of the large diorite body and numerous dikes and irregular small masses of igneous rock ranging from syenite to diorite. The Kasaan Peninsula intrusions have been dated by the lead-alpha method on zircon as probably mid-Cretaceous (27). The mineralization consists of magnetite, pyrite, and chalcopyrite, in a tactite gangue which includes garnet, epidote, diopside, jasper and actinolite. The orebodies have a rough north-south orientation due to intense fracturing and faulting. The orebodies bottom at shallow depth, with a gentle eastward dip suggesting a general lithologic control. The mineralization is considered a replacement of both andesite and limestone along north-south zones of fracturing and faulting related to the Mesozoic orogeny. The area is transected by numerous north-south dikes which are both post-and pre-ore. The dikes include syenite, monzonite, diorite, trachyte and andesite porphyry, gabbro and diabase. The igneous rocks of the region show a general low content of free silica. In addition all of these rocks exhibit extensive alkalic alteration; that is, development of albite and potash feldspar. This alkalic alteration is believed to be secondary and closely associated with the mineralization. Potash feldspar is extensively developed in the mineralized tactite sections at Mt. Andrew.

The Rich Hill copper deposit is about four miles northwest of the Mt. Andrew-Mamie deposits. It consists of disseminated chalcopyrite, pyrite and magnetite in garnet-epidote tactite, which has replaced andesitic flows or sills and included calcareous sediments that constitute the Kasaan greenstone in this area. The mineralization occurs in three well-defined northwest-trending zones, parallel to the strike of the formation (46). The magnetite replaces the well fractured tactite with the sulphides occuring as late fracture fillings. Northeast-trending faults are also considered an important ore control.

The Poorman orebody about four miles northwest of Rich Hill is a vein-like deposit of magnetite, with some pyrite and a little chalcopyrite, which strikes northward and dips moderately steeply to the west. The magnetite replaces brecciated andesite and limestone of the Kasaan greenstone along a north-trending fault zone (46). The mineralized zone is somewhat displaced by northwest-trending syenite and porphyry dikes, which cut the orebody into four unequal segments. The orebody pinches out in limestone at its north end and in heavily sheared andesite at its south end.

At the It mine, about one mile northwest of the Poorman deposit, a large body of diorite surrounds many fairly large but irregular remnants of greenstone and limestone (Kasaan greenstone). The orebodies were evidently lenses of chalcopyrite, pyrite, magnetite, hematite and molybdenite developed along northwest-trending contacts between tactite and marble (46). Some of the orebodies were associated with north-trending shear zones which dip steeply west. The copper orebodies have been traced down to 350 feet vertically.

The Salt Chuck mine is at the head of Kasaan Bay, about 7 miles northwest of the Poorman deposit. It is a pipe-like replacement deposit in a gabbro-proxenite stock, which intrudes Silurian graywackes. The sulphides consist of bornite with some chalcopyrite replacing sheared, fractured, and altered gabbro and pyroxenite at the intersection of a major west-northwest fault with numerous north-trending fractures and small faults. Low palladium values accompany the copper.

The Rush and Brown copper mine is about two miles west of the Salt Chuck mine and consists of a northeast-trending quartz vein which dips moderately steeply to the southeast. Mineralization consists of chalcopyrite, pyrite, pyrrhotite and magnetite in a quartz-calcite gangue. In addition to the vein deposit, a pyrometasomatic replacement lens of magnetite with chalcopyrite occurs along an east-west shear in brecciated greenstone and limestone of Silurian age.

The Hetta Inlet copper district on the west coast of Prince of Wales Island includes a number of pyrometasomatic deposits in early Paleozoic limestone and calcareous schist around the periphery of a large granodiorite stock. The mineralization consists of chalcopyrite, pyrite, pyrrhotite, and magnetite in a garnet-diopside tactite with granodiorite forming the footwall and limestone the hanging wall. As at Mt. Andrew, this area is marked by extensive potash feldspar introduction.

The Cymru copper deposit is at the head of the North Arm of Moira Sound, about one mile from tidewater. This deposit comprises four veins in Paleozoic limestone and schist, with the veins

trending northwesterly and dipping moderately steeply to the southwest. These veins vary from one to five feet wide and consist of chalcopyrite, pyrite and quartz (3,4).

The Sumdum copper-zinc prospect is about 50 miles southeast of Juneau and about five miles east of Holkham Bay, between Tracy and Endicott Arms. It occurs in strongly foliated and folded gneiss, showing felsic and mafic layers, with minor schist and quartzite (26). The age of these metamorphic rocks is not known except that they antedate the Coast Range quartz diorite which is regarded as probably of Cretaceous age (27). The intrusive contact lies several thousand feet to the northeast of the mineral occurrences, and is marked by a northwest-trending fault which dips steeply to the northeast. The metamorphic rocks have been folded into a series of isoclinal folds with numerous minor folds, all overturned to the southwest.

Some copper production was recorded between 1905 and 1908 from the Niblack Mine at the head of Niblack Anchorage which is about 30 miles southwest of Ketchikan. Here, chalcopyrite, pyrite, and magnetite occur as fairly massive replacement of jasperoid greenstone schist along the nose of a southeast-plunging anticlinal fold. The greenstone schists are altered andesitic flows and are interbedded with quartz sericite schist, slate, phyllite and limestone. These beds are in the form of isoclinal folds overturned to the northeast with fold axes plunging to the southeast. This whole assemblage, which is Devonian or older, is intruded by quartz diorite north of the mine (18).

The Khayyam deposit at the south end of McKenzie Arm on Prince of Wales Island is a replacement of sheared andesite north of a diorite stock. The deposit strikes northwesterly parallel to the foliation of the volcanics. The mineralization consists of pyrrhotite, chalcopyrite, sphalerite, and pyrite (2).

On the north side Trocadero Bay, on the west coast of Prince of Wales Island about 50 miles west of Ketchikan, the Big Harbor mine shipped small tonnages of copper ore in 1913 and 1916. The orebodies are small and irregular, occurring along the sheared contact between greenstone schist above the quartz mica schist below. The foliation strikes N 60° E and dips about 60° northwest. The mineralization consists of lenses of pyrite and chalcopyrite (44).

3. Uranium

The Ross-Adams uranium deposit is near the head of the west arm of Kendrick Bay, on the southeast coast of Prince of Wales Island, about 40 miles southwest of Ketchikan. It is an irregular, elongate north-south orebody in the Bokan Mountain boss of peralkaline granite of Mesozoic age (25), and has a high grade core surrounded by a lower grade transition zone. At its south end steep east-west faults and fractures displace the south blocks to the west and downward. The orebody has a gentle south plunge which steepens southward due to the faulting. The main ore minerals are uranothorite and uranoan thorianite which are disseminated throughout the ore and also occur in thin veinlets with hematite and calcite, and some fluorite, pyrite, galena, and quartz. The hematite gives the mineralized section a reddish coloration (25).

Other uranium-thorium deposits occur in the granite boss or around its periphery as veins or accessory minerals or in associated pegmatite and aplite dikes but none of these has been economic (25).

4. Tungsten

Scheelite occurs in small orebodies at the Apex-El Nido mine on Chichagof Island (44), and at the Mountain View and Riverside properties in the Hyder district (7). The Apex El Nido mine has been described under gold deposits and the Hyder district will be described more fully under silver-lead-zinc deposits. At the Riverside Mine three scheelite ore shoots agregating about 10,000 tons were mined between 1941 and 1944. The average grade is slightly over one percent WO_3. No production has come from the Mountain View mine, but a scheelite-bearing vein has been explored underground for a length of 400 feet (7).

5. Silver-Lead-Zinc

The silver-lead-zinc-gold deposits of the Hyder district occur in quartz fissure veins in and around the Texas Creek granodiorite which is believed an early phase of the Mesozoic Coast Range intrusions (6). These veins in general strike northwesterly and dip fairly steeply to the northeast. They follow shear zones and fractures and are best developed in the granodiorite but some have been traced into the interbedded flows and pyroclastics of the Jurassic Bear River formation along the eastern contact of the granodiorite stock. These quartz fissure veins though narrow are quite persistent and carry pyrite, galena, sphalerite, tetrahedrite, chalcopyrite and scheelite (47).

The Riverside vein is developed along the Lindeborg shear in Texas Creek granodiorite. It trends N 60° W dipping 60° northeast and varies from three to ten feet in width. The silver, gold, and tungsten values are confined to shoots in the vein (7).

Low grade zinc-lead deposits occur as bedded replacements of certain metamorphosed sedimentary beds of the Wrangell-Revillagigedo metamorphic belt in the Groundhog Basin about 13 miles east of Wrangell. The metamorphic rocks have been intruded by Coast Range quartz diorite and associated dikes and sills; and certain beds, which are believed to have been originally limestone, are replaced in varying degrees by sphalerite, galena, pyrrhotite and magnetite. These deposits as presently known are not very large and would average less than five percent lead and zinc combined (15).

6. Iron

Iron ore deposits in southeastern Alaska occur as contact metamorphic deposits and as segregations in Mesozoic ultrabasic igneous rocks. All of the important contact metamorphic magnetite deposits occur in association with copper on Prince of Wales Island and have been previously described under the copper deposits.

There are numerous magnetite occurrences in ultrabasic igneous rock in southeastern Alaska but only three of these are at present considered important--Klukwan, 23 miles northwest of Haines; Snettisham, 30 miles southeast of Juneau; and Union Bay on Cleveland Peninsula, 35 miles northwest of Ketchikan.

The Klukwan deposit consists of magnetite in pyroxenite, believed derived from metamorphosed volcanic flows near their contact with a diorite intrusive (34). The deposit is estimated to contain several billion tons grading 15% to 20% total iron, of which 11% to 15% represents magnetic iron. Titanium occurs in the magnetite as ilmenite intergrowths, and also in sphene, leucoxene and amphiboles. A magnetite concentrate made at 100-mesh grind contains 65% iron and 2%-3% TiO_2. The lowest section of the pyroxenite body is higher grade and is estimated to contain 500 million tons grading about 20% iron. An alluvial fan adjoins the pyroxenite body and is estimated to contain several hundred million tons of broken rock averaging 10% magnetic iron.

At the Snettisham deposit titaniferous magnetite occurs as masses and disseminations in a pyroxenite body at least 6000 feet long and 2000 feet wide with a northeast elongation (41). The pyroxenite occurs at the north end of Snettisham Peninsula as a basic segregation and grades into diorite to the south and southeast. This deposit is estimated to contain 500 million tons grading 15 to 20 percent iron and over two percent TiO_2.

The Union Bay deposit occurs in an ultrabasic lopolith with the magnetite largely confined to peripheral pyroxenite and hornblende pyroxenite layers (37). It is considered a true magmatic segregation. This deposit is estimated to contain a billion tons grading 18 to 20 percent total iron with over two percent titanium.

7. Nickel

Although there has been no production of nickel from southeastern Alaska to date, the low-grade nickel-copper deposits on Yakobi, Chichagof, Baranof and Admiralty Islands are considered an important part of the mineral resources.

The principal nickel deposits are in Bohemia Basin on Yakobi Island about 75 miles west of Juneau. These deposits are apparently the remnants of a once much larger trough-shaped concentration of sulphides near the lower boundary of a norite intrusive (50). The sulphide zone is as much as 150 feet thick. The metallic minerals include pyrrhotite, pentlandite, chalcopyrite, pyrite and magnetite (33). Reserves are estimated to be 18 million tons grading 0.5% nickel and 0.27% copper(50).

The Funter Bay deposit on Admiralty Island, about 18 miles west of Juneau, is in a gabbro pipe which plunges at about 30° to the east in highly folded schist and phyllite. Pyrrhotite, pentlandite and chalcopyrite occur as veinlets and disseminated grains mainly along the keel of the pipe. Estimated reserves are greater than 500,000 tons grading 0.45% nickel and 0.4% copper (50).

At Mirror Harbor on Chichagof Island, about 75 miles WSW of Juneau, pyrrhotite, pentlandite and chalcopyrite occur in norite in both massive and disseminated form. The higher grade deposits are small and the larger disseminated deposits very low grade (42).

At Snipe Bay, on the southwest coast of Baranof Island, sulphides are disseminated throughout an altered basic intrusive. Reserves are estimated to be 400,000 tons grading 0.3% nickel and 0.3% copper (50).

The Brady Glacier nickel-copper deposit about 75 miles west of Juneau consists of pyrrhotite, pyrite, pentlandite and chalcopyrite as masses, veinlets and disseminations in a layered gabbro intrusive.

CONCLUSIONS

Most of the gold deposits of southeastern Alaska occur in the metamorphosed Mesozoic sedimentary and volcanic belts developed along the southwest contact of the Coast Range intrusions and along the west coast of Chichagof Island. These deposits are at least in part controlled by the major northwest folding and by transverse faults and joints which dip steeply to the northwest. The small gold occurrences of the Hollis area are distributed around a small Mesozoic intrusive and the predominant vein trends are also northwest and northeast. Most of the copper deposits of southeastern Alaska occur in the Devonian and Silurian sedimentary and volcanic rocks on Prince of Wales Island. They are mainly contact metasomatic deposits in proximity to small Mesozoic intrusives.

The Paleozoic rocks on Prince of Wales Island evidently provided a more favorable environment for copper mineralization than did the Paleozoic rocks elsewhere in Southeastern Alaska. This may be due to: a) the lack of volcanic rocks in the Paleozoic section north of Prince of Wales Island; b) the lack of younger intrusives in the Paleozoic rocks north of Prince of Wales Island; or c), a combination of (a) and (b). The marked northwest alignment of the copper deposits on Kasaan Peninsula suggests the possibility of a fault along Kasaan Bay. The widespread potash feldspar alteration along Kasaan Bay near these copper deposits may be further evidence of such structural control. The copper deposits follow short north-south and east-west faults developed between two parallel northwest-trending normal faults of steep dip. The Hetta Inlet copper deposits are peripheral to a small Mesozoic plug and may be controlled by east-west faulting. Other copper deposits on Prince of Wales Island are in Paleozoic rocks, usually along bedding plane shears and in proximity to the Mesozoic intrusives. The Sumdum deposit at Holkham Bay is in part a replacement of metamorphic rocks of probable Mesozoic age along the west margin of the Coast Range intrusions. The mineralization is further localized by faulting and by folding about southeast-plunging axes. The ore is believed to have been emplaced during a late stage of the Coast Range orogeny (26).

The large low-grade iron deposits in Southeastern Alaska occur in ultrabasic plutons which were emplaced during the Mesozoic intrusive episode. The ultrabasics are distributed along a northwest-trending belt which roughly lies to the east of a line between Cape Chacon at the south end of Prince of Wales Island and Klukwan, to the north of Haines.

Nickel deposits on the other hand are associated with smaller ultrabasic intrusions, considered of Tertiary age (1), which are distributed along a belt to the west of the iron-bearing ultrabasic belt. These intrusions are particularly abundant in the northwestern part of the belt.

Silver-lead-zinc veins in the Hyder district occur in and around a small granodiorite stock apparently somewhat older then the main Mesozoic intrusions (6). The associated copper-lead-zinc

replacement deposits occur in Mesozoic volcanics along the east margin of the Coast Range intrusive complex. The lead-zinc deposits near Wrangell occur in metamorphic rocks, probably of Mesozoic age, intruded by Coast Range plutons.

The main uranium district in southeastern Alaska is limited to the rather unique Bokan Mountain granite boss and associated dykes on the south end of Prince of Wales Island. The main deposit is related to east -west faults and fractures in the granite boss which intrudes a much larger stock of quartz diorite and quartz monzonite. The latter stock is considered to be early Paleozoic, probably Ordovician, on the basis of potassium-argon and lead-alpha measurements (23). The same methods indicate a late Triassic or early Jurassic age for the granite boss. The uranium occurs in the Bokan Mountain granite and associated dykes and therefore is Mesozoic or younger.

Thus most of the important mineral deposits of Southeastern Alaska are closely related to the intrusive, metamorphic and deformational events that extended from the early Mesozoic into the early Tertiary periods. Further, most of these deposits occur in and around small Mesozoic intrusives which are considered to be outliers of the main Coast Range intrusions. The highly folded Mesozoic rocks and their associated intrusive masses are the locus of most of these deposits. Thus far, very few significant mineral deposits have been found in the main Coast Range intrusions in Southeastern Alaska.

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DIVISION OF MINES AND MINERALS

General

The Division of Mines and Minerals was created to aid and promote increased mineral exploration and production in the State of Alaska. In actual practice, it is doing everything within its means to foster and encourage mineral exploratory work and new production in the best interests of the State.

The Division 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, but it 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 the necessary technical help and advice on mineral leasing, unitization, discovery royalty awards, 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 on the following two pages give a brief over-all view of the Division organization, personnel, functions, and a summary of work accomplished in 1966. Later pages discuss the 1966 work in greater detail and present plans for work in 1967.

ORGANIZATION, FUNCTIONS, AND COSTS

DIRECTOR

ADMINISTRATION BRANCH	MINING BRANCH	METALLURGY BRANCH	PETROLEUM, BRANCH	GEOLOGY BRANCH
Authorized Personnel				
Administrative Ass't Minerals Analyst Secretary Officer Manager Clerk Typist	4 Mining Engrs.	X-ray Mineralogist Assayer Chemist Assayer Minerals Lab Tech.	Petro. Supervisor 2 Petrol Engineers Petro. Geologist Clerk Steno	3 Mining Geologists 3 summer assistants Clerk Typist
Locations				
Juneau Anchorage	Juneau Anchorage Fairbanks	Anchorage College	Anchorage	Anchorage
Functions				
Mineral records & information	Prospect examination geochem sampling & reports	Ore Assaying geochemical, & other analyses	Conservation regulations	Ore province evaluation
Publishing	Safety inspections Public inquiries	Mineral identifications	Technical aspects of unitization & leasing regulations	Economic geology reports & maps
Budget, finance, property & personnel	Technical advice & help to prospectors and miners	Ore testing, Research	Public inquiries, Care & release of well logs & samples	Ore deposit investigations
Costs (FY 66-67 Appropriations)				
76,100	86,700	63,300	113,200	93,000

Division Total $432,300

SUMMARY OF WORK ACCOMPLISHED IN 1966

DIRECTOR

Supervision and administration of Division

ADMINISTRATION BRANCH

Accounting, budgeting, personnel, & property administration; public information; published 14 professional reports, semi-annual and annual report, petroleum statistics, monthly bulletin (circulation 2090), 1283 claim location notices and 7095 affidavits processed, 9786 unpatented claims now on file, 2000 visitors assisted, 1760 requests for information received, 2685 professional reports sold or distributed, 1300 information circulars mailed; total mailing 29,300 items

MINING BRANCH

Geochemical investigations were made of nine areas in which 966 stream sediment samples were taken; 42 coal mine and several metal mine safety inspections were made, 16 prospectors were assisted under the Prospector Assistance Program. Over 300 prospectors and professional people were assisted, and over 300 letters pertaining to the mineral industry were written.

METALLURGY BRANCH

Received 2800 samples, on which 5500 assays and analyses were made. Assisted a large part of the visitors.

PETROLEUM BRANCH

Approved 64 oil well drilling permits, all wells were checked for compliance with regulations, compiled production and related statistics, inventoried and made available core samples, gave technical advice to Division of Lands on leasing, royalty, and unitization matters, held five public hearings, issued nine conservation orders, drafted geologic and well drilling progress maps, witnessed well production tests.

GEOLOGY BRANCH

870 square miles of geology mapped, 1000 stream sediment samples taken, assisted prospectors and visitors, furnished information to professional people, prepared reports and maps on previous year's investigations.

Petroleum Branch Activities

The Petroleum Branch of the Division of Mines and Minerals issued 64 permits to drill oil and gas wells in 1966, a record number. This is more than one-and-one-half times the number issued in 1965, and nine more than were issued in 1961 when the Swanson River Field development program was at its peak.

The reports on all of the 65 active wells were received and checked. Field operations were inspected to insure compliance with Oil and Gas Regulations. All drillstem tests and production tests were witnessed when a change in lease status or an application for five-percent royalty award was concerned. Technical data pertaining to the five-percent discovery incentive royalty were checked on seven applications.

The two-year confidential periods for samples and cores from 20 additional wells expired, and these samples and cores are now available for study at the Division of Mines and Minerals building in Anchorage. Electric logs, lithology logs, and well reports on 24 additional wells were made available to the public. See Tables XIV and XV. A complete inventory of samples and cores now on hand is given in Table XVI.

Five Oil and Gas Conservation hearings were held during the year. Two of these developed from applications by Pan American Petroleum Corporation for 80-acre density drilling in the Middle Ground Shoal Field. There is a unique regulatory situation in Cook Inlet where 30-foot tides, six to eight knot currents, and heavy winter floating ice result in conditions favoring permanent-type drilling and producing platforms utilizing deviated holes rather than individual sub-sea completions utilizing straight holes. This means that all but one well of the possible maximum of 48 wells drilled from one platform must be drilled as deviated holes. Since there are several thousand feet of gross pay in some of the offshore wells, the convergence of the deviated wells at shallow depths under the platform makes ideal spacing in the upper pays impossible if the same wells are properly spaced in the lower pools. This situation is somewhat alleviated in the Middle Ground Shoal Field by removing the footage spacing rules in areas where no correlative rights problems exist.

A public hearing concerning the beneficial use of gas in the Middle Ground Shoal Field was held, and was continued for a maximum of 12 months. Another public hearing was held to determine the permanent spacing acreage in the Kenai Gas Field, and a conservation order was issued. In addition, nine conservation orders were issued where spacing exceptions were requested. See Table XVII.

A public hearing on proposed changes in the State Oil and Gas Conservation Regulations resulted in the formation of a committee of representatives from all interested parties. The purpose of this committee is to draft the proposed changes, additions, and deletions of all the present rules and regulations for presentation at a future public hearing.

All oil and gas production data were processed and tabulated and are presented in the appropriate sections of this report. State, Federal, and private agencies depend on the Petroleum Branch for current production statistics, so monthly reports are also prepared. Oil and gas royalty income forecasts were prepared for administrative and legislative use.

The Petroleum Branch was called upon to evaluate technical information concerning outlines of unitized areas, plans of development, and participating areas. Personnel from the Petroleum Branch participated in public meetings and hearings pertaining to water pollution and related problems.

Table XIV

Well records released to the public during 1966 through local scouting services and reproduction firms in Anchorage:

Well Name and Number	Operator
Sandy River Federal #1	Gulf Oil Corp. of Calif.
Happy Valley Unit 31-32	Superior Oil Company
Kenai Unit 33-1	Union Oil Co. of California
Shale Wall Unit #1	B. P. Exploration Company
Pure-Kahiltna Unit #1	Union Texas Petroleum
Susitna State Unit #1	Humble Oil and Refining Co.
Romig Park #1	Pan American Petroleum Corp.
Salmon Berry Lake Unit #1	Socony Mobil Oil Company
East Umiat #1	B. P. Exploration Company
Schrader Unit #1	Sinclair Oil & Gas Company
Beluga River Unit 14-19	Standard Oil Co. of Calif.
Ninilchik Unit #1	Socony Mobil Oil Company
Little Twist Unit #1	Sinclair Oil & Gas Company
Kuparuk Unit #1	B. P. Exploration Company
Tyonek 17586 #2	Pan American Petroleum Corp.
Kasilof State #1	Union Oil Co. of California
Cook Inlet State 17589 #1 (old 1-A)	Pan American Petroleum Corp.
Kasilof State #2	Union Oil Co. of California
North Cook Inlet State #1	Shell Oil Company
Middle Ground Shoal State 17595 #4	Pan American Petroleum Corp.
Middle Ground Shoal State 17595 #3	Pan American Petroleum Corp.
Kuparuk Unit #1 (retest)	B. P. Exploration Company
Middle Ground Shoal State 18743 #1	Pan American Petroleum Corp.
Kuparuk Unit #1-A	B. P. Exploration Company

Table XV

Well Records to be Released During 1967
and their release dates

Well Name and Number	Operator	Date
Kenai Unit 13-8	Union Oil Co. of California	1 - 8-67
Kuparuk #1-A	B. P. Exploration Company	1 -12-67
Tyonek Reserve #1	Humble Oil & Refining Co.	2 - 4-67
Itkullik #1	B. P. Exploration Company	4 -20-67
Trading Bay #1	Union Oil Co. of California	6 - 9-67
Kenai Unit 33-32	Union Oil Co. of California	6 -26-67
West Foreland Unit #1	Pan American Petroleum Corp.	6 -27-67
Kenai Unit 21-6	Union Oil Co. of California	6 -29-67
Birch Hill Unit 22-25	Standard Oil Co. of Calif.	7 - 9-67
Kenai Unit 43-6	Union Oil Co. of California	7 -14-67
Kenai Unit 21-7	Union Oil Co. of California	7 -16-67
Middle Ground Shoal A-43-11	Shell Oil Company	7 -20-67
Trading Bay #1-A	Union Oil Co. of California	7 -25-67
Kenai Unit 43-7	Union Oil Co. of California	7 -28-67
Wallace & Knutson #1	Wallace Mining Company	7 -28-67
Kenai Unit 11-6	Union Oil Co. of California	7 -30-67
Tyonek State 18742 #1	Pan American Petroleum Corp.	8 -21-67
Trading Bay #2	Union Oil Co. of California	8 -24-67
Granite Point #1	Mobil Oil Company	9 - 5-67
SRS State #1	Shell Oil Company	9 -11-67
Trading Bay #3	Union Oil Co. of California	10- 1-67
Grayling #1	Union Oil Co. of California	10- 7-67
Middle Ground Shoal A-32-11	Shell Oil Company	10-17-67
Tyonek State 17587 #2	Pan American Petroleum Corp.	11-17-67
Middle Ground Shoal State 18746 #1	Pan American Petroleum Corp.	11-17-67
Grayling #1-A	Union Oil Co. of California	12- 7-67
Cook Inlet State 18740 #1	Pan American Petroleum Corp.	12- 8-67
Cook Inlet State 18741 #1	Pan American Petroleum Corp.	12-22-67
Middle Ground Shoal A-23-12	Shell Oil Company	12-26-67
Moquawkie #1	Mobil Oil Company	12-28-67
Tyonek State 18742 #2	Pan American Petroleum Corp.	12-28-67

See instructions on last page

DIVISION OF MINES AND MINERALS

SAMPLE & CORE INVENTORY
Table XVI

Well samples & cores in sample storage
at 3001 Porcupine Drive, Anchorage, Alaska

*Destroyed by March 27, 1964 earthquake. Replacement is being attempted and any progress will be noted in subsequent inventories.

Sample Set No.	Public Release Date	Permit No.	Operator	Well and Number	Sample Interval	Cores
1	6 -15-60		Phillips Pet. Co.	Sullivan Unit #1	200-10013	
2	6 -15-60		Phillips Pet. Co.	Sullivan Unit #2	0-12000	yes
3	6 -15-60		Anch. G & O Dev. Co.	Rosetta #1	1100-4245	
*4	6 -15-60		Anch. G & O Dev. Co.	Rosetta #3	120-6060	
5	6 -15-60		Colo. Oil & Gas Co.	Yakutat #1	772-9315	
5A	6 -15-60		Colo. Oil & Gas Co.	Yakutat #2	90-11750	
5B	8 - 6-60		Standard Oil Co. of Calif.	Deep Creek Unit #1	1000-12253	yes (cores only)
6	4 - 4-61		Humble Oil & Refg.	Bear Creek #1	0-14375	
7	5 -23-61		Colo. Oil & Gas Co.	Yakutat #3	1220-10820	
7A	5 -23-61		Colo. Oil & Gas Co.	Core Hole #1	50-3230	
7B	5 -23-61		Colo. Oil & Gas Co.	Core Hole #2	50-5690	yes
7C	5 -23-61		Colo. Oil & Gas Co.	Core Hole #3	30-5484	
7D	5 -23-61		Colo. Oil & Gas Co.	Core Hole #4	60-5326	yes
8	6 -13-61	2	Halbouty Alaska Oil	Halbouty-King #1	60-12030	yes
9	10-14-61	4	General Pet. Corp.	Great Basins Unit #1	20-11070	yes
*10	11-11-61	3	Union Oil Co. of Calif.	Kenai Unit 14-6 (1)	4180-15054	
11	11-13-61	8	Anch. G & O Dev. Co.	Rosetta #4	0-1619	
12	12-11-61	10	General Pet. Corp.	Great Basins Unit #2	15-8865	
13	12-19-61	12	Alaska Cons. Oil Co.	Iniskin U.-A. Zappa #1	100-11230	
13A	6 -27-62		Paul G. Benedum	Nulate Unit #1	0-12015	
*14	7 - 7-62	7	Richfield Oil Co.	Kaliahk Riv. Unit #1	1600-14699	
15	7 -20-62	6-61	Pan. Am. Pet. Corp.	Napatuk Creek #1	60-14890	yes
16	10-10-62	26	Halbouty Alaska Oil	Bishop Creek Unit 11-11 (1)	40-9030	
17	10-26-62	24	Halbouty Alaska Oil	A O & M-King Oil 1-B	50-14019	yes
18	5 -24-63	42	Standard Oil Co. of Calif.	Falls Creek Unit #1	1370-13780	
19	9 - 4-63	14-61	Union Oil Co. of Calif.	Sterling Unit 23-15	1000-14830	
20	9 -18-63	15-61	Richfield Oil Co.	Duktoth River Unit #1	1000-10360	

21	10-25-63	31-61	Standard Oil Co. of Calif.	Swan Lake 34-27 (1)	5200-11984	yes
22	11- 7-63	27-61	Hackathorn Drlg. Co.	Rosetta #4-A	1600-2405	
23	11-26-63	42-61	Pure Oil Company	Canoe Bay Unit #1	0-6642	
24	1 -24-64	21-62	Standard Oil Co. of Calif.	Anchor Point Unit #1	1030-14700	
25	3 - 9-64	48-61	Pan Am. Pet. Corp.	Stedatna Creek-State #1	120-7450	yes
26	4 - 6-64	3-62	Union Oil Co. of Calif.	Nenana #1	450-3030	
27	4 -25-64	55-61	Standard Oil Co. of Calif.	Soldotna Creek 34-16 (32)	990-11880	
28	4 -29-64	49-61	Pan Am. Pet. Corp.	West Foreland #1	30-13500	yes
29	5 -26-64	16-62	Standard Oil Co. of Calif.	West Fork Unit 233-16	0-8400	
30	6 - 9-64	50-61	Superior Oil Company	Chuit-State #1	200-12500	
31	6 -27-64	10-62	Union Oil Co. of Calif.	Pittman Unit	25-6140	
32	6 -31-64	5-62	British American	Bell Island Unit #1	130-11349	
33	8 - 7-64	25-62	Union Oil Co. of Calif.	Sterling Unit 43-28	1150-5630	
34	8 -26-64	7-62	Pan Am. Pet. Corp.	M. G. S. State #1	150-5200	
35	9 -23-64	8-62	Pan Am. Pet. Corp.	Cook Inlet State #1 (CI St. 17589 Well No. 1)	1600-12200	
36	9 -31-64	9-62	Standard Oil Co. of Calif.	Riou Bay Unit #1	140-14100	
37	10- 4-64	26-62	Superior Oil Company	Chuit State #2	2604-9157	
*38	10-14-64	11-62	Shell Oil Company	SRS State #1	465-14041	
39	10-21-64	20-62	Standard Oil Co. of Calif.	Soldotna Creek Unit 22-32 (34)	1000-14560	
40	11-22-64	22-62	Colo. Oil & Gas Co.	Malaspina Unit #1-A	0-13823	yes
41	11-24-64	27-62	Union Oil Co. of Calif.	Tazlina #1	2970-8837	
42	11-25-64	12-62	B. P. Exploration Co.	White River Unit #2	10-12400	
43	11-25-64	23-62	Occidental Pet. Corp.	South Diamond Gulch #1	696-10568	
44	12-29-64	28-62	Pan Am. Pet. Corp.	Cook Inlet State #1-A	11930-12676	
45	1 - 1-65	24-62	Union Oil Co. of Calif.	Ninilchik State #1	220-14940	
46	1 -18-65	18-62	Standard Oil Co. of Calif.	Beluga River Unit #1	130-16440	
47	1 -28-65	33-62	Standard Oil Co. of Calif.	Beluga River Unit 212-25	290-5800	
48	3 - 6-65	15-62	Pan Am. Pet. Corp.	Tyonek State #1	1000-12480	yes
49	3 - 6-65	15-62	Pan Am. Pet. Corp.	Tyonek State #1-A	12000-13082	
50	3 -22-65	36-62	Sinclair Oil & Gas Co.	Swan Lake #2	146-6930	
51	3 -25-65	63-1	B. P. Exploration Co.	Wasilla State #1	0-4849	
52	4 - 3-65	63-5	Halbouty Alaska Oil	Fritz Creek #1	300-3780	
53	4 -25-65	63-2	Standard Oil Co. of Calif.	Beluga River Unit 233-27	300-5080	
54	5 - 6-65	32-62	Aledo Oil Company	Eureka #2	4100-8450	yes
55	5 -14-65	29-62	Standard Oil Co. of Calif.	Swanson River Unit 14-9	200-14300	
56	5 -22-65	38-62	Standard Oil Co. of Calif.	Soldotna Creek Unit 22A-32	1000-14452	
57	8 -18-65	63-3	Pan Am. Pet. Corp.	Moose Creek Unit #1	600-7864	
58	9 -29-65	63-15	Union Oil Co. of Calif.	Knik Arm State #1	180-6110	
*59	10- 8-65	63-4	B. P. Exploration Co.	White River Unit #3	30-6980	
60	10-17-65	35-62	Richfield Oil Corp.	Wide Bay State #1	100-12570	
61	10-18-65	63-9	Shell Oil Company	M. G. S. State #1	5014-9645	
62	12-12-65	63-13	Colo. Oil & Gas Co.	Gubik Unit #1	600-4405	
63	12-16-65	63-8	Pan Am. Pet. Corp.	M. G. S. State #2 (17595)	240-10899	yes
64	1 - 2-66	63-14	Gulf Oil Company	Sandy River Federal #1	0-13050	yes
65	1 - 9-66	63-16	Superior Oil Company	Happy Valley Unit 31-22	0-13550	yes

66	4 - 7-66	63-25	B. P. Exploration Co.	Shale Wall Unit #1	0-4026	yes
67	4 -11-66	63-23	Union Texas	Pure-Kahiltna Riv. Unit #1	700-7265	
68	4 -12-66	63-19	Pan Am. Pet. Corp.	Romig Park, Inc. #1	130-11560	
69	4 -12-66	63-22	Humble Oil & Refg.	Susitna State Unit #1	60-12550	
70	4 -18-66	63-21	Mobil Oil	Salmon Berry Lake #1	130-7910	
71	4 -28-66	63-24	B. P. Exploration Co.	East Umiat Unit #1	102-3340	
72	5 -24-66	64-4	Sinclair Oil & Gas Co.	Schrader Unit #1	0-5129	yes
73	6 -15-66	63-20	Standard Oil Co. of Calif.	Beluga River Unit 14-19	220-14950	
74	6 -22-66	54-3	Mobil Oil	Ninilchik Unit #1	200-12710	yes
75	7 - 6-66	64-5	Sinclair Oil & Gas Co.	Little Twist Unit #1	0-3600	yes
76	7 -15-66	64-8	B. P. Exploration Co.	Kuparuk Unit #1	0-6570	yes
77	7 -24-66	63-6	Pan Am. Pet. Corp.	Tyonek State #2	220-12580	
78	7 -28-66	64-2	Union Oil Co. of Calif.	Kasilof State #1	1500-16121	
79	9 - 5-66	64-9	Union Oil Co. of Calif.	Kasilof State #2	2050-6686	
80	10-13-66	63-18	Shell Oil Company	North Cook Inlet State #1	1504-14815	
81	11-13-66	64-6	Pan Am. Pet. Corp.	M. G. S. State #4 (17595)	180-9203	yes
82	12- 4-66	64-7	Pan Am. Pet. Corp.	M. G. S. State #3 (17595)	130-11170	yes
83	12-15-66	64-10	Pan Am. Pet. Corp.	M. G. S. State #6 (18743 Well #1)	500-10710	
84	1 - 8-67	64-14	Union Oil Co. of Calif.	Kenai Unit 13-8	1160-5500	
85	2 - 4-67	64-11	Humble Oil & Refg.	Tyonek Reserve #1	330-13600	
86	4 -20-67	64-15	B. P. Exploration Co.	Itkillik Unit #1	0-7750	
87	6 -27-67	64-12	Pan Am. Pet. Corp.	West Foreland Unit #1	4700-11002	
88	7 - 9-67	65-1	Standard Oil Co. of Calif.	Birch Hill Unit #22-25	220-15500	
89	7 -20-67	65-4	Shell Oil Company	SRS-MGS State #A-1-3 (#A-43-11)	320-9840	
90	7 -25-67	65-13	Union Oil Co. of Calif.	Trading Bay #1-A	170-6530	
91	8 -21-67	65-14	Pan Am. Pet. Corp.	Tyonek State 18742 #1	316-9505	
92	8 -24-67	65-18	Union Oil Co. of Calif.	Trading Bay #2	810-6620	
93	9 - 5-67	65-2	Mobil Oil Company	Granite Point #1 (State)	110-11565	yes
94	9 -11-67	11-62	Shell Oil Company	SRS State #1 (drld. deeper)	14040-16360	
95	10- 1-67	65-20	Union Oil Co. of Calif.	Trading Bay #3 State	800-7260	
96	11-17-67	65-19	Pan Am. Pet. Corp.	Tyonek State 17587 #2	630-12335	
97	11-17-67	65-22	Pan Am. Pet. Corp.	M. G. S. State 18746 #1	260-10298	
98	12- 7-67	65-25	Union Oil Co. of Calif.	Grayling #1-A (McArthur River Field)	820-10227	
99	12- 8-67	65-30	Pan Am. Pet. Corp.	Cook Inlet State 18740 #1	0-6182	
100	12-22-67	65-23	Shell Oil Company	SRS S. Cook Inlet #2	0-15403	
101	12-22-67	65-28	Pan Am. Pet. Corp.	Cook Inlet State 18741 #1	300-1740	
102	12-28-67	65-12	Mobil Oil Company	Moquawkie #1	200-10120	yes
103	1 -20-68	65-21	Standard Oil Co. of Calif.	North Fork Unit #41-35	246-12810	yes
104	1 -21-68	65-34	Atlantic Refining Co.	Rainbow Federal #1	0-3000	
105	2 -26-68	66-1	Atlantic Refining Co.	Rainbow Federal #2	0-2793	
106	3 -28-68	65-37	Atlantic Refining Co.	Lorraine State #1	0-8010	yes
107	4 - 8-68	65-31	Sinclair Oil & Gas Co.	Colville State #1	60-9930	yes
108	5 - 1-68	65-36	Pan Am. Pet. Corp.	U. S. A. Edna Mae Walker #1	340-16300	
109	5 -27-68	63-17	Standard Oil Co. of Calif.	Naptowne Unit #24-8	0-15226	yes
110	5 -30-68	65-16	Wallace Mining Co.	Wallace-Knutson #1-A	0-6100	

111	6 - 6-68	65-27	Texaco, Incorporated	Nicolai Creek State #1	230-8330	
112	6 - 6-68	66-8	Texaco, Incorporated	Nicolai Creek State #1-A	3885-9300	yes
113	6 - 7-68	66-6	Austral Oil Company	Needham #1	250-6016	
114	7 - 8-68	66-9	Union Oil Co. of Calif.	Kustatan #1	880-11852	
115	7 -16-68	66-16	Shell Oil Company	Forelands Channel #1	0-11786	
116	7 -18-68	66-14	Pan Am. Pet. Corp.	North Redoubt State #1	2170-11280	
117	7 -24-68	66-20	Atlantic Richfield Co.	Middle River State #1	0-7250	
118	8 -12-68	66-10	Pan Am. Pet. Corp.	Tyonek State 17588 #1	0-13523	
119	8 -18-68	66-23	Standard Oil Co. of Calif.	Falls Creek Unit #2	276-8256	
120	9 - 7-68	66-30	Union Oil Co. of Calif.	Kustatan #1-A	4600-11130	
121	9 -18-68	66-18	Hunt Oil Company	Oldman Bay State #1	0-12951	
122	9 -19-68	66-33	Shell Oil Company	Forelands Channel #1-A	6975-12951	
123	9 -25-68	66-17	Great Basins Petroleum Co.	Ugashik #1	0-9476	
124	9 -27-68	66-26	Atlantic Richfield Co.	West Foreland Unit #3	0-9768	
125	10- 3-68	66-7	Trinity Canadian Drlg. Co.	Homesteaders #1	6780-13890	
126	10-14-68	66-12	Pan Am. Pet. Corp.	West Foreland Unit #2	30-11948	
127	10-21-68	66-32	Atlantic Richfield Co.	McArthur State #1	0-10255	yes
128	10-28-68	66-34	Union Oil Co. of Calif.	Kenai Unit #41-2	0-5735	
129	11- 6-68	66-21	Standard Oil Co. of Calif.	Ivan River #44-1	0-15269	yes
130	11- 9-68	65-29	Texaco, Incorporated	Trading Bay State #1	800-9104	
130-A	11-21-68	66-41	Atlantic Richfield Co.	Middle River State #2	630-10295	
131	11-23-68	66-38	Texaco, Incorporated	Nicolai Creek State #2	300-5012	
132	12- 7-68	66-42	Shell Oil Company	West Foreland Unit #4	0-11160	
133	12-10-68	66-45	Union Oil Co. of Calif.	E. Trading Bay State #1	670-10364	
134	12-15-68	66-50	Atlantic Richfield Co.	Drift River State #1	0-5410	yes
135	12-30-68	65-33	Texaco, Incorporated	Coal Bay State #1	200-4013	

Instructions :

At release date, all samples will be available washed, dried, and in envelopes.

All sample boxes must be checked in and out of the sample room by the Petroleum Branch stenographer.

Well samples and cores may not be examined outside of the Petroleum Branch offices. All of the sample must be returned to the sample envelope.

Table XVII

Summary of Oil and Gas Conservation Orders

Order No.	Date Issued	Pertinent Data
1	August 7, 1958	Adoption of amended regulations which became effective on October 1, 1958.
2	April 30, 1959	Footage exception for the surface location of the Union Oil Company of California #14-6 Kenai Unit.
3	October 30, 1959	Footage exception for the surface location of the Union Oil Company of California #34-31, Kenai Unit. This followed emergency order #3 which was issued on October 17, 1959.
4	April 4, 1960	Spacing exception allowing Standard Oil Company of California to drill the #32-4 Soldotna Creek Unit well for the purpose of establishing a 160-acre pattern that conformed with the Swanson River Unit spacing pattern.
5	November 25, 1960	Granted a temporary 80-acre spacing pattern for Hemlock wells in the Swanson River Field because of the lack of reservoir continuity.
6	October 20, 1961	Footage exception for the surface location of the Superior Oil Company #1 Chuit State.
7	November 15, 1961	Footage exception for the surface location of the Pan American Petroleum Corporation #1 Stedatna Creek State.
8	May 11, 1962	Granted a permanent 80-acre spacing pattern for wells producing from the Hemlock Zone in the Swanson River Field.
9	May 11, 1962	Granted Standard Oil Company of California permission to conduct a pressure maintenance program by injecting natural gas into the Hemlock Zone of the Swanson River Field.
10	May 31, 1962	Footage exception for the surface location of the Pan American Petroleum Corporation #1 Middle Ground Shoal State.
11	June 21, 1962	Footage exception for the surface location of the Pan American Petroleum Corporation #1 Cook Inlet State.
12	May 23, 1963	Footage exception for the surface location of the Pan American Petroleum Corporation #2 Middle Ground Shoal State.
13	August 26, 1964	Footage exception for the surface location of the Pan American Petroleum Corporation #6 Middle Ground Shoal State; subsequent to Emergency Order #13 issued August 13, 1964

14	August 18, 1964	Footage exception for the surface location of the Humble Oil and Refining Company #1 Tyonek Reserve.
15	April 5, 1965	Footage exception for the surface location of the Shell Oil Company #A-1-3 SRS - MGS (new #A-43-11 MGS); subsequent to Emergency Order #15 issued April 2, 1965.
16	April 21, 1965	Granted a temporary 320-acre spacing pattern for wells in the Kenai Gas Zone of the Kenai Unit because of the technical evidence that was submitted.
17	May 12, 1965	Footage exception for the surface location of the Mobil Oil Company #1 Moquawkie; subsequent to Emergency Order #17 issued April 28, 1965.
18	October 11, 1965	Footage exception for the surface location of the Sinclair Oil & Gas Company #1 Colville.
19	November 12, 1965	Footage exception for the surface location of the Atlantic Refining Company #1 Federal.
20	Not Issued	It was not necessary to issue this order.
21	April 25, 1966	Footage exception for the surface location of the Shell Oil Company #1 Forelands Channel State; subsequent to an Emergency Order issued April 15, 1966.
22	May 24, 1966	Footage exceptions for the subsurface locations of the producing horizons of the Shell Oil Company #A-32-11 MGS.
23	Not Issued	Footage exception for the subsurface location at the producing horizon of the Texaco, Incorporated #1 Nicolai Creek will be considered when the well begins actual production.
24	June 28, 1966	Footage exception for the surface location of the Atlantic Richfield Company #1 McArthur State.
25	July 6, 1966	Footage exception for the subsurface location of the bottom of the hole of the Shell Oil Company #1-A Forelands Channel.
26	August 4, 1966	In a certain, defined area of the Middle Ground Shoal Field, the 500' standback was exempted (except for ownership changes and the perimeter of the area), 160-acre spacing was retained, seven pools were designated (A through G) and commingling of Pools B, C, and D and E, F, and G was allowed; permanent spacing to be decided in not more than 18 months.
27	Not Issued	It was not necessary to issue this order.
28	August 23, 1966	Footage exceptions for the surface and subsurface productive locations of the Texaco, Incorporated #2 Nicolai Creek Unit.

29	August 23, 1966	Footage exception for the surface location of the Hunt Oil Company #1 Kalgin Island State.
30	October 21, 1966	The permanent spacing pattern for the Kenai Gas Zone of the Kenai Unit was designated to be 320 acres.
31	October 19, 1966	Conservation Order #26 restated. In the same described area of the Middle Ground Shoal Field, the 500' standback was exempted (except ownership changes), 160-acre spacing was retained, two of the seven pools were redefined, the same commingling rule was more clearly stated and to continue in force for no longer than 18 months.
32	Not Issued	Dated November 7, 1966, a hearing was continued for a maximum of 12 months. Within that time, the operators in the Middle Ground Shoal Field must show cause why a no-flare order should not be issued to insure the beneficial use of the natural gas produced in the field.
33	December 9, 1966	Footage exception for the surface location of the Union Oil Company of California #1 Kookpuk.
34	December 28, 1966	Footage exception for the surface location of the Hunt Oil Company #2 Kalgin Island State.

Geologic Field Work

SINUK AREA, Seward Peninsula (1)*

Gordon Herreid, Mining Geologist
70 square miles - 150 stream sediment samples
July 16 - August 9, 1966

Lead, zinc

The Sinuk map area lies 18 miles northwest of Nome along the Nome-Teller highway. Bedrock is made up almost entirely of interbedded marble and schist. Gossans containing up to several hundred thousand tons of limonite have long been known in this district. Old trenches and shallow pits in the gossans have failed to penetrate to the unweathered rock and no concentrations of sulfides approaching ore grade are known. No drilling has been done at any of the deposits. Reconnaissance geochemical sampling of the gossans during 1965 indicates that anomalous amounts of zinc and possibly lead are at least locally present in the largest gossan (Monarch property). The conclusion from the 1965 work was that the gossans represent surface oxidations of pyritic deposits probably localized along faults that cut the marble bedrock and that lead and zinc deposits possibly exist at depth.

A second type of ore deposit in the area is lead-zinc-barite replacement along schist-marble contacts. Two such deposits are known along the southwest margin of the marble highland that cuts across upper Washington Creek. No ore grade material is exposed at these deposits, but strong geochemical anomalies were found in tundra-covered areas adjacent to each of them. The larger of these anomalies measured approximately 2,000 x 6,000 feet.

Field work in 1966 consisted of more detailed mapping in parts of the 1965 map area and extension of the area to the south and east. Shallow plunging marble fold hinges are present, some of which are dolomitized. Also there are many faults with displacements of a few tens or hundreds of feet. The only geochemical anomaly found was traced a distance of 2 1/4 miles upstream to a zone of zinc-lead float nearly in place. This deposit, which is exposed only as float, is marked by soil anomalies which extend for at least 5,000 feet. It is associated with silicification and dolomitization of the enclosing schist. A geochemical-geological progress map showing the Sinuk mapping to date and a description of this new find will be released shortly.

FAREWELL AREA, central Alaska Range (6)

Gordon Herreid, Mining Geologist
116 square miles - 228 stream sediment samples
June 13 - July 13, 1966

Nickel, mercury, copper

The map area lies along the south side of the Farwell fault. This fault is a major tectonic feature with large movement, possibly beginning in the Mesozoic era. Several mining districts are present in the Kuskokwim region near the Farewell fault and along the similar Iditarod fault. One recently discovered nickel prospect is known in the map area, while lead, zinc, and cinnabar deposits are present east and west of the area.

Bedrock in the map area is early Paleozoic thin bedded limestone, slatey limestone, black slate, and thick bedded limestone. These are complexly folded with axes plunging in various directions. Two granitic intrusions are present along the west edge of the map area, just east of Big River. Eastward from the largest granite body a series of steep east-west trending dikes of rhyolite, dacite, andesite, and basalt are present. These form a belt some four miles wide in

*Numbers in parentheses refer to locations on map shown in figure 13.

which, over large areas, the dikes are more abundant than the country rock. The rhyolite and dacite are probably related to the granitic intrusives in origin, but the andesite and basalt are younger and cut the granite. These dikes extend east of the Windy Fork, beyond the area mapped. The only associated mineralization is pyrite in the dacite dikes. The only prospect known in the area lies outside the dike belt. It is the Chip-Loy prospect, located on a tributary near the headwaters of the Middle Fork of the Kuskokwim. It contains copper-and nickel-bearing pyrrhotite veins and disseminations along a diabase dike.

Dikes and areas underlain by rhylite and andesite were noted in the mountains along the Windy Fork near the Farewell fault. This area was not mapped.

Geochemical stream sediment samples were taken throughout the mapped area. Field anomalies were found only in the vicinity of the Chip-Loy prospect. Total copper, lead, zinc, molybdenum, and nickel analyses indicate possible extensions of the Chip-Loy dike or mineralized zone. A few scattered moderate anomalies for various metals are present elsewhere in the area. A second pyrrhotitic zone was discovered, but not examined due to the crevassed condition of the glacier at its base. Float considered to come from this deposit contains 0.04-0.1% nickel and traces of copper and chromium.

It seems most likely that the intrusion of acid and basic rocks took place during the Cenozoic and later part of the Mesozoic along breaks related to movements on the Farewell fault. Further mapping is planned along this igneous belt.

DOLOMI-PAUL LAKE, Prince of Wales Island, southeastern Alaska (21)

Gordon Herreid, Mining Geologist
9 square miles - 79 stream sediment samples
May 19 - June 5, 1966

Gold, base metals

The map area is 40 miles southwest of Ketchikan on the east coast of Prince of Wales Island. Numerous quartz-tetrahedrite veins, valuable mainly for gold and silver, were discovered in the area between 1898 and WorldWar I. These deposits were explored by numerous shafts, adits, and pits, most of which are now overgrown or caved. Sporadic small scale mining has been done on at least two of the deposits between 1898 and World War II, but no production figures are available.

Most of the map area is underlain by schist-phyllite and marble of the Wales group of Silurian(?) age. Relatively unfoliated andesitic graywacke and slate with minor marble in the southwestern part of the area is of Devonian(?) age. The Wales group in the area is made up of marble and schist-phyllite ranging from approximately 100 to 2,000 feet thick. Bedding of the Devonian(?) graywacke and slate is roughly parallel to the older Wales group, but the two are probably separated by a fault or unconformity.

The rocks of the Wales group show progressive metamorphism, ranging from low-grade phyllite to garnet schist over a distance of 1 1/4 miles from the south side of Port Johnson to the head of Dolomi Bay. Elsewhere greenschist facies rocks are up-graded to synkematic garnet schist locally along schist marble contacts. Widely scattered post-kinematic mafic dikes are the only igneous rocks in the area.

The marble and schist units of the Wales group have a domal structure centered on Paul Lake. This dome is cut by an east-west fault of small(?) displacement at the Valparaiso mine and by a major north-south fault system which extends through Dolomi Bay. Post-metamorphic dolomitization has taken place in several areas of up to a few hundred feet in extent. Dolomitization is also present locally along faults in the Dolomi Bay fault system.

Along known faults silica has been extensively introduced as replacements of marble (jasperoid) and cross-cutting quartz veins. The veins carry tetrahedrite locally and have values in gold, silver, and copper. No mineralization was detected in the jasperoid.

Stream sediment samples taken throughout the area show a sparse scattering of local zinc and lead anomalies along the two fault zones which cut the Paul Lake dome. These fault zones, with their associated dolomitization, silicification, and mineralized quartz veins, extend northward beyond the map area. There is a greater than average incidence of vein or replacement deposits along these zones. The possibilities for finding undiscovered deposits north of the map area appear to be good.

ANTON LARSON BAY, Kodiak Island (16)

A. W. Rose and D. H. Richter, Mining Geologists
20 square miles mapped - 43 stream sediment samples
May 9-16, 1966

Tungsten, gold

The original plan for this project was to conduct geological and geochemical studies in a large area around the known scheelite occurrences, but because of heavy snow above the 500 foot elevation, work was largely restricted to the shoreline. A thick sequence of graywacke and slate is intruded by two muscovite-biotite granodiorite plutons within the map area. Mineral occurrences consist of small disseminated scheelite bodies in graywacke, and a zone of gold-bearing quartz veins in one of the granodiorite intrusives. The composition of the intrusives and the possible genetic association of the tungsten with the intrusives, combined with the relative lack of prospecting near the large areas of intrusive on the island, suggest that further prospecting may be worthwhile. Stream sediment sampling is made difficult by the large volume of volcanic ash from the 1912 eruption of Mt. Katmai.

HASSELBORG-THAYER LAKE AREA, Admiralty Island, southeastern Alaska (18)

A. W. Rose, Mining Geologist
50 square miles mapped - 150 stream sediment samples
June 2-30, 1966

Copper and other metals

The Hasselborg Lake area was suggested for detailed mapping by the U.S. Geological Survey on the basis of numerous gossans. The gossans occur in schist east of a large granodiorite pluton. Gossans within the map area have developed from pyrite and pyrrhotite disseminated in schist. Trace to minor chalcopyrite occurs with the iron sulfides. Only part of the area of gossans was mapped. At the south end of Hasselborg Lake, low-grade copper-nickel mineralization occurs in gabbro, and a chalcopyrite-pyrite vein cuts sedimentary rocks. Several weak to moderate copper, zinc, and nickel anomalies were obtained in stream sediments.

UPPER CHISTOCHINA RIVER, eastern Alaska Range (8)

A. W. Rose, Mining Geologist
45 square miles mapped - 149 stream sediment samples
July 10 - August 26, 1966

Copper, iron, lead, zinc, gold, platinum, and asbestos

The map area includes the Slate Creek placer camp, and extends west to the Gakona glacier. Pennsylvanian and Permian andesite-dacite, argillite, basalt, and minor limestone of the Chisna and Mankomen formations have been intruded by ultramafic, mafic, and granitic bodies in Mesozoic time, causing extensive metamorphism. Volcanics and sediments of probable Tertiary age overlie the older rocks. The Denali fault, a regional strike-slip fault, crosses the north side of the area, and a parallel zone along Slate Creek probably has similar movement. Gold at Slate Creek may have been concentrated from the Tertiary sediments with an original source north of the Denali fault. Additional gold reserves could occur in a former channel. Strong copper, zinc, and lead anomalies were detected at several locations along the Slate Creek fault zone and deserve follow-up exploration. Numerous small copper and iron occurrences were found.

NORTHERN TALKEETNA MOUNTAINS (7)

A. W. Rose, Mining Geologist
50 square miles mapped - 39 stream sediment samples
August 31 - September 8, 1966

Copper and iron

This area of iron-staining was selected for ground work on the basis of aerial reconnaissance in 1965. A large quartz diorite pluton occupies the southeast margin of the area. A sequence of interlayered greenstone and sediments, including at least one limestone bed, trends northeastward across the remainder of the map area. The sediments probably correlate with the limestone and argillite of the nearby Iron Creek area where copper-iron replacement deposits are known. Streams draining a pyritic phyllite unit contain anomalous copper content. Several minor copper occurrences were found.

UPPER SLANA RIVER-MENTASTA PASS, Eastern Alaska Range (9)

D. Richter, Mining Geologist
275 square miles mapped - 98 stream sediment samples
July 14 - August 31, 1966

Gold, copper, chromite, nephrite

This area includes most of the drainage of the Slana River west of Mentasta Pass and a limited part of the drainage of the Little Tok River east of Mentasta Pass. It is the third investigation in various areas of the eastern Alaska Range by the Division since studies were initiated in that region in 1963.

The map area covers a 30-mile long segment of the Denali fault zone, a major strike-slip feature in southcentral Alaska. South of the fault a series of nonmetamorphosed sedimentary and volcanic rocks ranging in age from Permian to Lower Cretaceous dip at moderate angles to the northeast. North of the fault, the rocks are all metamorphic, probably Devonian or older in age and dip steeply to the southwest.

In the bedded rocks south of the Denali fault the following four distinct stratigraphic units have been recognized:

Age	Name	Description	Thickness
Upper Jurassic-Lower Cretaceous	"Mentasta" argillite	Argillite, interbedded with graywacke, siltstone, shale, conglomerate and minor limestone.	>9,000'
?	"Jack" limestone	Massive reef(?) limestone with minor thin bedded limestone	0-600 feet
?	"Slana" basalt	Dark green, brown, maroon, amygaloidal basalt.	6,000-8,000'
Permian	Mankomen Formation	Limestone, chert, argillite, and shale.	>2,500'

The metamorphic rocks north of the fault are quartz mica schist, phyllite, and slate with subordinate limestone, marble, serpentinite, and greenstone. Small stocks of diorite, granodiorite, and quartz monzonite intrude all the bedded and metamorphic rocks in the area with the

possible exception of the "Mentasta" argillite. A lenticular body of dunite, associated with a larger mass of amphibolite and amphibolite-pyroxenite gneiss, is exposed in the Denali fault zone.

Copper mineralization occurs in scattered localities generally near the top of the "Slana" basalt, and gold has been placered along one stream draining the diorite-basalt contact. Bands of disseminated chromite and small segregations of massive chromite occur in the dunite body. Nephrite has been found in association with serpentine and tremolite in a serpentinite-chlorite rock in the metamorphic unit north of the fault. Strong geochemical anomalies, principally in zinc, occur in a number of drainages north of the Denali fault, but may be due to a relatively high zinc background in the phyllitic country rock.

METAL CREEK AREA, Chugach Mountains (12)

D. H. Richter, Mining Geologist
160 square miles mapped - 79 stream sediment samples
June 6 - July 1, 1966

Gold, tungsten

The Metal Creek area is 25 miles east of Palmer and 50 miles northeast of Anchorage in the Chugach Mountains of southcentral Alaska. Placer gold has been mined intermittently on a small scale since 1906.

Country rock in the area is interbedded slate, siltstone, and graywacke of Cretaceous age locally metamorphosed to phyllite and quartz mica schist. Narrow discontinuous dikes of light-colored, slightly porphyritic quartz diorite(?) are common throughout the area, and one small stock of quartz diorite (trondjhemite) was mapped. A raised terrace of clay and glacial deposits extends up Metal Creek, and recent glaciers and glacial debris mantle most of the high valleys.

The sedimentary rocks are folded parallel to the trend of the Chugach Range. Strike of the bedding averages N10°-30°E and the dip is steep to vertical. The axes of minor folds and crinkles plunge at moderate angles to the southwest and northeast.

Quartz veins with minor pyrite and chlorite are common throughout the area. Around the periphery of the small quartz diorite stock an altered zone contains abundant quartz veins with minor pyrrhotite and chalcopyrite. Copper and gold values, however, are low.

Placer gold has been found only in Metal Creek, and significant cencentrations appear to be limited to the downstream half. The gold is apparently being reworked from glacial terrace deposits by present stream action. The original source of the gold is presumed to be local. Heavy minerals associated with the gold are: pyrite, zircon, and scheelite. No platinum was observed.

No stream sediment trace element anomalies were detected in the stream samples. Heavy mineral concentrates from the stream sediments, however, indicate anomalous concentrations of scheelite (tungsten) in parts of the Metal Creek drainage.

Geochemical Field Work

The four mining engineers collected 966 stream sediment samples for geochemical analyses during the field season, administered the Prospector Assistance Program, and made coal and metal mine safety inspections. Reports on the geochemical investigations are being prepared for publication.

Areas investigated by geochemical sampling during 1966 were:

Southeastern Alaska

Admiralty Island (18), Taku River (19), Chichagof Island (17)

Southcentral Alaska

Seward and Sterling Highways (13), Valdez to Tonsina and Chitina (11)

Northcentral Alaska

Tolovana River (2), Bear-Solo Creeks (4), Porcupine-Mastodon Domes (3), Columbia Creek (5). A special report on the Yukon-Tanana region has been in progress for two years and will be published soon.

Reports Published During 1966

Geological Reports

No. 17. Geology and Geochemistry of the Hollis and Twelvemile Creek Areas, Prince of Wales Island, Southeastern Alaska, by G. Herreid and Arthur W. Rose, April 1966. (32 pages, with numerous maps and figures). Price $1.00

No. 18. Geology of Chromite-Bearing Ultramafic Rocks Near Eklutna, Anchorage Quadrangle, Alaska, by A. W. Rose, May 1966. (20 pages, maps and figures). Price $1.00.

No. 19. Geology of Part of the Amphitheatre Mountains, Mt. Hayes Quadrangle, Alaska, by A. W. Rose, February 1966. (14 pages, includes maps and figures). Price $1.00.

No. 20. Geological and Geochemical Investigations in the Eureka Creek and Rainy Creek Areas, Mt. Hayes Quadrangle, Alaska, by A. W. Rose, June 1966. (Includes 36 pages, tables and maps). Price $1.00.

No. 21. Geology of the Slana District, Southcentral Alaska, by D. H. Richter, July 1966. (51 pages and maps). Price $1.00.

No. 22. Geology and Geochemistry of the Nixon Fork Area, Medfra Quadrangle, Alaska, by Gordon Herreid, July 1966. (37 pages and map). Price $1.00.

No. 23. The Geology and Geochemistry of the Inmachuk River Map Area, Seward Peninsula, Alaska by Gordon Herreid. In preparation.

No. 24. Preliminary Geology and Geochemistry of the Sinuk River Area, Seward Peninsula, Alaska, by Gordon Herreid, May 1966. (19 pages and map). Price $1.00.

Geochemical Reports

No. 6. Geochemical Investigations of Selected Areas in Southeastern Alaska, 1964 and 1965, by C. F. Herbert and W. H. Race, December 1965. (66 pages, plus maps and figures). Price $1.00

No. 7. Geochemical Investigations Along Highway and Secondary Roads in Southcentral Alaska, 1965, by M. W. Jasper, July 1966. (8 pages and various tables and illustrations). Price $1.00.

No. 9. A Geochemical Investigation Along the Taylor Highway, East-Central Alaska, by R. H. Saunders, February 1966. (17 pages and Appendix). Price $1.00.

No. 10. A Geochemical Investigation of the Nenana Highway Area, Central Alaska, by W. M. Burand, April 1966. (13 pages including figures and maps). Price $1.00.

No. 11. A Geochemical Investigation of Stream Sediments in the Elliott Highway Area, Alaska, by W. M. Burand, July 1966. (17 pages and numerous figures). Price $1.00.

No. 12. A Geochemical Investigation of Minook Creek, Rampart District, Alaska, by W. M. Burand and R. H. Saunders, April 1966. (15 pages and Appendix). Price $1.00.

Reports to be Published Soon

The following reports on field work done in 1966 are in preparation, and we plan to release them prior to the 1967 field season. The listed descriptions under "Area" refer only to the general areas covered and are not the exact titles that will be given the reports.

Geologic Reports

No.	Area	Author
25	Metal Creek & Upper Knik River, Chugach Mountains	Richter
26	Farewell, Central Alaska Range	Herreid
27	Dolomi, Prince of Wales Island	Herreid
28	Northwestern Chistochina River Drainage, Eastern Alaska Range	Rose
29	Sinuk, Seward Peninsula	Herreid
30	Upper Slana River Area, Eastern Alaska Range	Richter
31	Anton Larson Bay, Kodiak Island	Rose & Richter
32	Upper Talkeetna River, Talkeetna Mountains	Rose

Geochemical Reports

8	Admiralty Island	Race
13	Selected Areas of Yukon - Tanana Region	Burand
14	Seward and Sterling Highways	Jasper
15	Valdez to Tonsina and Chitina	Jasper

Special Report

	Yukon-Tanana Project	Saunders

Division Programs for 1967

Petroleum Branch

The petroleum industry is rapidly expanding. Regulatory responsibilities of the Petroleum Branch, which include drilling permits, well inspections, public hearings, and issuance of conservation orders, will increase correspondingly. Drilling activity is expected to increase even over the record level of 1966. Increased development drilling will result in more automatic metering installation which require regular field inspection. Further steps will be taken toward the eventual machine handling of production and well records. The development of each new oil or gas field requires the evaluation of various data to determine the correct well spacing, to delineate the pools, and to determine proper production rates. The Petroleum Branch is preparing for the handling of this expansion.

Geology and Mining*

Selected areas considered favorable for the occurrence of commercial ore deposits will be investigated and reports will be published on these investigations for the help and encouragement of exploration companies and prospectors.

Geochemical investigations of mineralized districts will be made and reports published. Some of the areas to be investigated are:

Southeastern Alaska

Chichagof Island (17): A large area which contained several productive gold mines, and several copper-nickel prospects.

Cholmondeley Sound, Prince of Wales Island (21): Continued detailed mapping in the Niblack Anchorage and Dolomi areas in which lead, zinc, copper, silver, and gold prospects exist.

Hollis, Prince of Wales Island (20): Continued detailed mapping in the area of geochemical anomalies found during the 1964 and 1965 field seasons.

Southcentral Alaska

Nuka Bay, Kenai Peninsula (15): An area of abundant lode gold quartz veins containing minor amounts of silver, copper, lead, and zinc.

Mentasta Mountains (10): Continuation of mapping project begun in 1965 in an area where copper occurs sporadically throughout an amygdaloidal basalt and molybdenum occurs in gneissic syenites along a diorite intrusive.

Upper Chistochina River (8): Continuation of detailed mapping and geochemical sampling begun during 1966 in which gold, platinum and copper have been reported.

Northcentral Alaska

Farewell area (6): Extend detailed mapping and sampling accomplished during the 1966 field season to the east to trace out the band of dikes near the Farewell fault.

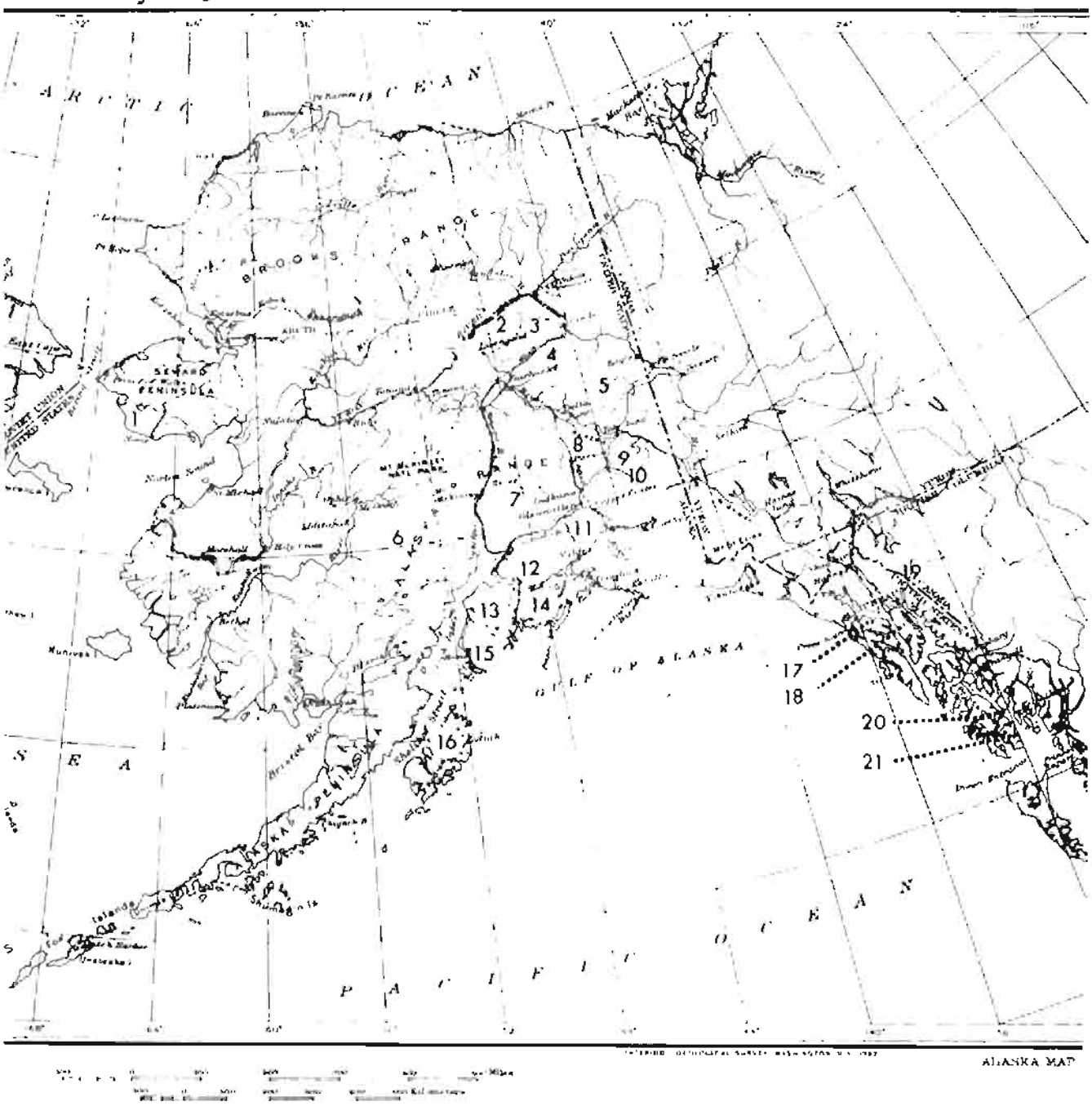
The Yukon-Tanana project report will be published.

*Numbers in parentheses refer to map locations in figure 13.

Northwestern Alaska

Sinuk area, Seward Peninsula (1): Completion of detailed mapping and geochemical sampling begun in 1965 in an area in which two large zinc anomalies have been found.

Figure 13



ALASKA MAP

Prospector Assistance Program

Forty requests for information concerning the State Prospector Assistance Program were received during the year. These inquiries, in addition to applications received from some of the previous years' participants, resulted in 29 application forms being mailed out. Twenty-two of these were received back, of which 21 were processed and approved, resulting in the encumbrance of the entire $30,000 appropriation. This money was not all spent, however, because only 13 of the 21 approved prospecting parties completed their programs and were reimbursed. Five parties withdrew from the program and two others have not been heard from. One party is still in the process of turning in reports on his work, and so has not been reimbursed at the date of this writing.

Seventy-one claims were staked on seven different prospects. However, specific information on the prospects cannot be released for two years unless cleared sooner by the prospector. Total cost to the State was $16,566.44 (plus an undetermined amount for the one uncompleted project mentioned above). This represents an average of $13.83 per man day spent in the field.

Members of the screening boards were:

Robert Saunders	-	State Mining Engineer, Fairbanks
Willow Burand	-	" " " "
Martin Jasper	-	" " " , Anchorage
William Race	-	" " " , Juneau
Dr. Donald Cook	-	College of Earth Sciences and Mineral Industry, University of Alaska
Dr. Robert Forbes	-	CESMI, University of Alaska
Leo Mark Anthony	-	" " " "
Henry Waterfield	-	" " " "

Table XVIII on the following page presents data on this year's program.

Table XVIII

PROSPECTOR ASSISTANCE PROGRAM - 1966

NAME	LOCALITY PROSPECTED	MAN DAYS	Claims Staked	Samples Assayed	ACTUAL PROSPECTING EXPENDITURES					Reimbursed by State
					Travel	Food	Equipment & Misc.	Total Expense	Expense per Man Day	
Ed Farrell & Bert Higgins	Manley Hot Springs	180			$1,411.04	$ 408.30	$ 3,583.92	$ 5,403.26	$30.02	$ 4,000.00
Jim Fuksa	Kantishna	88		9	233.98	121.10		355.08	4.04	196.75
Harold Gilbertson	Richardson	35	4	7	50.00	249.09	130.52	429.61	12.27	322.21
Ed Hudson & Richard W.Geraghty	Livengood	104	2	41	395.00	497.49	3,119.79	4,012.28	38.57	3,009.21
Clifford H.Larsen	Kantishna	106	11	15	770.00	338.17	180.71	1,288.88	12.16	966.66
Robert W.Leslie	Fairbanks	120		9		231.56	163.78	395.34	3.29	296.51
Richard B. Palmer	Chatanika	99		3		351.96	2,330.53	2,682.49	27.10	2,000.00
Max M.Rusaw	Matanuska	68	4	4	575.40	90.70	24.10	690.20	10.15	228.71
Ora P. Schoonover	Talkeetna	30			102.50	69.34	129.92	301.76	10.06	226.32
Julius Sirilo	Kuskokwim	58	1	19	249.00	326.06	148.65	723.71	12.48	542.78
A.W. & K.Smith	Alaska Peninsula	176	46	4	2,323.87	1,188.49	441.50	3,953.86	22.47	2,965.40
Lauren F.Smith	Mankomen Lake	70		7	168.00	273.21	905.01	1,346.22	19.23	1,009.67
Carl C.Wikstrom	Kantishna	64	3	27	852.00	204.53	13.09	1,069.62	16.71	802.22
	Totals	1198	71	145	$7,130.79	$4,350.00	$11,171.52	$22,652.31		$16,566.44
	Averages per man days				$ 5.95	$ 3.63	$ 9.32	$ 18.91		$ 13.83

INDUSTRY EMPLOYMENT

Because of the increasing difficulty of obtaining timely accident reports, the impossibility of estimating accidents, and the lack of jurisdiction in petroleum safety, we are omitting the accident statistics carried in previous Annual Reports together with employment totals. Accident information for 1966 can be obtained at a later date from the State Department of Labor.

Following are tables XIX and XX showing employment in the mineral industries in 1965 and 1966.

Table XIX

Estimated Employment

	1965		1966	
	Units	Employed	Units	Employed
Placer Mines				
Dredges	9	100	8	108
Nonfloat	55	135	60	123
Hydraulic	11	21	7	21
Coal Mines				
Underground				
Strip	4	183	4	205
Lode Mines				
Metal (1)	6	94	4	85
Nonmetal (2)	6	10	4	29
Petroleum				
Production &				
Exploration		697		856
Exploration				
Metal	66	245	85	307
Totals	151	1485	172	1734

(1) Includes intermittent underground operations and development
(2) Includes jade, peat, barite

NOTE: The above data is compiled from information collected by the Division of Mines and Minerals, the U.S. Bureau of Mines, and the State Department of Revenue. Many of the small mining operations are part time, and others accomplish little more than assessment work.

Table XX

Average Monthly Insured Employment

	1965	1966 (1)
Total Mining	1,089	1,260
Metal Mining	199	179
Placer Gold Mining	86	73
Coal Mining	205	205
Petroleum and Gas (2)	661	856
Mining and Quarrying nonmetals excluding fuels	24	20

NOTE: The above figures were compiled by the R & A Section, Employment Security Division, Alaska Department of Labor.

(1) Estimate.

(2) Not complete because offshore operators are required to report to the Federal Government only.

ACTIVE PETROLEUM COMPANIES

Oil and gas companies active in Alaskan production, drilling, and geological and geophysical crew activities. This list does not include the many organizations involved in leasing activity only. The address given for each company is the best address at which to contact that company.

American Petrofina Exploration Co.
Room B-410 Broadway Building
Denver U.S. National Center
Denver, Colorado 80202

Apache Corporation
823 South Detroit
Tulsa, Oklahoma 74120

Atlantic Richfield Company
P. O. Box 360
Anchorage, Alaska 99501

Austral Oil Company, Inc.
2700 Humble Building
Houston, Texas 77002

British American Oil Producing Co.
P. O. Box 180
Denver, Colorado 80201

BP Exploration Co. (Alaska), Inc.
326 I Street
Anchorage, Alaska 99501

Cities Service Oil Company
360 K Street, Suite 302
Anchorage, Alaska 99501

Colorado Oil and Gas Corp.
P. O. Box 749
Denver, Colorado 80201

Continental Oil Company
425 G Street
Anchorage, Alaska 99501

Great Basins Petroleum Co.
1011 Gateway West-Century City
Los Angeles, California 90067

Humble Oil and Refining Co.
P. O. Box 440
Anchorage, Alaska 99501

Hunt Oil Company
326 I Street
Anchorage, Alaska 99501

Marathon Oil Company
645 G Street
Anchorage, Alaska 99501

Mobil Oil Company
700 G Street
Anchorage, Alaska 99501

Pan American Petroleum Corp.
P. O. Box 779
Anchorage, Alaska 99501

Pennzoil Company
1007 Midland Savings Building
Midland, Texas 79704

Phillips Petroleum Corp.
P. O. Box 419
Anchorage, Alaska 99501

Placid Oil Company
326 I Street
Anchorage, Alaska 99501

Shell Oil Company
430 Seventh Avenue
Anchorage, Alaska 99501

Sinclair Oil and Gas Company
425 G Street
Anchorage, Alaska 99501

Skelly Oil Company
P. O. Box 1314
Anchorage, Alaska 99501

Standard Oil Co. of California
P. O. Box 7-839
Anchorage, Alaska 99501

Sun Oil Company
P. O. Box 2880
Dallas, Texas 75221

Sunray DX Oil Company
P. O. Box 2039
Tulsa, Oklahoma 74102

Superior Oil Company
First City National Bank Bldg.
Houston, Texas 77002

Tenneco Oil Company
P. O. Box 1703
Anchorage, Alaska 99501

Texaco, Incorporated
P. O. Box 664
Anchorage, Alaska 99501

Trinity Canadian Drilling Co.
515 D Street
Anchorage, Alaska 99501

Union Oil Company of California
2805 Denali Street
Anchorage, Alaska 99503

Wallace Mining Company, Inc.
6th Avenue & Gambell Street
Anchorage, Alaska 99501

ACTIVE COAL MINES, 1966

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	Jonesville Matanuska Field	Strip	85
Usibelli Coal Mines, Inc. Usibelli	Healy Creek Nenana Field	Strip	70
Vitro Minerals Corp. Box 1070, Fairbanks	Healy Creek Nenana Field	Strip	41
Lignite Coal Sales Lignite	Lignite Creek Nenana Field	Strip	6

Note: Above data from DM&M records.

* Size of crew is the average for the year through October.

LIST OF ALASKA MINING & EXPLORATION OPERATIONS
ACTIVE DURING 1966

Name and Address of Operator	Location of Mines & Recording District	Approx. Crew	Type of Operation*
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 Barite Co. 1112 So. Cushman Tacoma, Washington	Castle Island Petersburg	20	Open Pit Mine Barite production
Alaska Mines & Minerals, Inc. Box 422, Anchorage	Red Devil Mine Kuskokwim	1	Development
Alaska Nickel Co., Inc. Marjorie B. Savage Box 1913, Fairbanks	Eagle Bluff Fairbanks	3	Development
Alaska Portland Cement Co. Ltd. 136 Kentucky Street Petaluma, California	Foggy Pass Nenana	3	Limestone exploration
American Exploration & Mining Co. 23rd Floor Russ Bldg. San Francisco, California	Muir Inlet Juneau	5	Drilling
American Metals-Climax Box 3 Buena Vista, Colorado	Seward Peninsula Several	3	Exploration
Amero, A. W. Chandalar	E.Fork Chandalar River Fairbanks	1	Prospecting
Anaconda American Brass 122 - 744 West Hastings Vancouver, B. C.	Alaska General Several	6	Exploration
Asbestos Corp. Ltd. 814 - 837 W. Hastings Vancouver, B. C.	Alaska General Several	1	Exploration
Atlantic Refining Co. Box 59 Anchorage	Alaska Peninsula Iliamna	10	Exploration & claim staking
Au Limited Henry Warner Box 674, College	Porcupine Creek Fairbanks	4	Placer development

Baker, V. G. Fairbanks	Jade Mountain Noatak-Kobuk	2	Jade lode and placer
Bear Creek Mining Co. E.7621 Sprague Spokane, Washington	Alaska General Several	10	Exploration
Beckwith, Rea Box 119, Anchorage	Alaska General Several	1	Mineral investigations
Berg, Rhinehart Kobuk	Kugruk River Fairhaven	2	Exploration
Birch, Frank Chandalar	Tobin Creek Fairbanks	3	Nonfloat
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. E. 15 Walton Spokane, Washington	Prince of Wales Island 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 & trenching
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
Bunker Hill Co. Box 29, Kellogg, Idaho	Hannum Creek Fairhaven	5	Exploration
Buck, William & Billum, Frank Glennallen	Ahtell Creek Glennallen	8	Silver lode development
Busty Belle Mine Tury Anderson & Associates 101 E Street, Hamilton Acres, Fairbanks	Fairbanks Fairbanks	3	Lode exploration
Cambridge Mining Corp. Ltd. 1130 Bay Street Toronto, Canada	Seal Cove Ketchikan	5	Drilling
Canyon Creek Mining Co. Jens Kvamme & Sons Akiak	Canyon Creek Kuskokwim	4	Hydraulic

Carlson, Ivor C. Ophir	Little Creek Mt. McKinley	2	Nonfloat
Carr, G. W. Miller House or 4230 Altamont Drive Klamath Falls, Oregon	Circle District Fairbanks	1	Prospecting
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 Cape Nome	3	Dredge
College Road Peat Kushman Brothers 12 Timberland Dr., Fairbanks	College Road Fairbanks	2	Peat
Consolidated Wrangell Mining Corp. 712 Logan Bldg., Seattle	McCarthy McCarthy	6	Surface copper
Davis, Bon Box 45, Nome	Gold Run Cape Nome	1	Nonfloat
Davis Mining Co. Bill Davis 2919 N. 36 Street Phoenix, Arizona	Alaska Peninsula Aleutian Islands	20	Prospecting & exploration
Davis Mines, Inc. Talbert E. Davis 1511 Mary Ann, Fairbanks	Shovel Creek Noatak-Kobuk	2	Nonfloat
Dayo, Stanley Manley Hot Springs	Cooney Creek Manley Hot Springs	1	Nonfloat
Dickman, O. J. Teller	Gold Run Creek Cape Nome	4	Hydraulic
Douglas, B. E. Nome	Bear Creek Fairhaven	1	Prospecting
Eagle Picher Industries, Inc. Box 910 Miami, Oklahoma	Alaska General	1	Prospecting
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	2	Prospecting

Egnaty, Jack Sleetmute	George River Kuskokwim	1	Exploration
Elmer, Lewis 1624 Jessie St., Boise, Idaho	Slate Creek Chitina	1	Nonfloat & Prospecting
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 & Son Dredging Co. Box 489, Nome	Basin Creek Cape Nome	3	Dredging
Falconbridge Nickel Mines, Ltd. 504-1112 W. Pender Street Vancouver 1, B. C.	Kasna Creek Iliamna	5	Geophysics & feasibility study
Farland, Gene Box 365, Nome	Koyana Creek Cape Nome	1	Offshore prospecting
Farrell, Ed., & Higgins, Bert 511 7th, Fairbanks	Little Boulder Creek Manley Hot Springs	2	Drilling
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
Flat Creek Placers Fullerton Brothers Flat	Flat & Willow Creeks Mt. McKinley	3	Nonfloat
Foreman, Donald General Delivery, Fairbanks	Circle District Fairbanks	1	Prospecting
Foster, Neal W. Box 279, Nome	Seward Peninsula Several	1	Lode prospecting
Foster, Neal W. Box 279, Nome	Hannum Creek Fairhaven	2	Nonfloat
Fuksa, Jim General Delivery, Anchorage	Kantishna Mt. McKinley	1	Prospecting
Gates, Willard E.	Cripple & Bear Creeks Mt. McKinley	3	Nonfloat
Geo-X Surveys Ltd. 627 Hornby Street Vancouver, B. C.	Jumbo Mountain Ketchikan	5	Drilling
Ghezzi, Alfred R. Box 1857, Fairbanks	3rd & 4th Districts Several	1	Prospecting

Gilbertson, George 314 Charles Street, Fairbanks	Canyon Creek Fairbanks	2	Nonfloat
Gilbertson, Harold L. Mile 1418 Alaska Highway Delta Junction	Richardson Fairbanks	2	Prospecting
Glass & Heifner Jamestown, Ohio	Beauty Bay Seward	8	Mill construction
Gold Cord Mining Co. 2309 Lord Baranof Blvd. Anchorage	Fishhook Creek Palmer	2	Gold lode development
Goodnews Bay Mining Co. 422 White Building, Seattle, or Platinum	Salmon R. & tribs. Bethel	40	Platinum dredge
Grothe, Lenhart & Pearson, Clayton, Box 411, Nome	Lost River Cape Nome	4 (tin)	Nonfloat
Hanna Mining Corp. 1300 Leader Building Cleveland, Ohio	Alaska General Several	2	Exploration
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
Hapeman, Fred J. Chicken	Buckskin Creek Fairbanks	1	Prospecting
Hawkins, W. A., Eichner, Ken, & Lillie, Angus, Ketchikan	Southeastern Alaska Several	1	Prospecting
Heiner, Larry Petersburg	Southeastern Alaska Several	1	Prospecting
Herning, Harold Box 1792, Fairbanks	Candle Fairhaven	2	Nonfloat
Hersch & Herning, Harold Candle	Mud Creek Fairhaven	2	Nonfloat
Hill, Lloyd Star Route, Palmer	Grubstake Gulch Palmer	1	Soapstone mining
Holovic, Louis Manley Hot Springs	American Creek Manley Hot Springs	1	Hydraulic
Hogendorn, Jack Deering	Inmachuck River Fairhaven	1	Hydraulic
Holloway, Dorr Red Devil	Kolmakof Property Kuskokwim	2	Mercury lode

Hudson, Edwin & Geraghty, Richard 1733 Cottonwood, Fairbanks	Money Knob Fairbanks	2	Prospecting
Huff, J. W. Box 837, Ward Cove	Groundhog Basin Wrangell	2	Prospecting
Hunter Creek Mining Co. Melo Jackovich 803 Pioneer Road, Fairbanks	Hunter Creek Rampart	2	Nonfloat
Idaho Bar Mining Co. Kosta Melnikoff Rampart	Idaho Bar Rampart	1	Nonfloat
Kaufman, M. A. 23 East DeVere Way Sparks, Nevada	Alaska General Several	1	Prospecting
Kawolsky, Ignacey Nome	Charley Creek Cape Nome	1	Prospecting
Kelliher, Maurice Nome	Kougarok River Cape Nome	1	Prospecting
Kennecott Copper Corp. New Mines Division Kearns Building Salt Lake City, Utah	Ruby Creek Noatak-Kobuk	75	Copper lode development
Keystone Mines, Inc. Box 630, Fairbanks	Wolf Creek Fairbanks	6	Gold lode mining
Kloss, Herman (K & D Lode), Sunset Cove	Sunset Cove Juneau	1	Prospecting
Knorr, Vincent Bettles Field	Mascot Creek Koyukuk	2	Nonfloat
Langlow, Jens Central	Switch Creek Fairbanks	1	Hydraulic
Larsen, Clifford H. Box 1875, Fairbanks	Kantishna Mt. McKinley	2	Prospecting
Lee Brothers Dredging Co. Box 208, Nome	Cape Creek Cape Nome	5	Tin development
Leonard, Harry B. A. C. Mining Co. Wiseman	Vermont Creek Fairbanks	1	Small scale hand
Leslie, Robert Box 1838, Fairbanks	Rampart District Fairbanks	2	Prospecting
Lie, Harold Kotzebue	Bear Creek Cape Nome	1	Prospecting
Lindquist, Hjalmer 133 N. Marion, Bremerton, Washington, or Ophir	Beaver Rock & Ester Creeks Mt. McKinley	1	Nonfloat

Little Creek Mine Ivor C. Carlson, Ophir	Ophir Mt. McKinley	2	Nonfloat
Little Squaw Mining Co. 309 Radio Central Building Spokane, Washington	Chandalar District Fairbanks	3	Gold lode development
Locke, Barney Wasilla	Sheep Mt. & Soda Creek Anchorage & Nabesna Quads	1	Copper prospects
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	4	Cinnabar production
McClure, Francis Schaefer & Schaefer, Norman 62 Copeland Avenue La Crosse, Wisconsin	Cinnabar Creek Kuskokwim	2	Mercury lode exploration
McCombe, R. S. Chicken	Lost Chicken Creek Fairbanks	1	Prospecting
McGee, L. 836 Lindley Way Reno, Nevada	Cache Creek Manley Hot Springs	5	Development nonfloat
Marvel Creek Mining Co. Awe, Charles Aniak	Marvel Creek Bethel	4	Dredge
Meldrum, William Chicken	Stonehouse & Chicken Creeks Fairbanks	1	Stripping
Miller, James & Lindgrin, Earl & Atwood, M. J.	Koyukuk District Fairbanks	3	Prospecting
Mineral Basin Mining Corp. Moa, Arthur, Box 126, Hyder	Mt. View Property Ketchikan	2	Exploration (lode)
Miscovich Brothers Otter Dredging Co. Flat	Otter Creek Mt. McKinley	4	Dredge
Monroe, Gilbert & Jones, Francis Box 46, Glennallen	Boulder Creek Manley Hot Sptings	1	Placer development
Moore, Norman 326 Baranof Street Fairbanks	W.Fork Chistochina River Chitina	4	Prospecting
Morgan, Milton F. & Novak, M. J. Auric Offshore Mining Co. 5115 El Cajon Blvd. San Diego, California	Bluff Cape Nome	4	Prospecting offshore
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
Murphy, John	George River Kuskokwim	1	Prospecting
Newlun, O. H. Box 623, Ketchikan	Prince of Wales Island Ketchikan	1	Prospecting
North American Dredge Co. John Stevens, Flat	Flat Creek Mt. McKinley	3	Dredge
Northland Mines Charles W. Monroe Box 876, Delta Junction	Alaska Range Several	6	Prospecting
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 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	10	Exploration
Pannick, Harry General Delivery, Fairbanks	Flume Creek Fairbanks	1	Nonfloat
Parker, Fred	Inmachuck River Fairhaven	3	Nonfloat
Pederson, Steve Box 685, Nome	Niukluk River Cape Nome	2	Dredge
Permanente Cement Co. Oakland, California	Kings River Palmer	2	Limestone exploration
Phelps Dodge Corp. of Canada Ltd. 404-1112 West Pender St., Vancouver 1, B. C.	Alaska General Several	2	Investigations
Pieper, Paul Box 1294, Ketchikan	Kasaan Ketchikan	1	Prospecting

Pittman, Ray 1701 Stanton Avenue Anchorage	Alameda Creek Manley Hot Springs	1	Nonfloat
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
Purkeypile, I. W. & Associates 320 3rd St., Hamilton Acres Fairbanks	Tonzona District Mt. McKinley	3	Lode prospecting
Quitsch, William Valdez	Mineral Creek Valdez	1	Gold lode prospecting
Radovan, Martin McCarthy	Glacier Creek McCarthy	1	Copper lode prospecting
Rasmussen, C. T. Anchorage	Marsh Mountain Bristol Bay	2	Prospecting
Redstone Mining Co. Carl Heflinger 409 Clara St., Fairbanks	Livengood Creek Fairbanks	4	Nonfloat
Reed, Curtiss, Rybachek, Stanley & Radak, John Livengood	Wilbur Creek Fairbanks	1	Stripping
Renshaw, A. L. & Associates 2309 Lord Baranof Blvd. Anchorage	Alaska Peninsula Iliamna	2	Exploration
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 River & Alaska Peninsula area Several	3	Copper, iron & gold prospecting
Ricks, Dean 129 Noble Street, Fairbanks	Fairbanks District Fairbanks	1	Prospecting
Robinson, George F. Boundary	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 Co. Asher B. Richardson 326 Boundry St., Fairbanks	Long Creek Nulato	2	Nonfloat
Rupp, Ray Ferry	Little Moose Creek Fairbanks	1	Nonfloat
Rusaw, Max Route 2, Box 371 Nampa, Idaho	Rusaw Creek Palmer	1	Prospecting
Schoonover, Ora P.	Talkeetna District Talkeetna	1	Prospecting
Shapely, 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	5	Offshore prospecting
Sherman, Mike Candle	Patterson Creek Fairhaven	1	Nonfloat
Sinclair Oil Co. Box 584, Anchorage	Alaska Peninsula Several	6	Prospecting
Sirilo, Julius Box 625, Bethel	Aniak District Kuskokwim	1	Prospecting
Slate Creek Mining Co. DuRand, Edward H. Box 1564, Fairbanks	Slate Creek Fairbanks	1	Assessment work
Smith, A. W. & K. Box 3252 Eastchester Branch Anchorage	Alaska Peninsula Iliamna	2	Prospecting
Smith, Lauren R. Gakona	Mankomen Lake Chitina	2	Prospecting
Speaker, Henry Wolf Creek, Oregon	N.F. Harrison Creek Fairbanks	1	Placer development
Springer, Karl 502-1200 West Pender Street Vancouver 1, B. C.	White River Fairbanks	2	Prospecting
Spruce Creek Mining Co. 607 Clara Street, Fairbanks	Spruce Creek Mt. McKinley	2	Nonfloat
Standard Metals Corp. Box 1081, Ketchikan	Kendrick Bay Ketchikan	1	Development
Stanley, Kirk 7003 Mink Place Anchorage	Nabesna & Slana Chitina	3	Development

Steers, Al Box 826, Ketchikan	Southeastern Alaska Several	1	Prospecting
Stelting, H. W. Box 19, Haines	Haines Haines	1	Prospecting
Strandberg Mines, Inc. Box 2099, Anchorage	Tofty Manley Hot Springs	3	Nonfloat
Stuver, Jules Flat	Moore Creek Mt. McKinley	2	Hydraulic
T and T Mining Co. William Thomas Box 1464, Fairbanks, or Rampart	Hunter Creek Rampart	1	Stripping
Taylor, Arley & Associates 2916 - 236th S. W. Alderwood Manor, Washington	Eureka Creek Fairbanks	2	Nonfloat
Tennessee Corporation 61 Broadway, New York	Rainy Creek Fairbanks	10	Drilling copper
Titus, Jack & Cook, Fred Solomon	Shovel Creek Cape Nome	2	Small scale hand
Totem Exploration Co. Joe Blazek 317 Dock St., Ketchikan	Southeastern Alaska Several	1	Prospecting
Tweet, N. B. & Sons Teller	Kougarok River Cape Nome	6	Nonfloat
Uotila, Gus Ophir	Birch Creek Nulato	1	Stripping
U.S.S.R. & M. Co. Box 438, Nome	Northern Alaska Several	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 Corp. 525 William Penn Place Pittsburgh, Pa.	Alaska General Several	8	Development
Valdez Mines Ltd. W. Fillipek, President 10032 105th St., Edmonton, Alberta, Canada	Canyon Creek Chitina	5	Nickel-copper prospecting
Wackwitz, Charles & Fred Box 1595, Fairbanks	Bedrock Creek Fairbanks	2	Prospecting
Wall, Melvin Box 3256, Spenard	Valdez Creek Palmer	2	Placer development

Walsh, Pearse Nome	Mt. Distin Cape Nome	1	Prospecting
Walper, James A. Suite 330 - 355 Burrard St., Vancouver, B. C.	Southeastern Alaska Ketchikan	4	Prospecting
Weinard, Fred Candle	Mud Creek Fairhaven	2	Nonfloat
Weisner Trading Co. Ira Weisner Rampart	Little Minook & Hoosier Creeks Rampart	2	Development
Weston, David Fairbanks	Dome Creek Fairbanks	1	Nonfloat
Wheeler, Vernon & Associates Box 14A, Wasilla	Grubstake Gulch Palmer	2	Gold lode development
Wikstrom, Carl Hyder	Kantishna Mt. McKinley	2	Prospecting
Willis, George Alice & Bessie Mine Red Devil	Parks Property Kuskokwim	2	Small mercury operation
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	1	Prospecting
Zaiser, Leonard Spenard	Bird Creek Anchorage	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.

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 31, 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.

Report of the Division of Mines and Minerals for the year 1964.

Report of the Division of Mines and Minerals for the year 1965.

*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.

Information Circular #1: Proper Claim Staking in Alaska; Revised April 12, 1966

Information Circular #2: Mineral Rights of Aliens in the State; Revised October 28, 1966.

Information Circular #3: Hand Placer Mining Methods, April 16, 1962.

Information Circular #4: Uranium Prospecting in Alaska; Revised December 12, 1966.

Information Circular #5: General Alaskan Mineral Information; Revised March 14, 1966.

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