IMPACT OF A NATURAL GAS PIPELINE ON MINERAL AND ENERGY DEVELOPMENT IN ALASKA

By Robert G. Bottge, Alaska Field Operation Center
Juneau, Alaska

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UNITED STATES DEPARTMENT OF THE INTERIOR

Rogers C. B. Morton, Secretary

BUREAU OF MINES

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ABSTRACT

This report discusses the impact of one primary and seven alternative natural gas pipeline routes and their alternatives on Alaska's mining industry. Four routes begin on Alaska's North Slope and lead to the 48 contiguous States via Canada while three routes lead to tidewater where it would be liquified for transport to West Coast ports. The report answers specific questions raised by the Corridor Planning Team of the Bureau of Land Management, the lead Department of the Interior agency for preparing an environmental impact statement for the routes proposed by the Alaskan Arctic Gas Pipeline Company.

This report summarizes the geology and the potential for mineral and energy development by 1:250,000 quadrangles through which the various pipeline routes pass. The potential impact along each route is then discussed giving the type of development likely and the number of people who could be attracted to the area.

INTRODUCTION

The Alaska Field Operation Center is cooperating in the preparation of an environmental impact statement (EIS) for the Alaskan Arctic Gas Pipeline Company's route from Alaska's North Slope to the 48 contiguous States. The EIS is being prepared by the Department of the Interior and

1/ Mining Engineer, Alaska Field Operation Center

the Federal Power Commission. The Department of the Interior's lead agency in preparing the EIS is the Corridor Planning Team, Bureau of Land Management.

The Bureau of Mines' representative was assigned to the Corridor Planning Team on September 29, 1974, to provide input to the EIS. His base of operation remained in Juneau instead of the Corridor Planning Team in Anchorage because the Juneau office contained the data base for the minerals input. That input is summarized in this report. The reduced maps in this report were made as overlays for the 1:250,000 U.S. Geological Survey quadrangles and were submitted to the Corridor Planning Team.

This report does not conform to the EIS outline in format, but answers specific questions raised by the Corridor Planning Team. The maps conform to the guideline that all maps be self-contained. The area of influence for mineral or energy development is considered to be 50 miles either side of a proposed route.

PROPOSED NATURAL GAS PIPELINE ROUTES

The Alaskan Arctic Gas Pipeline Company proposed transmitting natural gas from Prudhoe Bay to the 48 contiguous States through Canada via the prime route designated "D" or the alternative route designated E,F,H or its option E,G,H, figure 1. Seven other routes and their alternatives were also considered exiting the State at points along the eastern border from the Arctic Ocean to the Alcan Highway, in Prince William Sound, Cook Inlet and Norton Sound, figure 1.

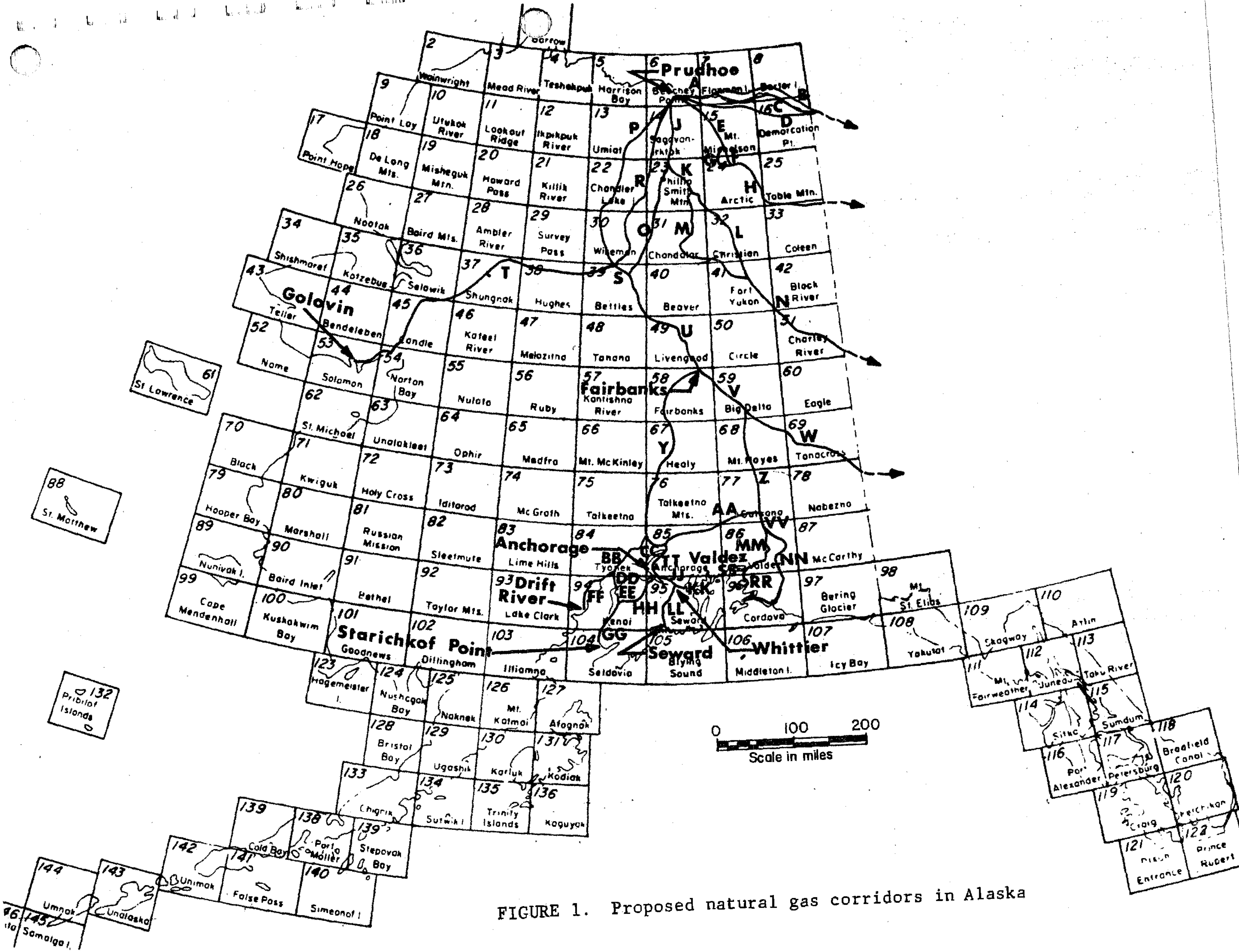

FIGURE 1. Proposed natural gas corridors in Alaska

THE NEED FOR ALASKA'S MINERALS

Table 1 lists minerals that have been or are likely to be found along the primary natural gas corridors and their alternatives. The primary quantity of each commodity produced in the United States in 1972 is given and compared with the primary demand. The difference between the two figures was made up by imports and/or the utilization of scrap. Two projections are given for the production of primary commodities in the United States in the year 2000. One projection assumes the Nation's mineral producers will continue to provide the same percentage of the Nation's projected requirements in 2000 as they did in 1972. The second projection for 2000 is based upon the trend of production for the last 20 years. Finally, the projected demand for 2000 primary production is given. All data is provided by the Bureau of Mines.

The table shows the United States' producers were capable of supplying the 1972 primary demand for only three commodities: coal, molybdenum and uranium. If production trends of the last 20 years continue, the Nation's producers will fall even farther behind meeting demands in the year 2000 than they did in 1972, thus requiring greater imports or greater utilization of secondary supplies such as scrap. Obviously, any mineral production from Alaska would help lessen the Nation's dependency upon imports and improve its balance of payments situation.

IMPACT ON MINERAL AND ENERGY DEVELOPMENT IN ALASKA

A natural gas pipeline would probably have little impact on the development of mineral and energy deposits in Alaska. Unless a company were able to contract for natural gas at the time the reserves were being committed, no natural gas would be available. Also, a mining venture is not a large consumer of energy for a cross country pipeline company to service. For example, a large company mining 100,000 tons of ore and waste and concentrating 40,000 tons of copper ore each day would consume approximately 16,100 Mcf per day for heat and power (1)2/. Adding smelting and refining capabilities at the concentrator site would bring total heat and power requirements to approximately 28,000 Mcf per day. By contrast, the City of Anchorage consumed about 58,000 Mcf per day in 1971 and the Collier ammonia and Phillips-Marathon liquid natural gas plants consumed about 101,000 Mcf per day. Large petrochemical plants producing ethane, propane and isobutane commonly consume 400,000 Mcf per day with the largest plants consuming over 1,500,000 Mcf per day (2). For a pipeline company transmitting 2,000,000 Mcf per day, a mining company probably is not a large enough consumer to consider servicing.

The primary impact of a natural gas pipeline on the development of mineral and energy deposits lies with an accompanying permanent road. The development of small, high-grade deposits or large, low-grade deposits within 50 miles either side of a pipeline road would be enhanced. However, a permanent road which originates on the North Slope and goes into Canada without passing through a supply point, such as Fairbanks, would have marginal utility for mining companies. The creation of an ice road to be used during the construction of the pipeline and then left to melt, such as has been

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2/ Underlined numbers in parentheses refer to references listed at the end of the text.

TABLE 1.- National supply-demand pattern from 1972-2000

Mineral	Unit	1972 Primary Production	1972 Primary Demand	2000 Production if 1972 constant ratio prevails	2000 Production if past 20-year trend prevails	2000 Primary Demand
Antimony (Sb)	S.T.	1,005	19,865	2,400	1,520	48,000
Asbestos	Thousand S.T.	131	759	420	290	2,430
Chromium (Cr)	Thousand S.T.	0	506	0	0	1,090
Coal	Million S T.	595	520	1,100	818	1,000
Cobalt (Co)	Thousand lb.	0	19,268	0	0	24,700
Copper (Cu)	Thousand S.T.	1,665	1,951	4,600	2,600	5,400
Gas	Billion C.F.	21,624	22,565	46,900	44,500	49,000
Gold (Au)	Thousand T.oz.	1,450	7,254	2,900	1,033	14,300
Iron (Fe)	Million S.T.	52	83	95	58	153
Lead (Pb)	Thousand S.T.	619	970	912	822	1,430
Manganese (Mn)	Thousand S.T.	29	1,366	50	0	2,360
Mercury (Hg)	Thousand Fl.	7	41	10	15	57
Molybdenum (Mo)	Thousand lb.	112,138	51,504	409,300	196,700	188,000
Nickel (Ni)	Thousand S.T.	17	172	38	38	385
Oil	Million bbl.	4,094	5,990	9,200	6,491	13,500
Platinum (Pt)	Thousand T.oz	5	467	9	0	820
Silver (Ag)	Thousand T.oz	37,233	122,257	64,000	45,200	210,000
Tin (Sn)	L.T.	(1)	48,853	90	58	90,000
Tungsten (W)	Thousand lb.	8,150	13,607	44,000	1,970	74,000
Uranium (U)	S.T.	11,590	10,250	92,700	20,659	82,000
Zinc (Zn)	Thousand S.T.	478	1,489	995	600	3,100

(1) Confidential company information.
Units: S.T. = short tons; lb. = pounds; C.F. = cubic feet; T.oz. = troy ounces; Fl. = flasks; bbl. = barrels; L.T. = long tons.
Source: U.S. Bureau of Mines Commodity Statements.

proposed for the prime route "D" or its alternative E,F,H and its option G, would have no impact on the development of mineral and energy resources.

The course of mineral development could be altered by the State of Alaska. Should the State take its royalty from natural gas production in kind, it may make the natural gas available for mineral ventures. However, even the State must make its request for natural gas when the reserves are being committed in order to have a supply to distribute. Likewise, a State policy to connect any permanent natural gas pipeline road to the road system within Alaska via proposed corridors would aid in the development of mining. If the State of Alaska desires mineral development, then there could be an impact on the mining industry from the natural gas pipeline and road, otherwise, the pipeline will have little or no impact on mineral development.

SOCIO-ECONOMIC IMPACT IN ALASKA

If mining develops, an impact upon the land will come from miners, service personnel, and their families brought to the area. Estimating the impact from unknown numbers and types of mines developed at unknown locations and commencing at unknown times is purely rank speculation. Problems which enter into these estimates will now be discussed.

Alaska is a relatively unknown area for hard rock minerals. In 1972, $6.5 million was spent in Alaska versus $4.5 million in the Yukon and $72.0 million in British Columbia (6, 5, 4). When considered on a per square mile basis, the average expenses for exploration were $11.50 on Alaska, $21.75 in the Yukon and $200.40 in British Columbia. Additional money spent on exploration in Alaska would help to define the areas of mineralization.

The number of people employed and otherwise associated with a mine depends upon numerous variables such as the kind of mineral, type and configuration of mineralization, type and degree of ore beneficiation, type of townsite (camp with dormitories or town with houses and apartments), company policy on purchasing replacement parts or fabricating much of what is needed. A review of Bureau of Mines' publications and the Yearbooks of the Canadian Mining Manual has led to the construction of table 2.

Table 2 is meant to give an order of magnitude for total employment at a mine, concentrator, plant and office located at a remote site. For example, a company using an open-pit technique to mine 50,000 tons of ore and waste per day and concentrate 15,000 tons of ore per day would employ about 80 people in the mine and 70 people in the concentrator, or 150 combined. The surface plant might employ 150 X 0.65 or 98 people, and the office 150 X 0.35 or 52. Because of the large number of variables, the number of employees can only be estimated within plus or minus 50 percent. So the mining complex might employ 300 ± 150 people.

The type and degree of ore concentration can make a big difference in the number of employees required for a mineral operation. Flotation is a common type of concentration for slufide ores, but gold ore is commonly treated by the cyanide process, and oxide ores require a roasting step. Vat leaching may be utilized in addition to the regular beneficiation processes. If a concentrate is produced by flotation, employment is relatively small, but smelting and refining can also be done at the concentrator site, thus boosting the concentrator figures given in table 2 by factors of three or more. In this report only the employees associated with flotation concentration are considered, so the concentrator employment must be considered minimum.

TABLE 2.- Estimated mine, concentrator, plant, and office personnel by type and size of mine 1/

Daily tonnage 2/	Underground: Room & pillar	Underground: Open stope	Open pit	Flotation concentrator 3/
175,000.......	-	-	160	-
150,000.......	-	-	150	-
100,000.......	-	-	120	-
75,000.......	-	-	100	240
50,000.......	-	-	80	180
40,000.......	-	-	70	150
30,000.......	-	-	60	120
25,000.......	430	-	50	110
20,000.......	380	-	40	90
15,000.......	320	-	35	70
10,000.......	250	-	-	50
7,500.......	210	-	-	40
5,000.......	160	330	-	30
4,000.......	140	290	-	25
3,000.......	120	250	-	20
2,000.......	100	210	-	15
1,000.......	60	120	-	10
500.......	40	80	-	5
250.......	30	60	-	5

Plant: (Underground mine employment + concentrator employment) X 0.492
(Open pit mine employment + concentrator employment) X 0.650

Office: (Underground mine employment + concentrator employment) X 0.189
(Open pit mine employment + concentrator employment) X 0.350

1/ Mine employees: those involved with drilling, blasting, and removing ore and waste from the mine.
Concentrator employees: those involved in crushing, grinding, and concentrating the ore and disposing of tailings.
Plant employees: all maintenance and shop personnel.
Office employees: all professional and clerical personnel.

2/ Daily tonnage for mines includes ore and waste; daily tonnage for the concentrator is ore only.

3/ The daily tonnage handled by the concentrator is less than that mined. Waste in underground mines may approximate 15 percent of the ore mined; in open pits, waste may be two to three times the ore mined and sometimes more.

The total number of people, employees and dependents brought into a townsite depends upon the company's townsite administration policy. If dormitories are built and only single men encouraged to work at the mine, then the population of the townsite will approximate company employment. If houses and apartments are built encouraging families to come, then the townsite population could be the company employment plus 1.5 to 2.5 times employment. Also, the composition of the townsite will have a definite impact on the other towns in Alaska. A townsite of predominantly single employees will require different services from nearby Alaskan towns than will a townsite composed predominantly of families. In the mine example above, the 300 employees might create a townsite of from 300 to 1,050 people excluding service personnel and their families.

The last component of a townsite is the service industry; that is, the number of people employed to service the mining company and its personnel. This component will vary for each company and each location. A review of twelve different sources for this type of data has led the author to conclude that the creation of 100 jobs in a basic industry will create between 67 and 108 new jobs in associated service industries within the State (3, 5). The number created at the mining townsite could be between 17.5 and 25.5 as these are the ratios existing at Clinton Creek and Faro in the Yukon Territory 3/. In the mine example here, the creation of 300 mine-associated jobs will create an additional 201 to 324 jobs within the State of Alaska of which 52 to 176 will be at the townsite. On the average, the service personnel would likely bring two dependents adding a total of 156 to 228 additional people to the townsite.

3/ From communications with personnel of Clinton Mine Division, Cassiar Asbestos Corporation, Ltd., and Anvil Mining Corporation, Ltd.

In total, a mining company employing 300 people could create a town with the following makeup:

	Low	Medium	High
Mine company employees	150	300	450
Service industry employees	26	60	115
Dependents	0	720	1130
Total	176	1080	1695

A company opening a 50,000 ton-per-day open pit mine with 15,000 ton-per-day concentrator may bring from 176 to 1,695 people to a townsite depending upon the type of ore deposit to be mined, type of beneficiation, and the policy of the company towards parts replacement and townsite administration. The estimate of population created by one size and type of mine may be 1,080 minus 84 percent or plus 57 percent. Because few mining ventures are completely composed of families or single employees, probably plus or minus 50 percent is a likely deviation from an average or medium estimate, making the population for the townsite range from 540 to 1,620.

Table 3 shows similar employment and population estimates for mining communities for three sizes and three types of mines. Population estimates are given in hundreds to show the order of magnitude for mining communities for various sizes and types of mines. High, medium and low estimates are given to show the influence that companies and ore deposits have on populations.

GEOLOGY AND DEVELOPMENT POTENTIAL BY QUADRANGLES

The quadrangles traversed by a corridor 50 miles either side of the prime and alternative routes proposed by the Alaskan Arctic Gas Pipeline Company as well as the seven additional routes and their options considered

TABLE 3.- Estimates of employment and population of mining communities by size and type of mine

Item	Open Pit			Underground - Room & Pillar			Underground - Open Stope		
	Small	Medium	Large	Small	Medium	Large	Small	Medium	Large
Daily tons of ore and waste 1/	15,000 - 50,000	30,000 - 75,000	50,000 - 175,000	250 - 1,000	1,000 - 5,000	5,000 - 25,000	250 - 500	500 - 2,000	2,000 - 5,000
Daily tons of ore	7,500 - 15,000	15,000 - 25,000	25,000 - 50,000	250 - 1,000	1,000 - 4,000	4,000 - 20,000	250 - 500	500 - 2,000	2,000 - 4,000
Daily tons concentrated	7,500 - 15,000	15,000 - 25,000	25,000 - 50,000	250 - 1,000	1,000 - 4,000	4,000 - 20,000	250 - 500	500 - 2,000	2,000 - 4,000
Mine personnel 2/	90 - 180	130 - 230	180 - 380	30 - 90	90 - 290	290 - 980	60 - 100	100 - 300	300 - 600
Concentrator personnel 2/	70 - 100	100 - 140	140 210	10 - 20	20 - 45	45 - 120	10 - 15	15 - 30	30 - 45
Plant personnel 3/	100 - 180	150 - 240	210 - 380	20 - 50	50 - 160	160 - 540	30 - 60	60 - 160	160 - 320
Office personnel 3/	60 - 100	80 - 130	110 - 210	10 - 20	20 - 60	60 - 210	10 - 20	20 - 60	60 - 120
Total company	320 - 560	460 - 740	640 - 1,180	70 - 180	180 - 555	555 - 1,850	110 - 195	195 - 550	550 - 1,085
Service industry personnel onsite 4/	60 - 110	90 - 150	130 - 240	10 - 40	40 - 110	110 - 370	20 - 40	40 - 110	110 - 220
Dependents 5/	770 - 1,340	1,100 - 1,780	1,540 - 2,830	160 - 440	440 - 1,330	1,330 - 4,440	260 - 470	470 - 1,320	1,320 - 2,610
Medium estimate of townsite population 6/	1,200 - 2,000	1,600 - 2,700	2,300 - 4,200	200 - 700	700 - 2,000	2,000 - 6,700	400 - 700	700 - 2,000	2,000 - 3,900
Low estimate of townsite population 7/	600 - 1,000	800 - 1,400	1,200 - 2,100	100 - 400	400 - 1,000	1,000 - 3,400	200 - 400	400 - 1,000	1,000 - 2,000
High estimate of townsite population 8/	1,800 - 3,000	2,400 - 4,100	3,500 - 6,300	300 - 1,100	1,100 - 3,000	3,000 - 10,100	600 - 1,100	1,100 - 3,000	3,000 - 5,900

1/ Rounded to nearest 1,000 tons except for small mines.
2/ Taken from table 2.
3/ Calculated by formula in table 2, rounded to nearest 10.
4/ Based upon 20 service employees per 100 company employees, rounded to nearest 10.
5/ Based upon 2 dependents for each service and company employee.
6/ Summation of company and service employees plus their dependents, rounded to nearest 100.
7/ Medium estimate of townsite population minus 50 percent, rounded to nearest 100.
8/ Medium estimate of townsite population plus 50 percent, rounded to nearest 100.

by the Corridor Planning Team were analyzed for their mineral and energy potential. The quadrangles also show the prime and alternative routes proposed by El Paso Gas Company. Quadrangles touched by a corridor 50 miles either side of these routes were considered when the Corridor Planning Team believed El Paso would file an application with the Department of the Interior. Consideration of the El Paso routes was dropped in November of 1974 by the Corridor Planning Team, but the mineral and energy resource assessment had been completed and so is included in this report.

The methodology to evaluate the geology and development potential for each quadrangle was to solicit the views of individuals who were highly knowledgeable about specific areas of the State. Respondents on hard rock minerals were Charles Hawley of C. C. Hawley and Associates, Phil Holdsworth of Inexco Mining Company, Jeffrey Knaebel of Resource Associates and Robert Seraphim of R. H. Seraphim Engineering, Ltd. The Bureau of Mines' staff provided additional input on coal, petroleum and minerals where specific knowledge was available. The author then summarized the participant's views. The views of each participant were held confidential so as to not relate specific information with specific individuals or organizations.

The geology section is a broad brush approach giving geology by major rock types. The purpose of this section is to show the reader what type of rocks occur and hence what types of minerals or fossil fuel may be present. For example, sedimentary rocks may be sources of oil, gas, coal and certain nonmetallics such as phosphates and oil shales, as well as uranium. Metamorphic rocks have the potential for mineralization due to a past history of heat and pressure being applied to the area. Igneous and volcanic rocks may indicate still different minerals being present in the area. Granites denote the possibilities of such elements as gold, copper, lead, zinc and antimony occurring while mafic and ultramafic rocks may indicate the presence of copper, nickel, chromium, asbestos and tungsten.

The mineral and energy potential for each quadrangle is then discussed. The areas of relative potential are described from energy and mineral maps, two maps for each quadrangle where needed. The potential maps show the types of minerals or energy likely to occur; they say nothing of the size or quality of mineral or energy resources. For example, large areas of Alaska have never been drilled for oil and gas but the occurrence of a sedimentary basin indicates the potential for these resources. Likewise, an area of mafic rocks indicates the potential for copper, nickel, chromium, asbestos and tungsten. Only an exploration program followed by drilling will prove or disprove the occurrence of resources in commercial quantities.

Finally, the potential for the development within a corridor 50 miles either side of a pipeline route is considered. The potential for each type of resource is a summary of views solicited by the author from the consultants and Bureau of Mines' staff mentioned earlier. This section is meant to show the types and sizes of resources which could be developed in an area between 1975 and 2001 with the construction of a natural gas pipeline with access road and a positive program of encouraging development by the State of Alaska. The size of development is given to relate the resource with the socio-economic impact. The number of people likely to be drawn to an area is taken from table 3.

QUADRANGLE: Ambler River

GEOLOGY: Predominantly sedimentary deposits of limestone and sandstone in the northern third and metamorphic rocks in the middle third. Glacial and glaciofluvial deposits locally cover sedimentary rocks in the southern third. Ultramafic rocks occur along the southern border

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $32,300 - placer gold, placer silver

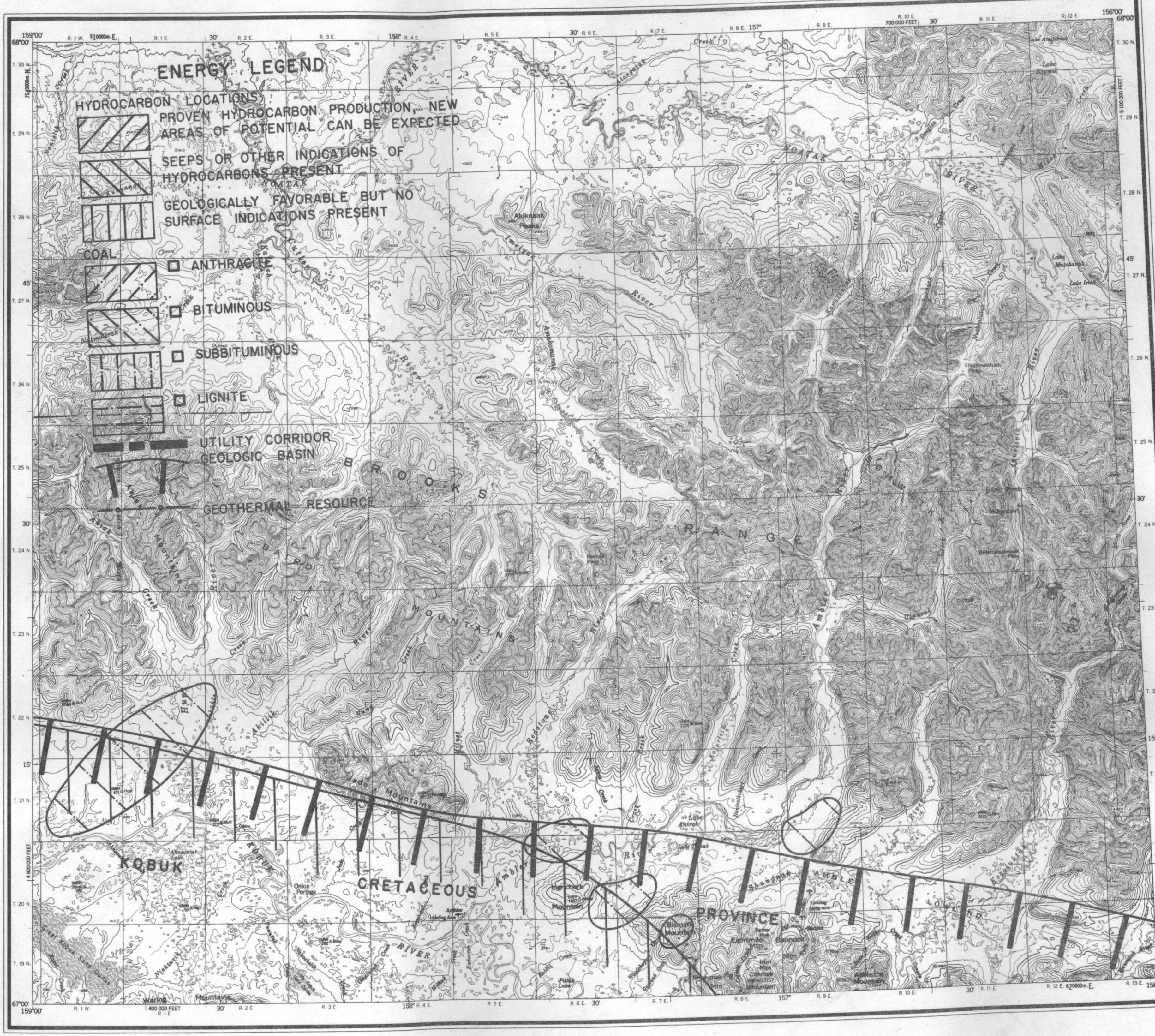
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The southern quarter is geologically favorable but no surface indications are present
Coal	Scattered outcrops of bituminous coal occur in the southern quarter
Minerals	The middle half has high potential for gold, antimony and tungsten and for copper, lead and zinc in a belt trending east-west through the southern part of the high potential area

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	Unknown; little exploration to date
Minerals	The Kobuk area is probably the most important potential mineral producing area in the State. Perhaps 8,000 to 12,000 claims have been staked there recently. Estimates place Kennecott's Bornite property at 5 million tons of 4 to 5 percent copper and its Arctic Camp property at 15 to 30 million tons of 4 to 6 percent copper plus 6 to 8 percent lead. A high potential exists for medium-size underground mines at both locations in the next ten years, and the potential is high for the development of similar properties nearby

AMBLER RIVER



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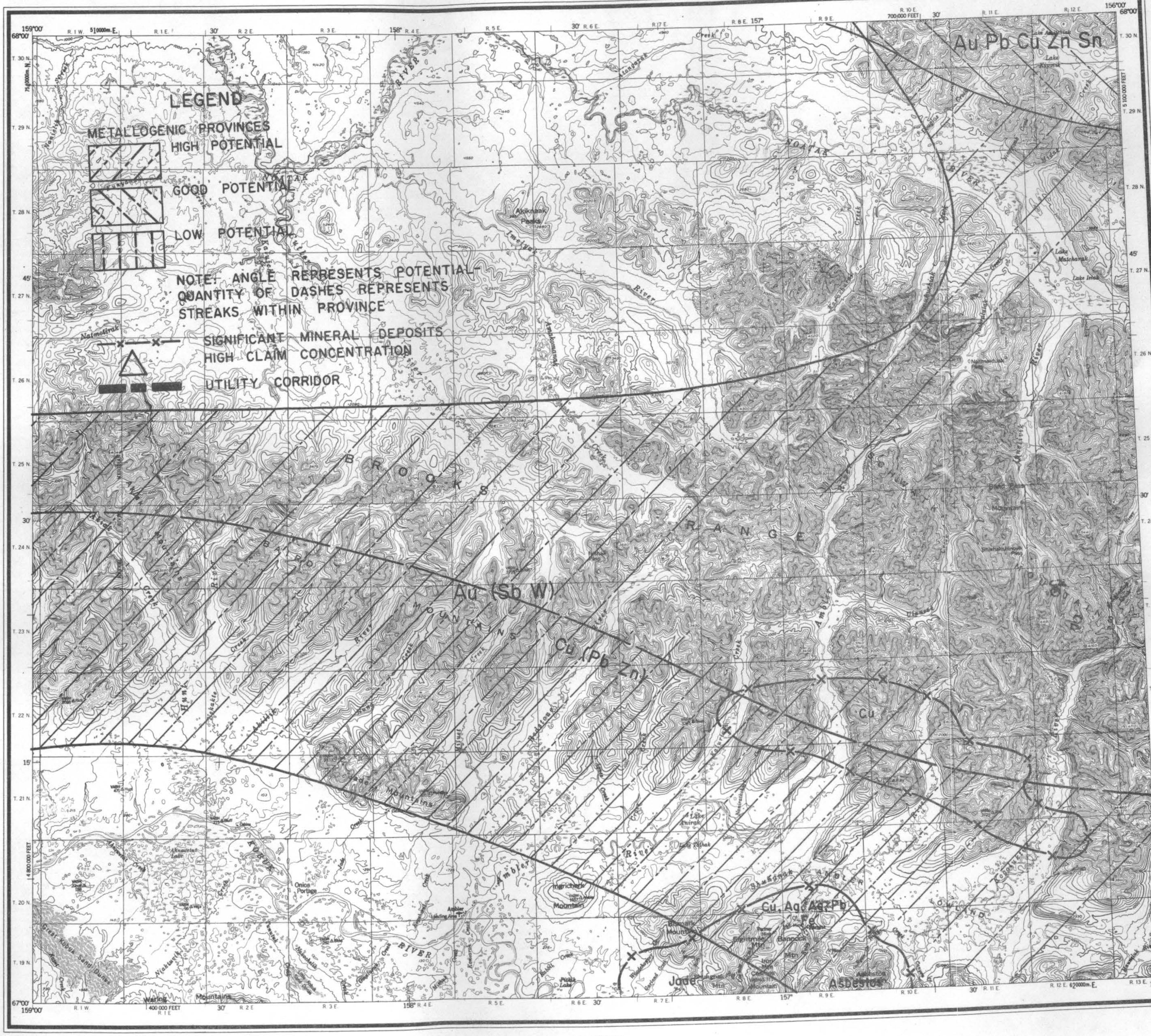

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QUADRANGLE: Anchorage

GEOLOGY: Predominantly sandstone and shale with minor amounts of conglomerate, volcanic rocks and limestone. Granitic intrusives occur along the northern border. Glacial and glaciofluvial deposits occur along the western border

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $88,058,800 - coal, lode gold, lode silver, placer gold, copper, lead, placer silver

MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	Much of the northwestern half is contained within the Cook Inlet Mesozoic Province. Much of the Province is geologically favorable for oil and gas although no surface indications exist
Coal	Anthracite, bituminous and subbituminous coal occur in the northwestern half
Minerals	The northwestern corner has good potential for gold, copper, silver, platinum, chromium and nickel. A central zone from southwest to northeast has good potential for copper, gold, lead, zinc, silver and tungsten

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	The potential for oil and gas deposits is good
Coal	An estimated 137 million tons of coal occur. The potential for medium-size, underground or open pit mines is fair
Minerals	The potential for small-size gold deposits is fair

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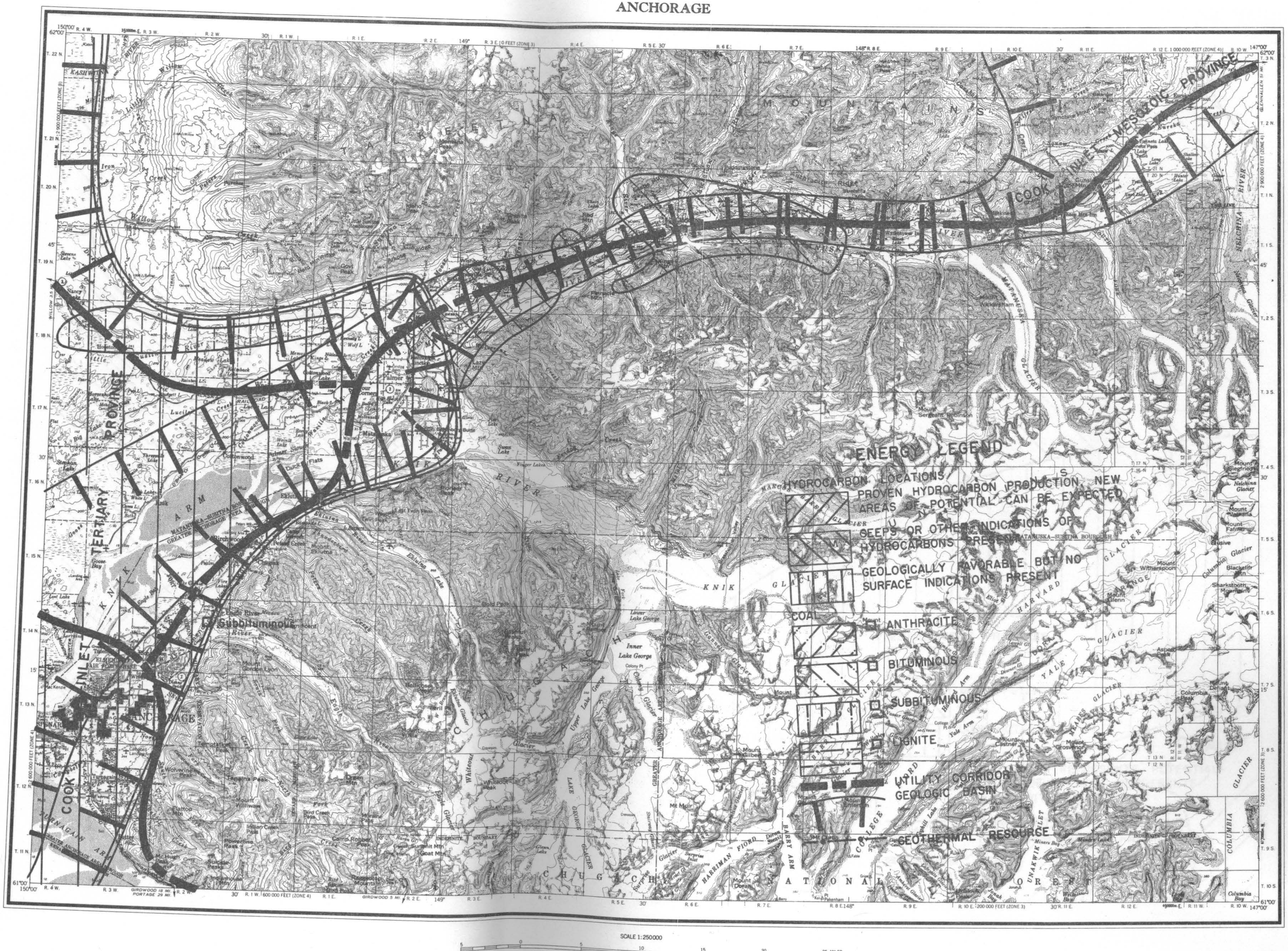
ENERGY LEGEND
HYDROCARBON LOCATIONS
PROVEN HYDROCARBON PRODUCTION. NEW AREAS OF POTENTIAL CAN BE EXPECTED
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SUBBITUMINOUS
LIGNITE
UTILITY CORRIDOR
GEOLOGIC BASIN
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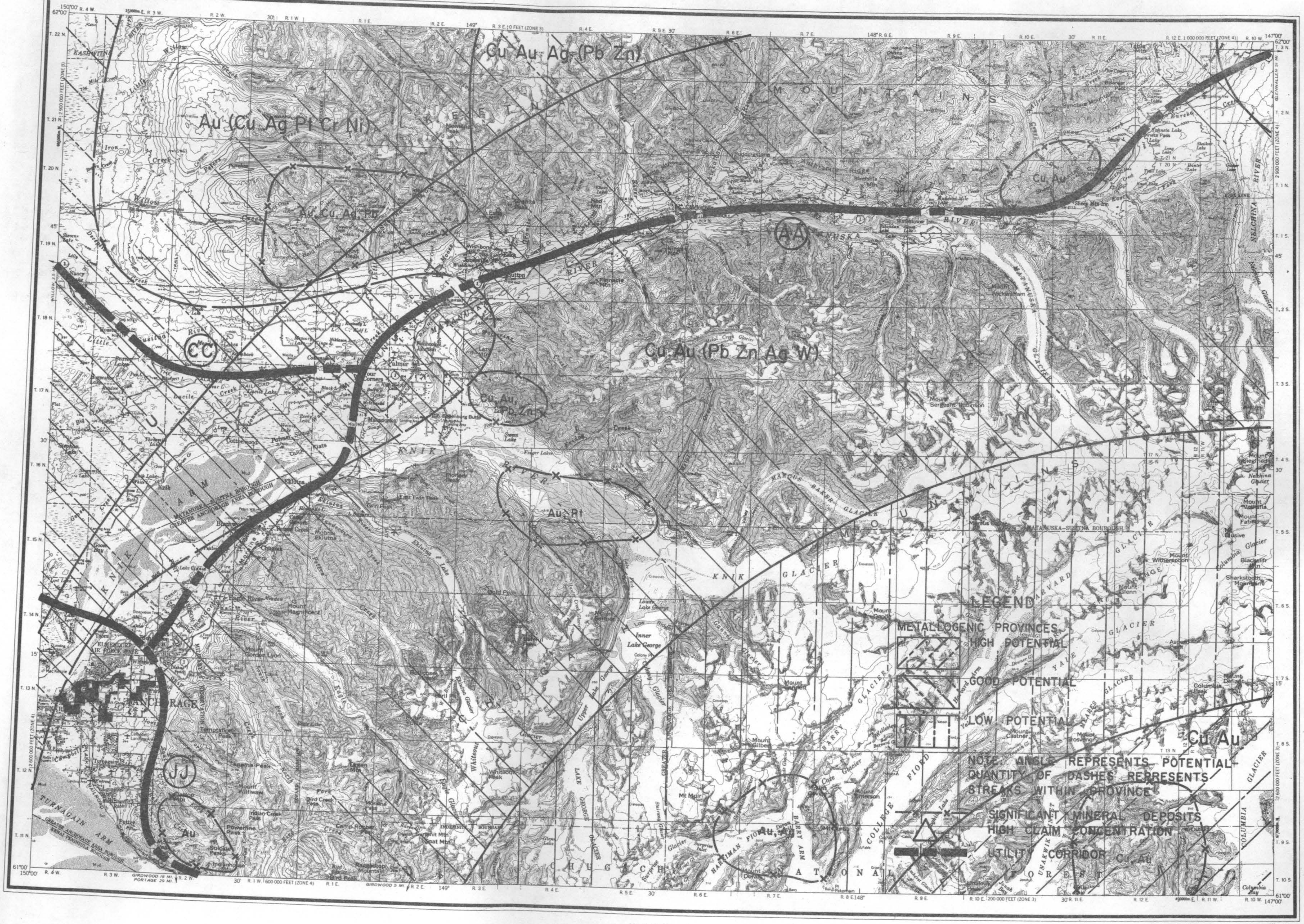

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QUADRANGLE: Arctic

GEOLOGY: Predominantly sedimentary rocks - limestones, sandstones and shales; some scattered volcanic deposits. Some metamorphic rocks in southern and southwestern area

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: None

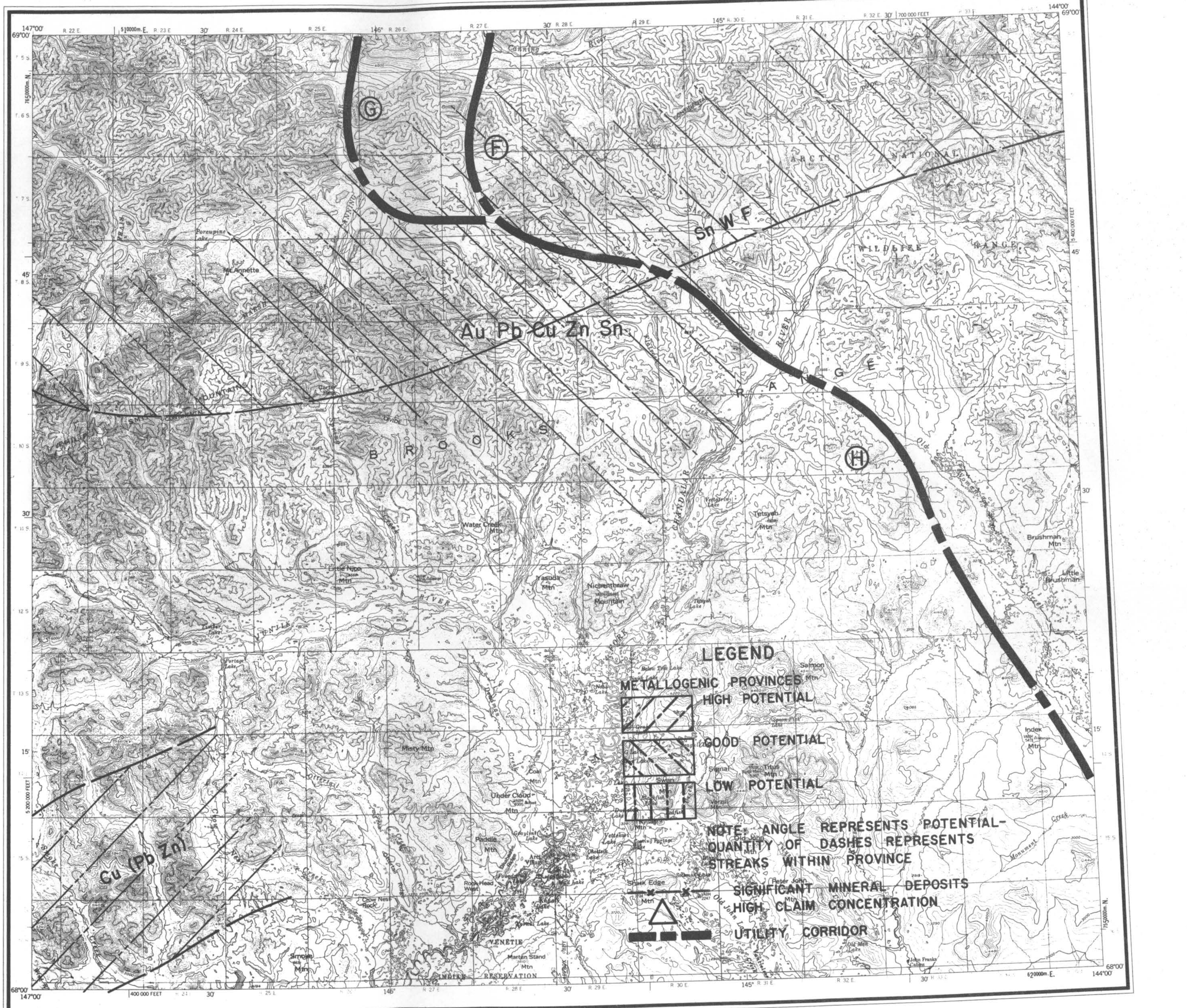
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	None
Coal	None
Minerals	The southern three-quarters have good potential for deposits of gold, lead, copper, zinc and tin. The northern quarter has good potential for tin, tungsten and fluorite deposits

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	None
Coal	None
Minerals	Unknown; little exploration to date

ARCTIC



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5 0 5 10 15 20 25 MILES

QUADRANGLE: Barter Island

GEOLOGY: Marine and nonmarine sediments overlain by alluvium and beach deposits

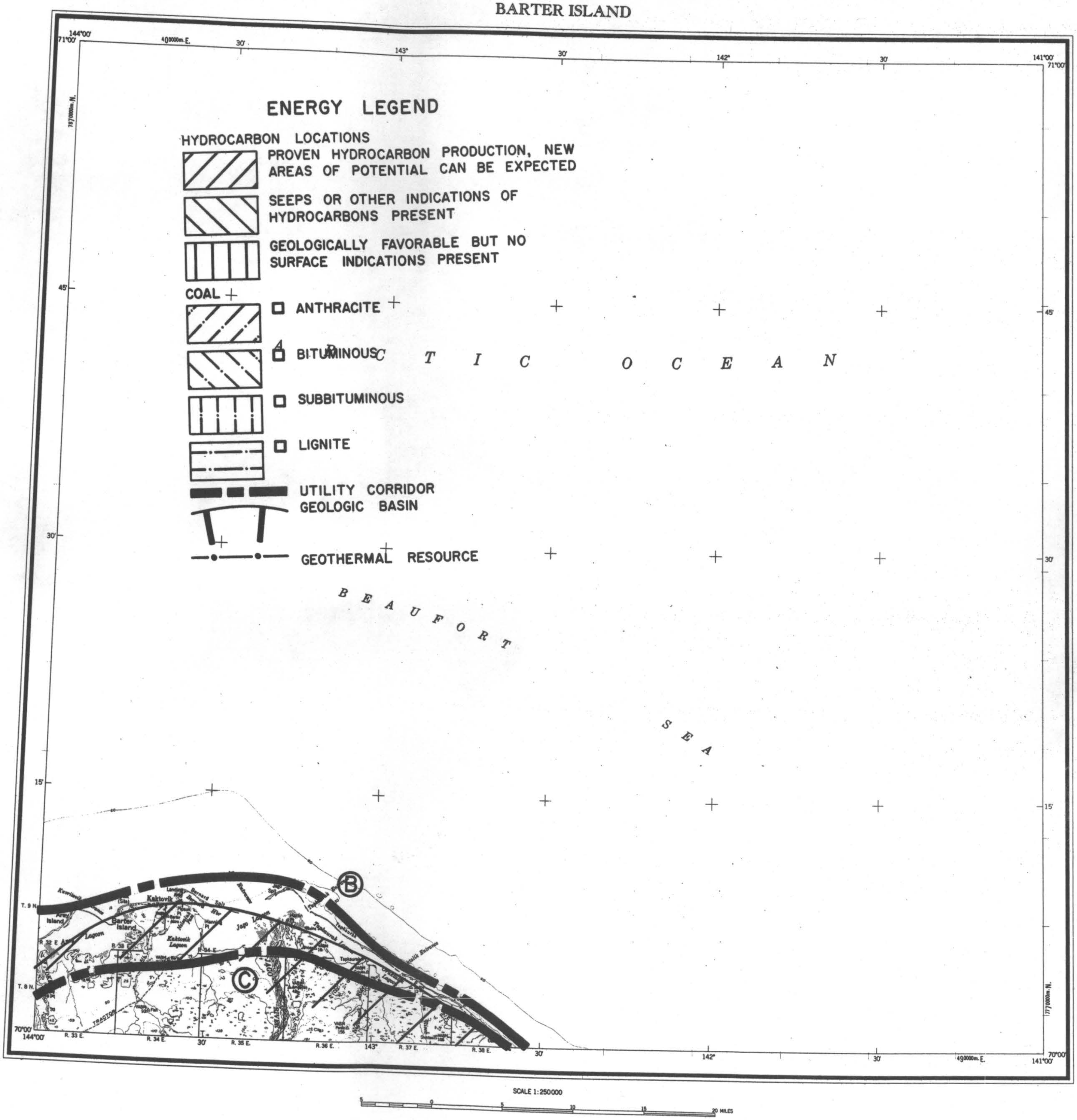
MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: None

MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The land area is one of high potential
Coal	No surface occurrences known; may occur in areas with oil and gas
Minerals	None

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	The potential for the occurrence of hydrocarbons is high
Coal	Unknown; little exploration to date
Minerals	None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QUADRANGLE: Beaver

GEOLOGY: The northwestern half is underlain by metamorphic rocks with scattered granitic intrusions. The southeastern half has alluvium and glaciofluvial deposits overlaying sedimentary rocks

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: None

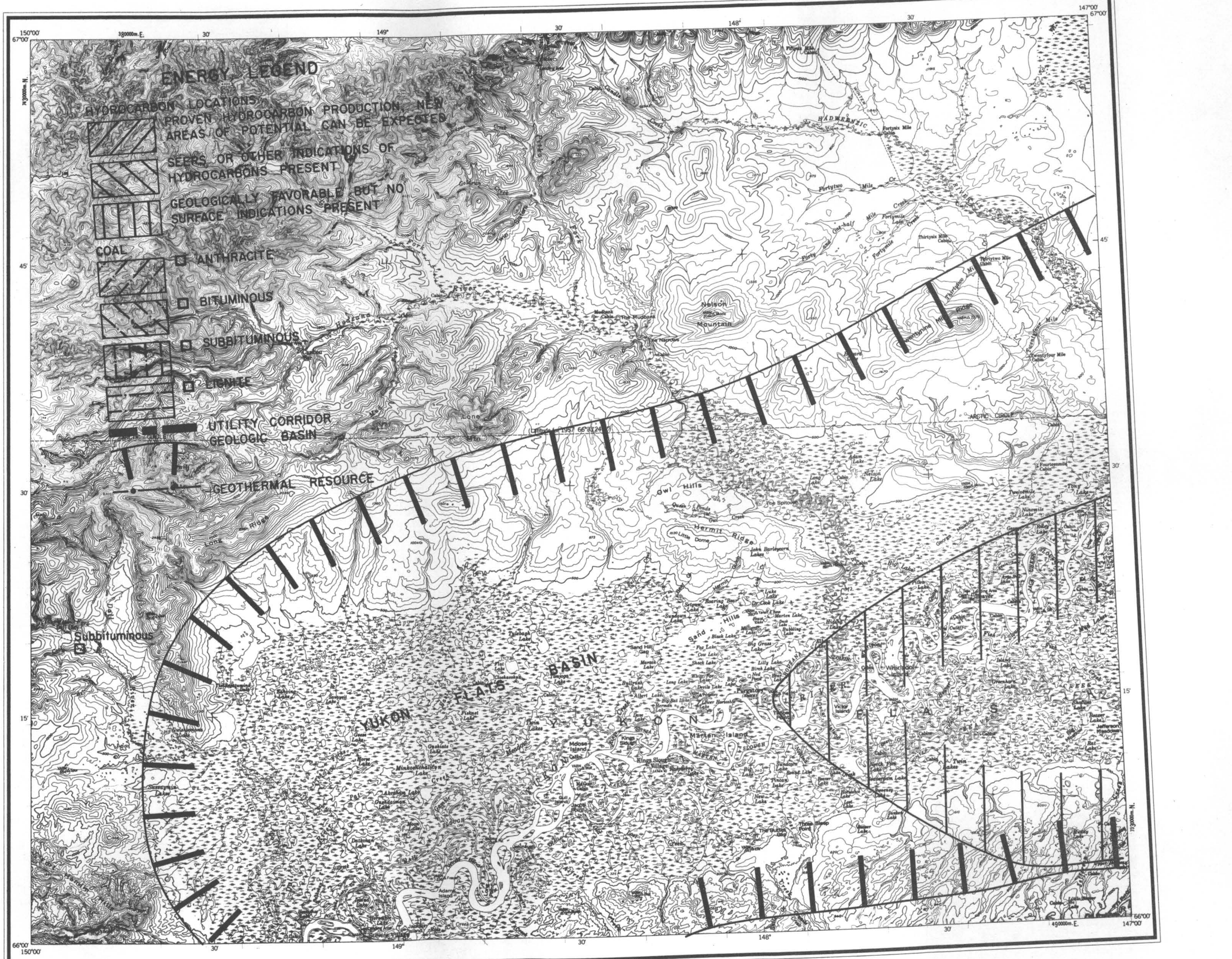
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The southeastern half is within the Yukon Flats Basin where oil and gas may occur. The southeastern quarter is geologically favorable for oil and gas but no surface indications are present
Coal	Small scattered outcrops occur along the east central border
Minerals	Most of the northwestern half has a high potential for gold, antimony and tungsten. An area in east central portion has good potential for placer gold

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	Unknown; little exploration to date
Minerals	Unknown; little exploration to date

BEAVER



SCALE 1:250000

5 0 5 10 15 20 25 MILES

BEAVER


LEGEND
METALLOGENIC PROVINCES
HIGH POTENTIAL
GOOD POTENTIAL
LOW POTENTIAL
NOTE: ANGLE REPRESENTS POTENTIAL-
QUANTITY OF DASHES REPRESENTS
STREAKS WITHIN PROVINCE
SIGNIFICANT MINERAL DEPOSITS
HIGH CLAIM CONCENTRATION
UTILITY CORRIDOR
Au Pb Cu Zn Sn
Au (Sb W)
Au
Sn W Au
Pb Zn
(Cu Sb Ag)
Nelson Mountain
Owl Hills
Hermit Ridge
Long Ridge
Y U K O N
R I V E R
F L A T S
ARCTIC CIRCLE
SCALE 1:250 000
25 MILES

QUADRANGLE: Beechey Point

GEOLOGY: Marine and nonmarine sediments overlain by alluvium and beach deposits

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $2,500,400

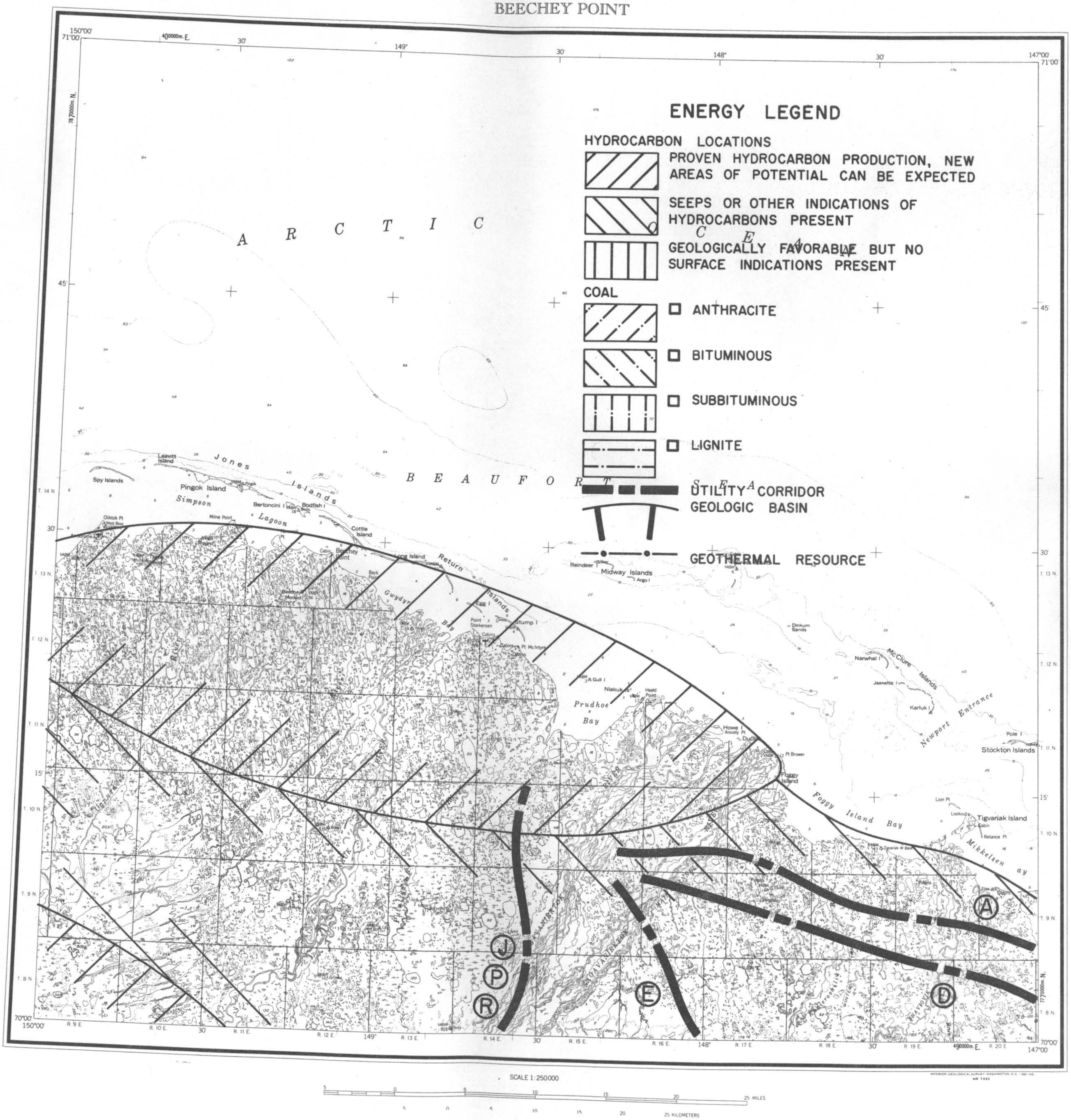
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	Most of the land area has proven hydrocarbon production or are areas of high potential
Coal	No surface exposures known; may occur in areas of oil and gas potential
Minerals	None

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	The potential for developing additional oil and gas deposits is high
Coal	Unknown; little exploration to date
Minerals	None

BEECHEY POINT



QUADRANGLE: Bendeleben

GEOLOGY: Predominantly metamorphic rocks with granite intrusives. Scattered sedimentary deposits

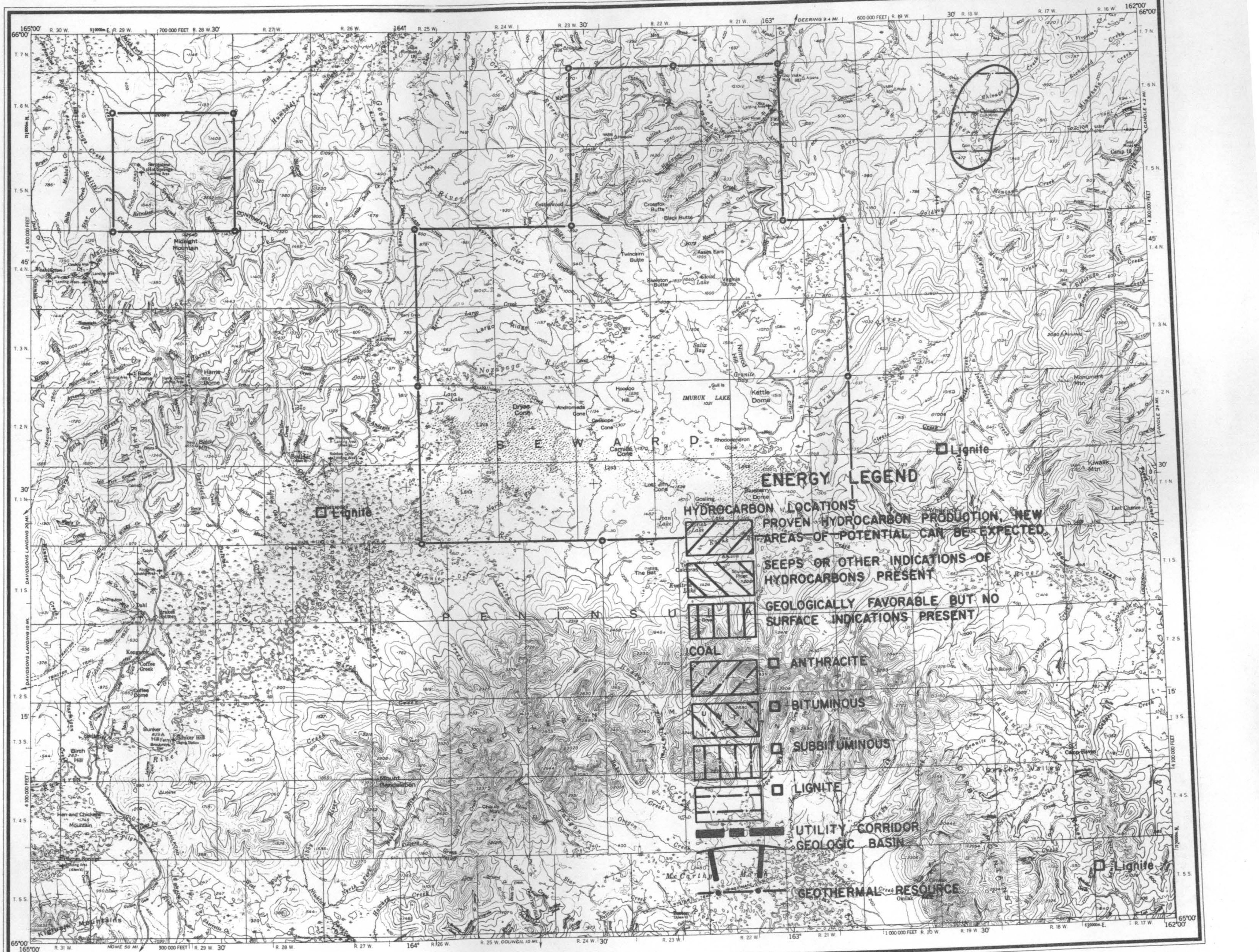
MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $10,012,600 - placer gold, lode silver, placer silver, lead, lode gold

MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	None
Coal	Scattered occurrences of lignite
Minerals	The northern three quarters have good potential for gold, lead, silver, tungsten and mercury. The southern quarter has good potential for uranium and thorium. The northwest corner and eastern border have been major placer gold producers

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	None
Coal	No production potential known
Minerals	The potential for small and medium-size placer gold deposits is high. There is fair potential for small lead-zinc deposits and large uranium deposits



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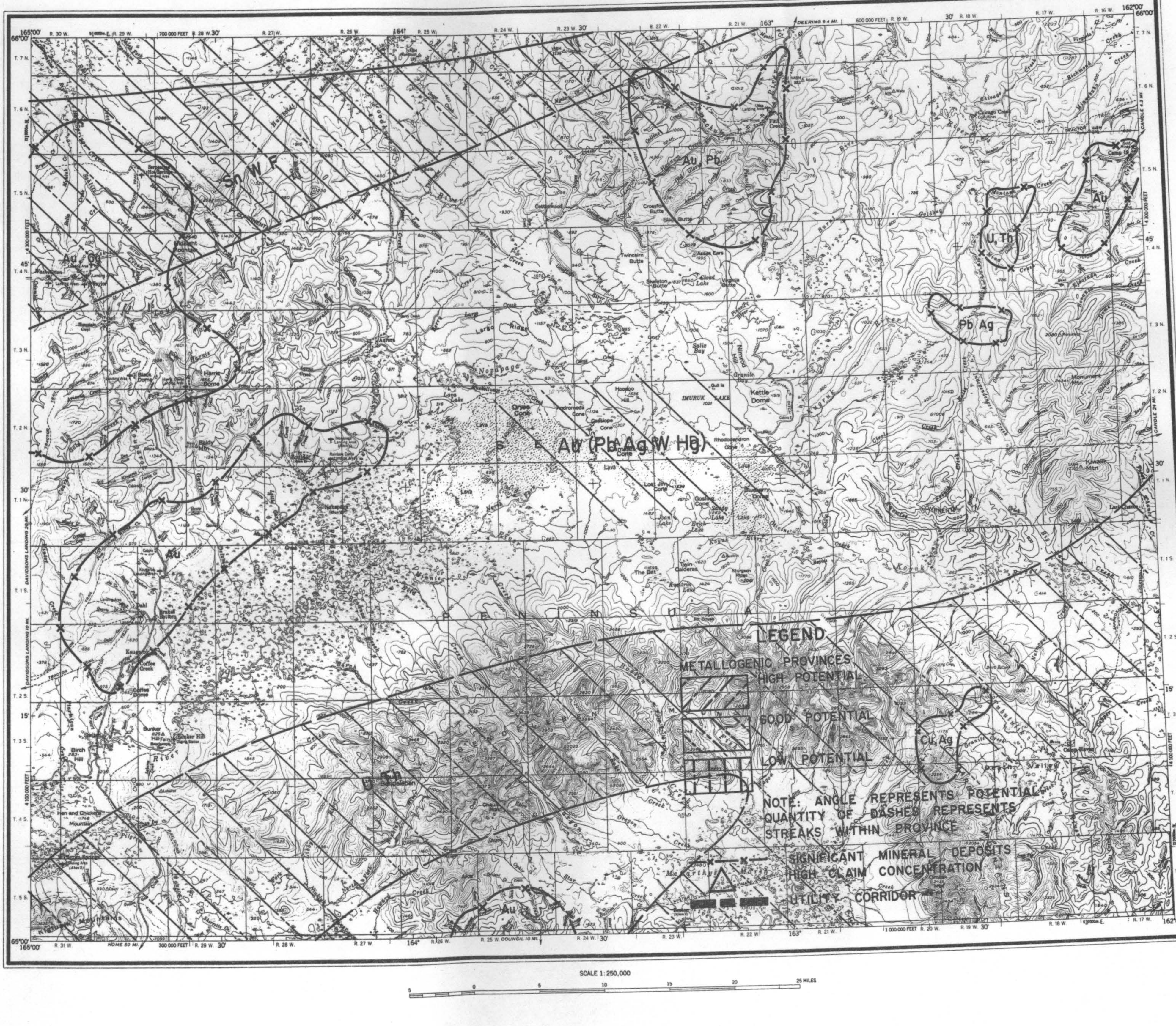
BENDELEBEN



SCALE 1:250,000

5 0 5 10 15 20 25 MILES

QUADRANGLE: Bettles

GEOLOGY: Sandstones and shales in the northwestern two-thirds covered by alluvium and terrace deposits, along major drainages. The central and southeastern third consists of metamorphic rocks intruded by granitic rocks in part and covered by granitic volcanics partially

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $201,600 - placer gold, placer silver

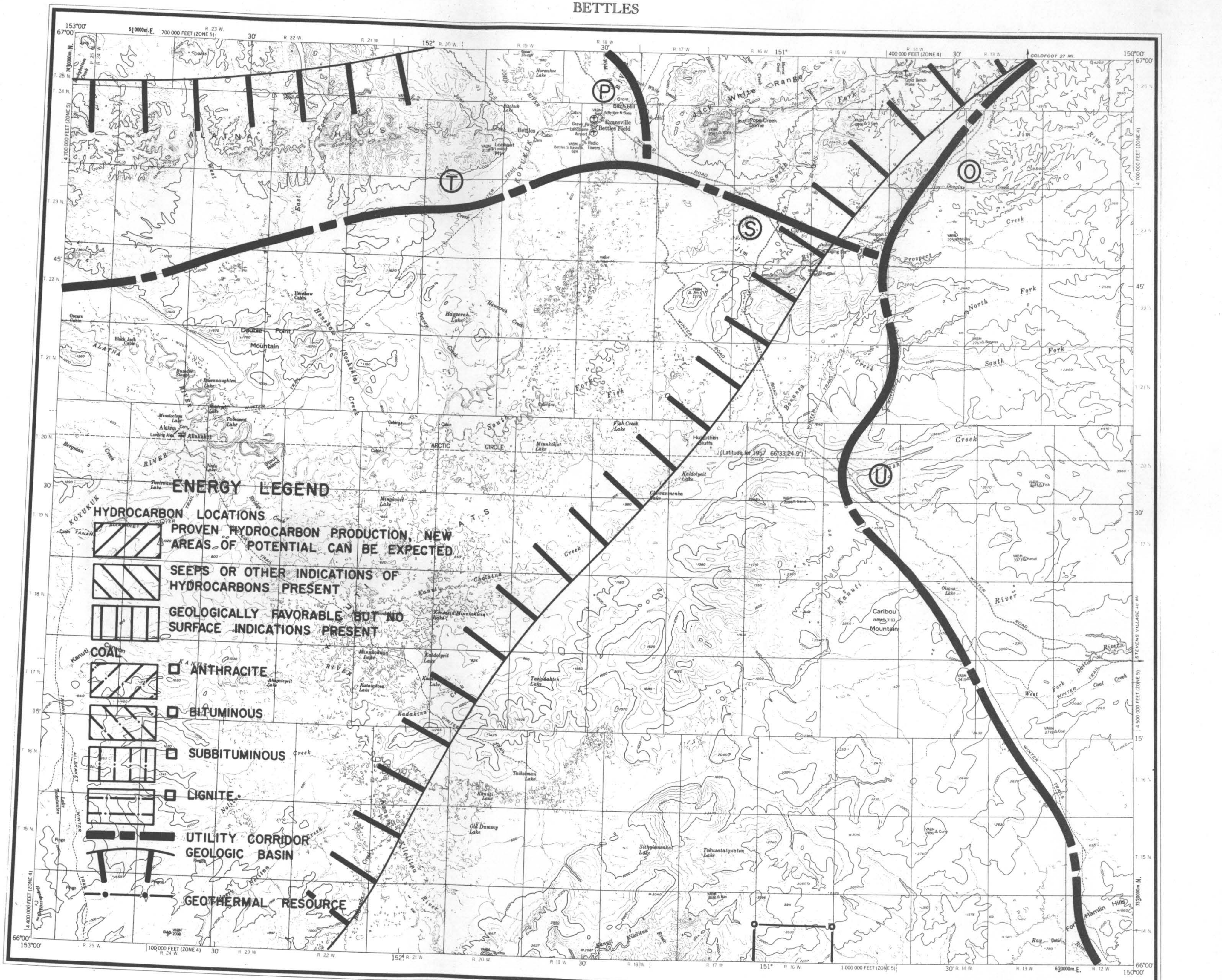
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The northwestern half is contained in the Kobuk Cretaceous Province and hence may have potential for oil and gas
Coal	No known surface occurrences; may occur in the Kobuk Cretaceous Province
Minerals	The northeastern quarter has high potential for gold, antimony and tungsten. The southeastern quarter has high potential for tin, tungsten, gold, lead, zinc, copper, antimony and silver; the southwestern quarter has good potential for tin, tungsten and fluorite; and the northwestern quarter has good potential for gold, lead, silver, tungsten and mercury

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	Unknown; little exploration to date
Minerals	The potential for developing medium-size lead-zinc deposits associated with metamorphic rocks is rated fair. A low probability exists for the development of a large tin or nickel-chromium deposits in the ultramafic rocks

BETTLES



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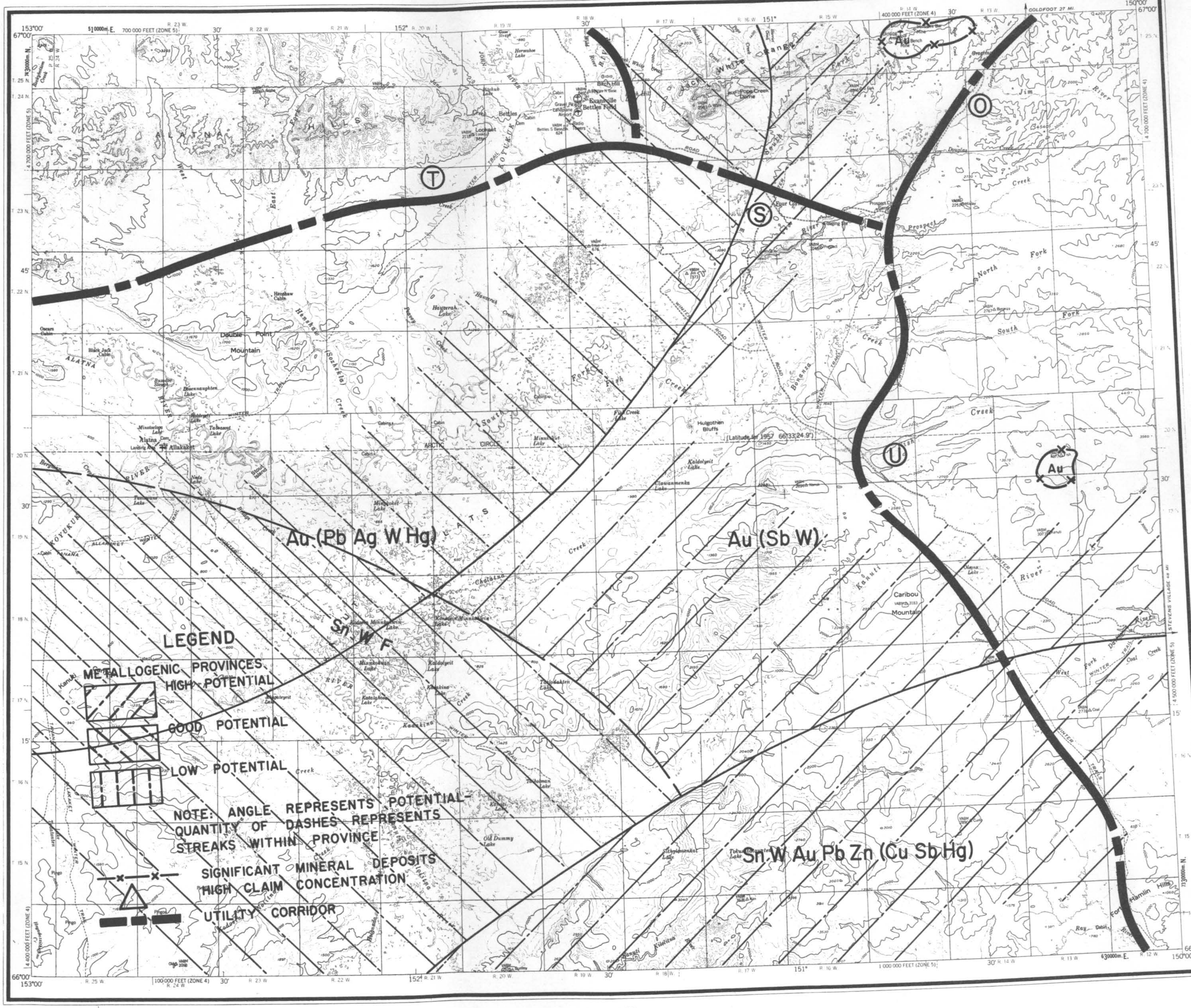


SCALE 1:250 000

5 0 5 10 15 20 25 MILES

QUADRANGLE: Big Delta

GEOLOGY: Predominantly metamorphic rocks with granitic and mafic to ultramafic intrusives partially covered with glacial and glaciofluvial deposits in the southwestern corner

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $4,429,400 - placer gold, placer silver, lode gold, lode silver

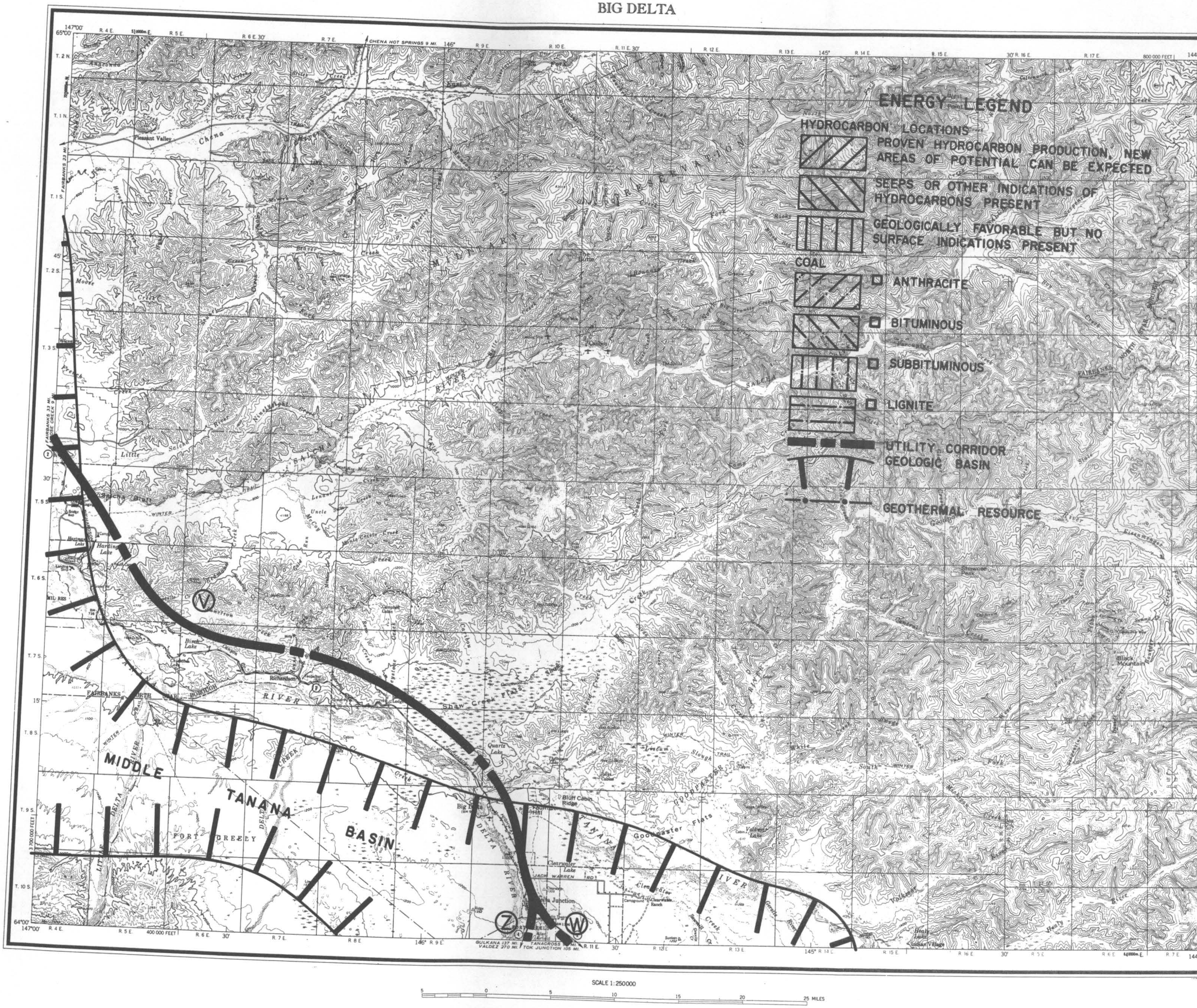
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The Middle Tanana Basin occurs in the southwestern quarter so oil and gas have potential there
Coal	No known surface occurrences; may occur in the Middle Tanana Basin
Minerals	The northern three quarters have good potential for antimony, gold, silver, lead, zinc and mercury. The southwestern quarter has good potential for uranium. Ultramafic rocks may hold asbestos, nickel and platinum

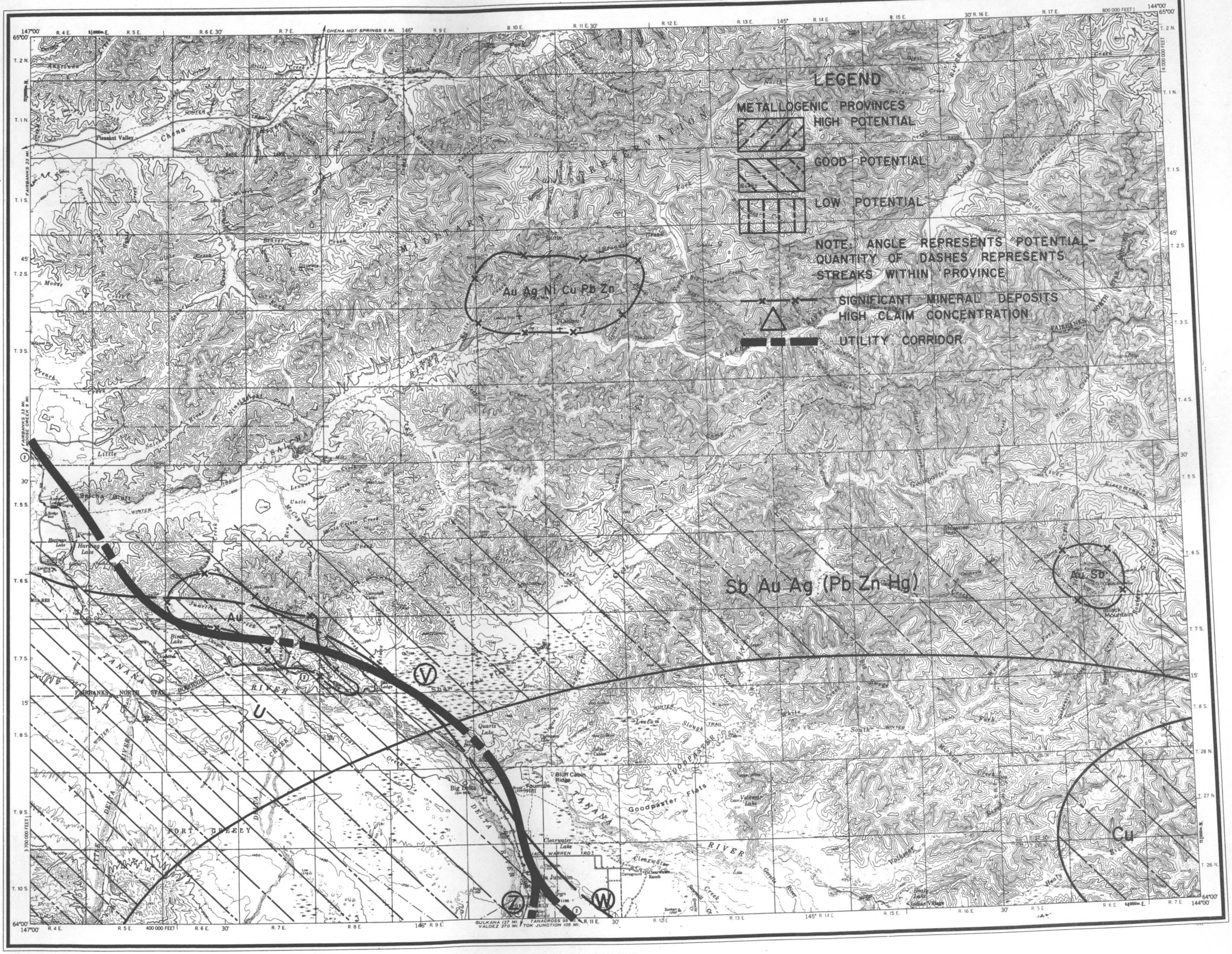
POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	Unknown; little exploration to date
Minerals	The potential for small and medium-size placer gold deposits is high in permafrost zones. Small gold-silver deposits in the metamorphic rocks associated with intrusives have good potential. The potential for medium-size asbestos and copper-nickel deposits in the metamorphic rocks is fair

BIG DELTA


ENERGY LEGEND
HYDROCARBON LOCATIONS
PROVEN HYDROCARBON PRODUCTION, NEW AREAS OF POTENTIAL CAN BE EXPECTED
SEEPS OR OTHER INDICATIONS OF HYDROCARBONS PRESENT
GEOLOGICALLY FAVORABLE BUT NO SURFACE INDICATIONS PRESENT
COAL
ANTHRACITE
BITUMINOUS
SUBBITUMINOUS
LIGNITE
UTILITY CORRIDOR
GEOLOGIC BASIN
GEOTHERMAL RESOURCE
MIDDLE TANANA BASIN
FORT GREELY
Big Delta
Delta Junction
Shaw Creek Flats
Goodpaster Flats
Quartz Lake
Bluff Cabin Ridge
Clearwater Lake
Harding Lake
Birch Lake
Richardson
Pleasant Valley
Chena
MILITARY RESERVATION
SALCHA RIVER
TANANA RIVER
DELTA RIVER
CHENA HOT SPRINGS 9 MI.
GULKANA 137 MI. TANACROSS
VALDEZ 270 MI. TOK JUNCTION 105 MI.
SCALE 1:250000
25 MILES

BIG DELTA



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5 0 5 10 15 20 25 MILES

QUADRANGLE: Black River

GEOLOGY: Much of the western half is overlain by alluvium and glaciofluvial deposits. The northeastern quarter consists of limestones and clastic deposits; the southwestern quarter consists of sedimentary rocks partially overlain by alluvium

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: None

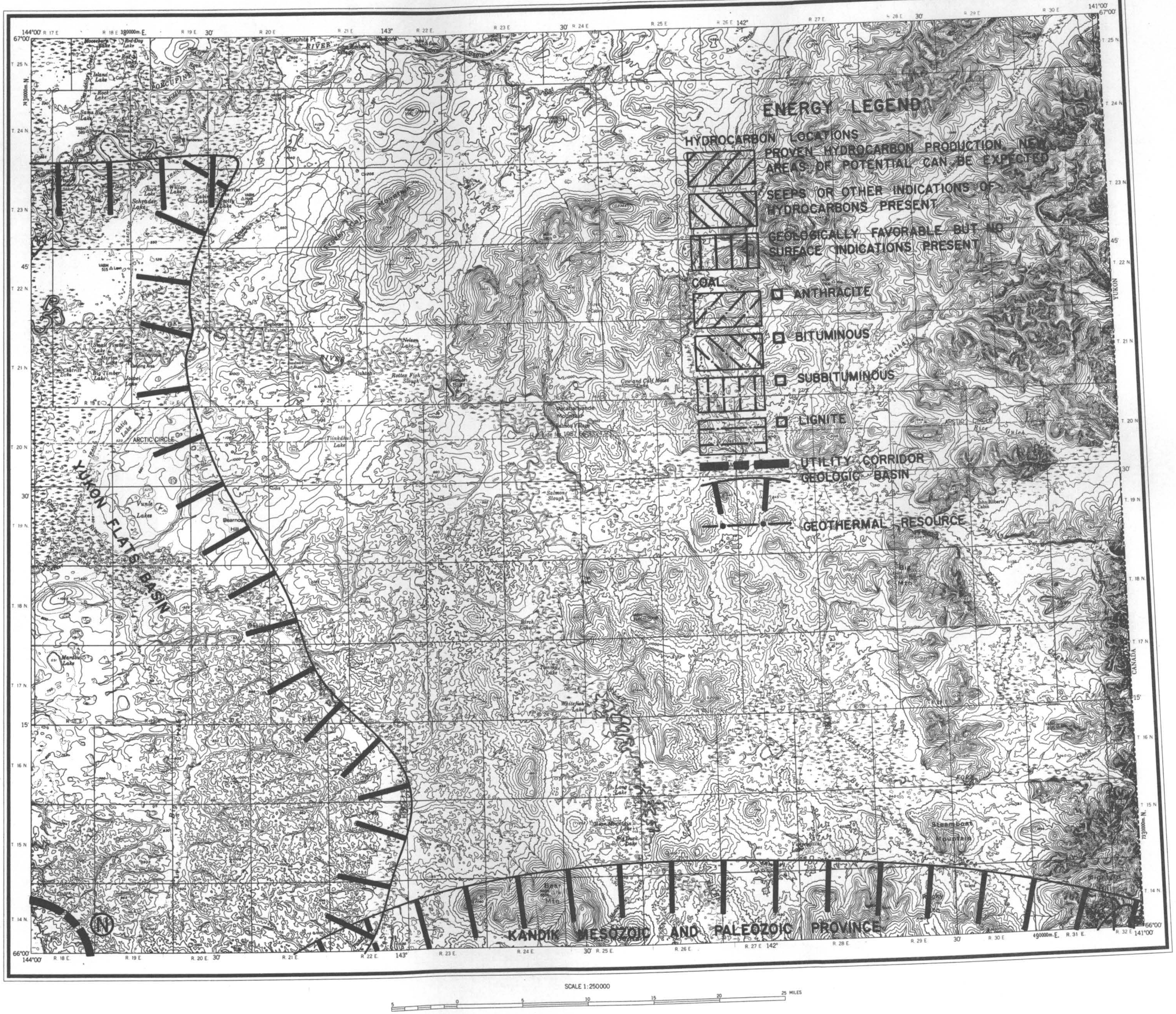
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The western third is within the Yukon Flats Basin and may have oil and gas potential
Coal	No surface exposures known; may occur in the Yukon Flats Basin
Minerals	Much of the eastern two-thirds have good potential for gold, lead, copper, zinc and tin

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR from 1975-2001:

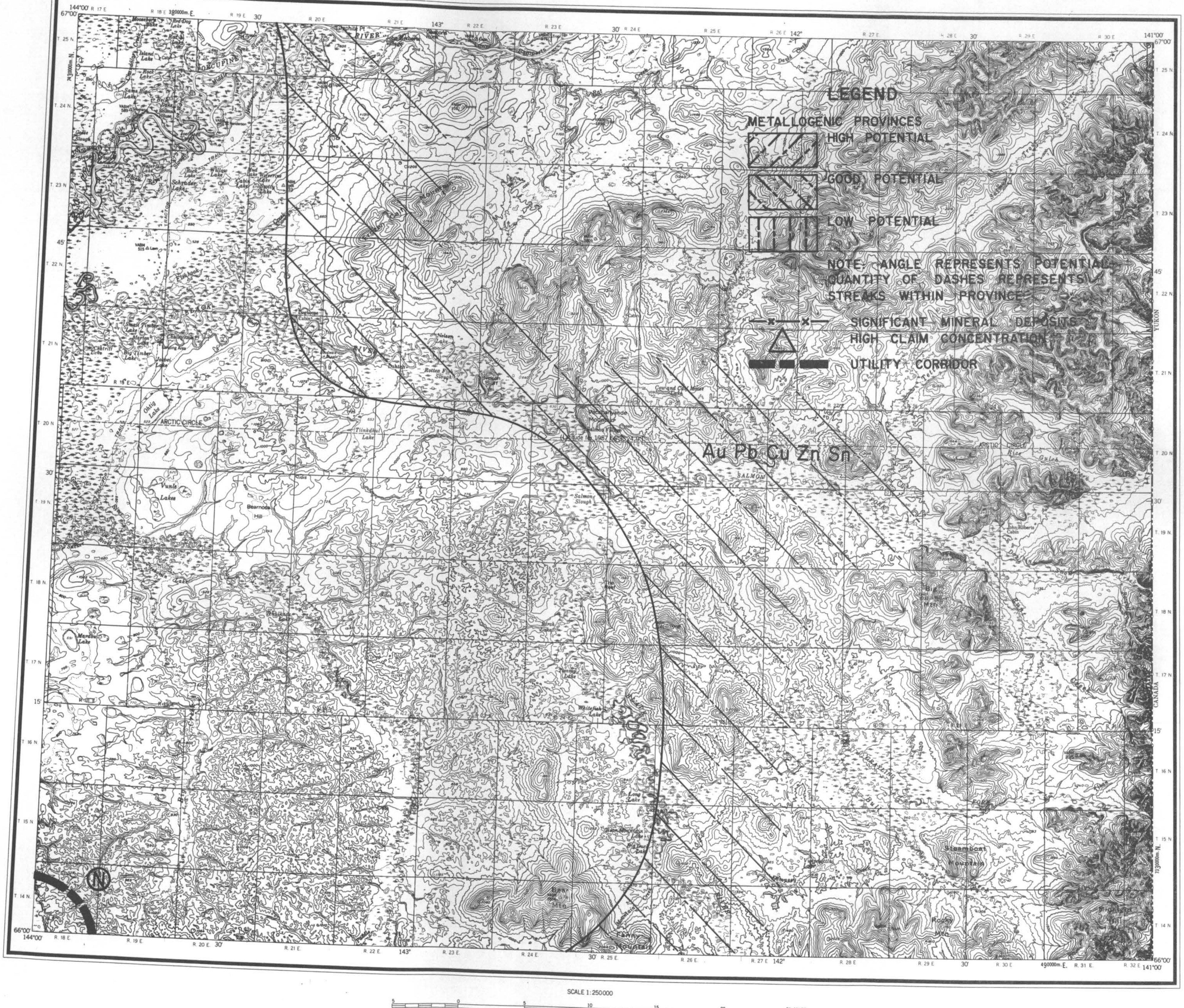
Oil and gas	Unknown; little exploration to date
Coal	Unknown; little exploration to date
Minerals	Unknown; little exploration to date

BLACK RIVER



ENERGY LEGEND
HYDROCARBON LOCATIONS
PROVEN HYDROCARBON PRODUCTION, NEW AREAS OF POTENTIAL CAN BE EXPECTED
SEEPS OR OTHER INDICATIONS OF HYDROCARBONS PRESENT
GEOLOGICALLY FAVORABLE BUT NO SURFACE INDICATIONS PRESENT
COAL
ANTHRACITE
BITUMINOUS
SUBBITUMINOUS
LIGNITE
UTILITY CORRIDOR
GEOLOGIC BASIN
GEOTHERMAL RESOURCE
YUKON FLATS BASIN
KANDIK MESOZOIC AND PALEOZOIC PROVINCE
ARCTIC CIRCLE
YUKON
CANADA
SCALE 1:250000
25 MILES

BLACK RIVER



LEGEND
METALLOGENIC PROVINCES
HIGH POTENTIAL
GOOD POTENTIAL
LOW POTENTIAL
NOTE: ANGLE REPRESENTS POTENTIAL QUANTITY OF DASHES REPRESENTS STREAKS WITHIN PROVINCE
SIGNIFICANT MINERAL DEPOSITS
HIGH CLAIM CONCENTRATION
UTILITY CORRIDOR
Au Pb Cu Zn Sn
ARCTIC CIRCLE
YUKON
CANADA
SCALE 1:250000
25 MILES

QUADRANGLE: Candle

GEOLOGY: The western third is predominantly volcanic and intrusive granitic rocks with metamorphic rocks and scattered sedimentary rocks. The eastern two thirds consist of sandstones and shales with scattered volcanics. Some ultramafic rocks occur

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $11,443,600 - placer gold, placer silver

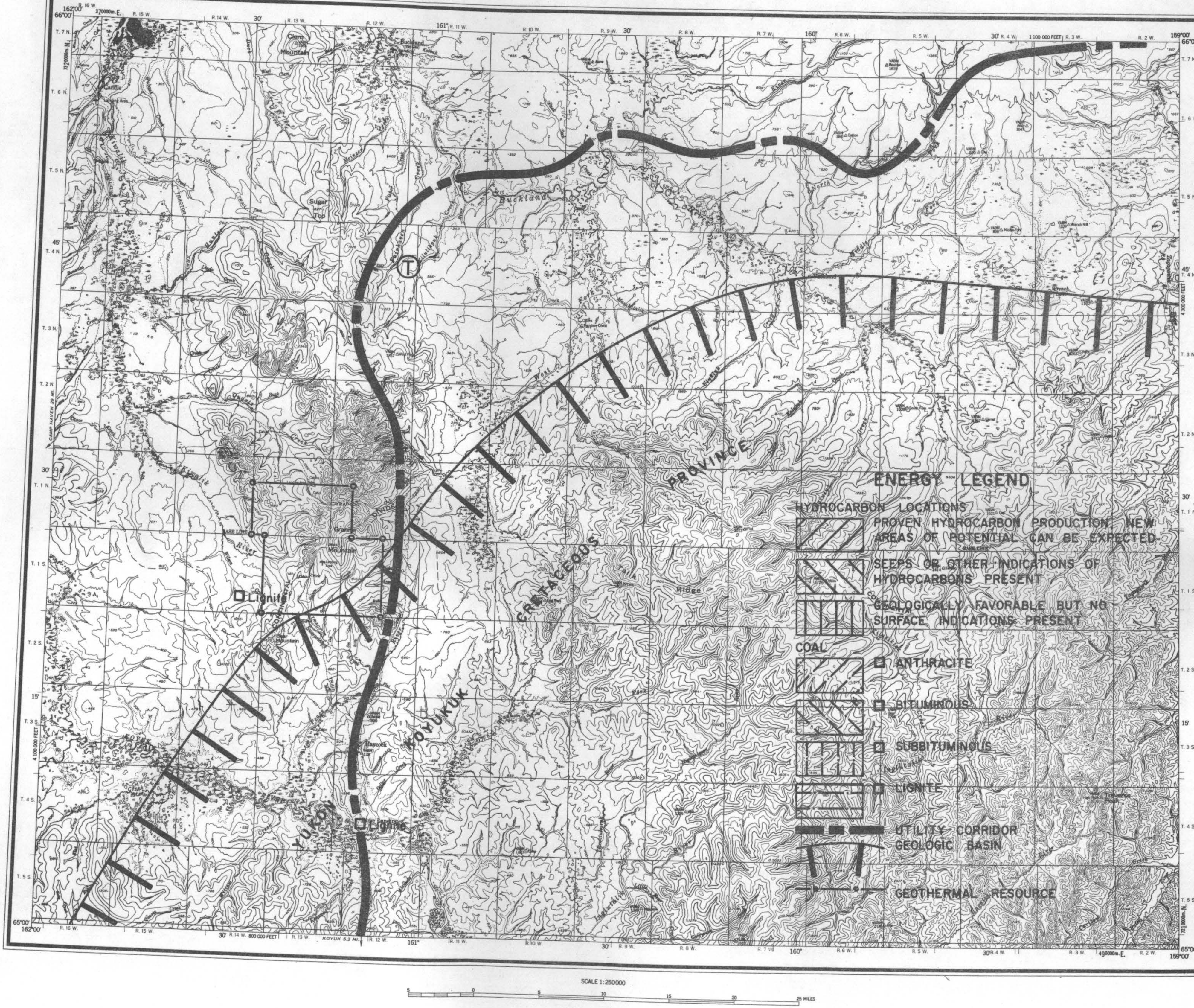
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

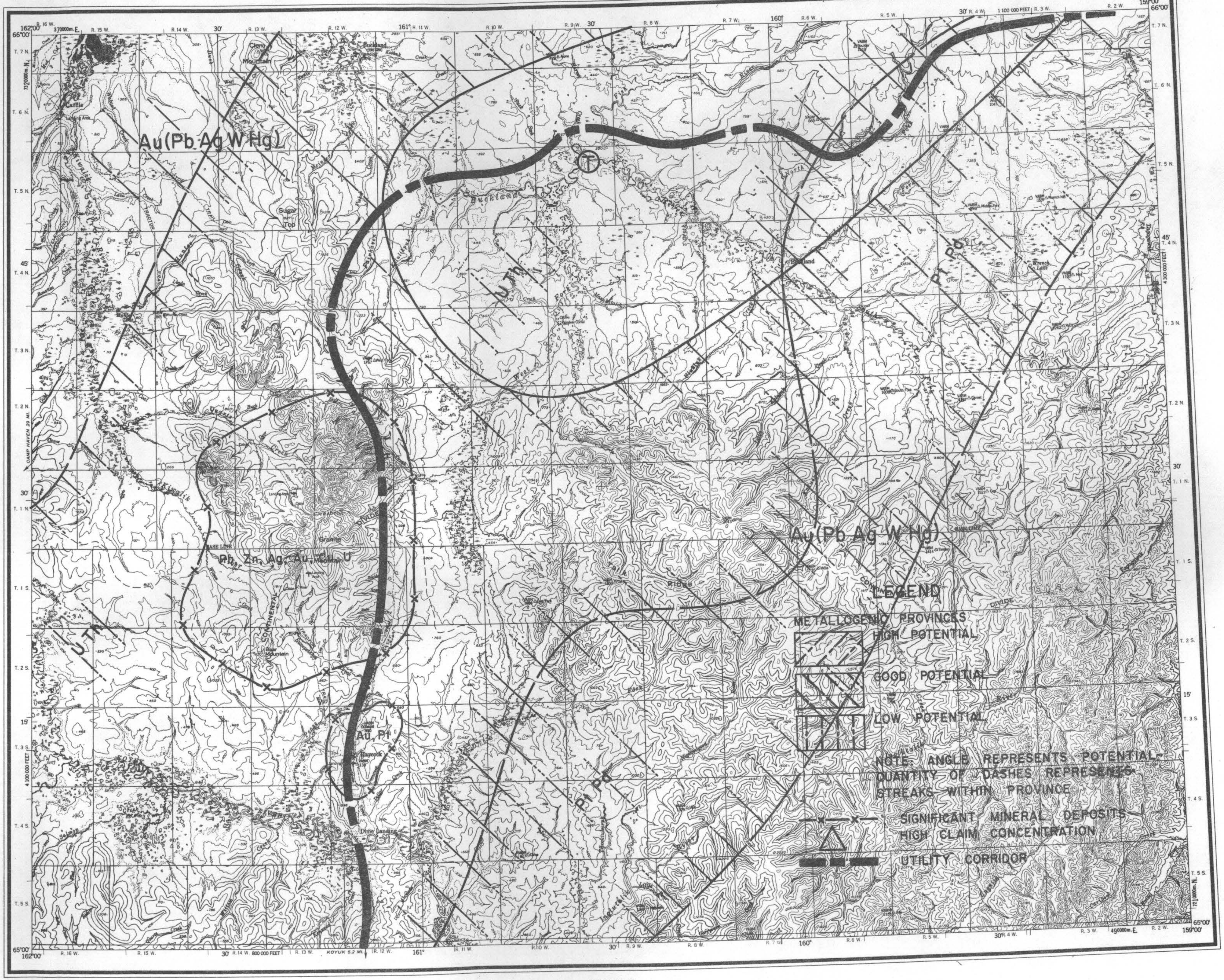
Oil and gas	The eastern two thirds are within the Yukon-Koyukuk Cretaceous Province and may have oil and gas potential
Coal	Scattered outcrops of lignite occur in the western third
Minerals	The western third has good potential for uranium and thorium, the middle third for platinum and palladium, and the eastern third for gold, lead, silver, tungsten and mercury. The western third has been a major placer gold area

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	Unknown; little exploration to date
Minerals	The potential for small and medium placer gold deposits is high. The occurrences of large, low-grade gold, lead and uranium deposits is fair

CANDLE


ENERGY LEGEND
HYDROCARBON LOCATIONS
PROVEN HYDROCARBON PRODUCTION NEW AREAS OF POTENTIAL CAN BE EXPECTED
SEEPS OR OTHER INDICATIONS OF HYDROCARBONS PRESENT
GEOLOGICALLY FAVORABLE BUT NO SURFACE INDICATIONS PRESENT
COAL
ANTHRACITE
BITUMINOUS
SUBBITUMINOUS
LIGNITE
UTILITY CORRIDOR
GEOLOGIC BASIN
GEOTHERMAL RESOURCE
YUKON KOYUKUK CRETACEOUS PROVINCE
Lignite
Lignite
Buckland
Candle
Sugar Top
Granite Mountain
SCALE 1:250000
25 MILES



SCALE 1:250000

5 0 5 10 15 20 25 MILES

QUADRANGLE: Chandalar

GEOLOGY: Predominantly limestones and other clastic rocks in the northern quarter. The middle half predominates in metamorphic rocks intruded in the central area by granitic intrusives. The southern quarter has sedimentary rocks metamorphosed in places by granitic intrusives and extrusives

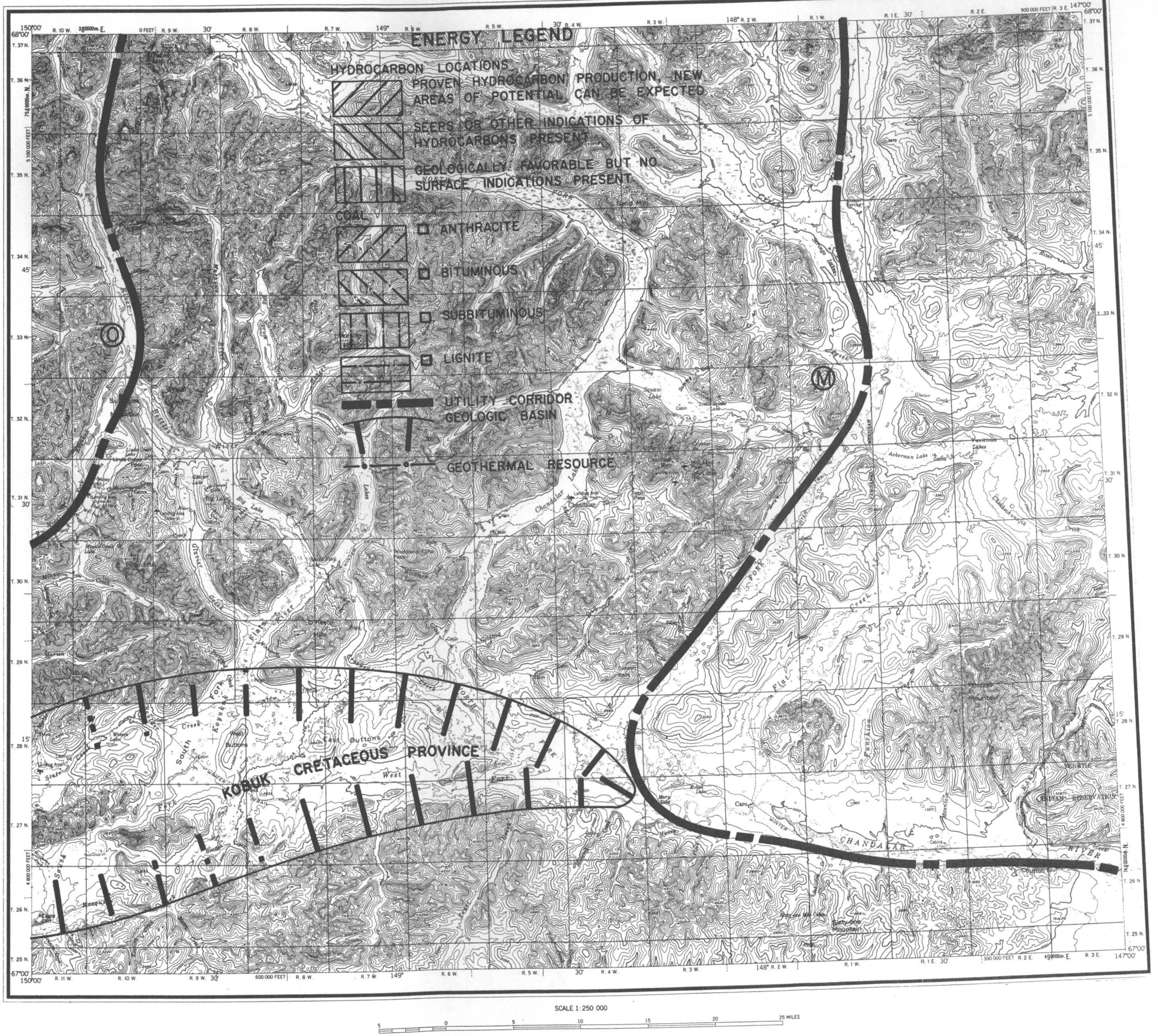
MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $985,200 - placer gold, lode gold, placer silver, lode silver

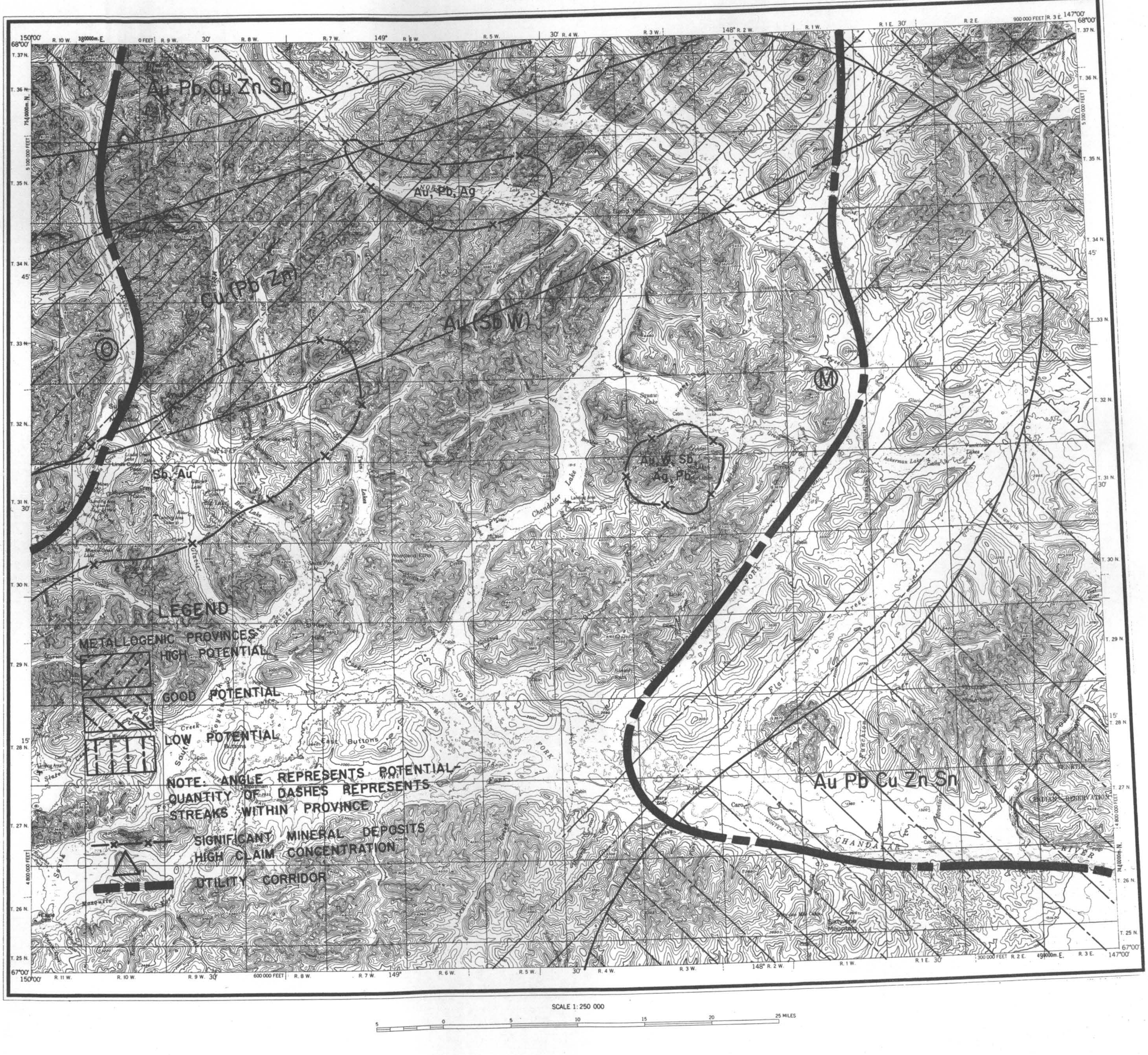
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The southwestern corner is part of the Kobuk Cretaceous Province and may have potential
Coal	No surface exposures known; may occur in the Kobuk Cretaceous Province
Minerals	The western three quarters have high potential for gold, antimony and tungsten. A belt of copper, lead and zinc occurs in the northern quarter. The eastern quarter has good potential for gold, lead, copper, zinc and tin. Placer gold has been produced from the west central area

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	Unknown; little exploration to date
Minerals	The potential for continued development of small and medium-size placer gold deposits is high. A high probability exists for the development of medium-size, high-grade copper, lead and zinc deposits associated with the metamorphic rocks. These deposits could be similar to the deposit staked by Kennecott at Arctic Camp. A good probability exists for the development of small but high-grade copper, lead and zinc deposits where the limestones have been intruded by granites. The Little Squaw gold mine is currently operating within 12 miles of segment "M" in metamorphic rocks


ENERGY LEGEND
HYDROCARBON LOCATIONS
PROVEN HYDROCARBON PRODUCTION, NEW AREAS OF POTENTIAL CAN BE EXPECTED
SEEPS OR OTHER INDICATIONS OF HYDROCARBONS PRESENT
GEOLOGICALLY FAVORABLE BUT NO SURFACE INDICATIONS PRESENT
COAL
ANTHRACITE
BITUMINOUS
SUBBITUMINOUS
LIGNITE
UTILITY CORRIDOR
GEOLOGIC BASIN
GEOTHERMAL RESOURCE
KOBUK CRETACEOUS PROVINCE
CHANDALAR RIVER
SCALE 1:250 000
25 MILES


Au Pb Cu Zn Sn
Au, Pb, Ag
Cu (Pb Zn)
Au (Sb W)
Sb, Au
Au, W, Sb, Cu, Ag, Pb
Au Pb Cu Zn Sn
LEGEND
METALLOGENIC PROVINCES
HIGH POTENTIAL
GOOD POTENTIAL
LOW POTENTIAL
NOTE: ANGLE REPRESENTS POTENTIAL-
QUANTITY OF DASHES REPRESENTS
STREAKS WITHIN PROVINCE
SIGNIFICANT MINERAL DEPOSITS
HIGH CLAIM CONCENTRATION
UTILITY CORRIDOR
Chandalar Lake
CHANDALAR RIVER
SCALE 1:250 000
5 0 5 10 15 20 25 MILES

QUADRANGLE: Chandler Lake

GEOLOGY Marine and nonmarine shales and sandstones with minor areas of limestones and volcanics

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: None

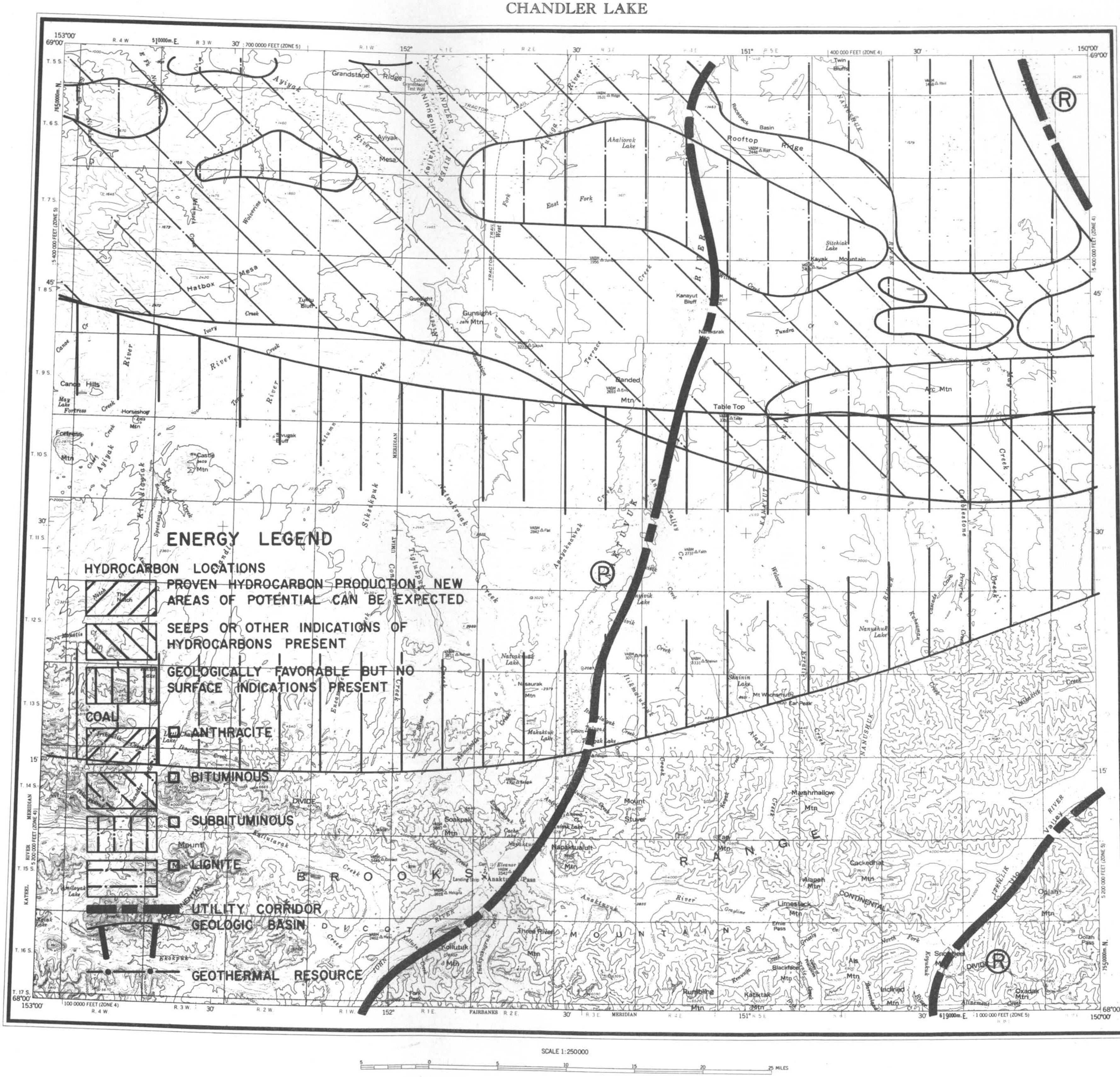
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	Northern third has good potential based on oil seeps or other indications; the middle third is geologically favorable but no surface indications have been found
Coal	The northern third is underlain by bituminous and subbituminous coals
Phosphate	Deposits occur in central and west central area
Minerals	The southern third ranges from less favorable to favorable for the occurrence of gold, lead, copper, zinc and tin

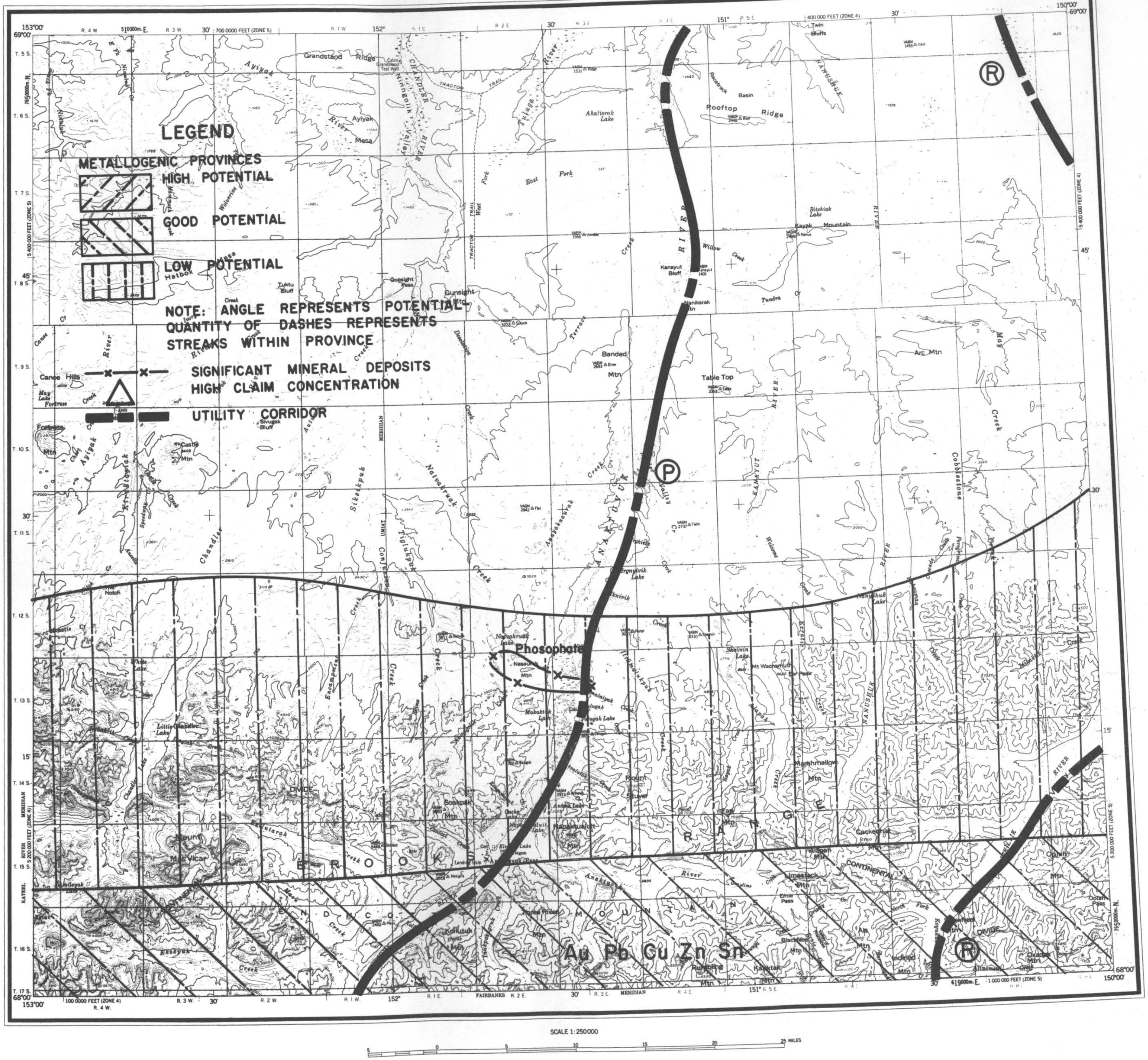
POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	An estimated 7.4 billion tons of coal reserves exist within the corridor. The prospects for its development are considered low
Minerals	The potential for developing the medium-size, low-grade phosphate deposits is considered low

CHANDLER LAKE



CHANDLER LAKE



QUADRANGLE:	Charley River
GEOLOGY:	Predominantly sedimentary rocks north of the Yukon River with volcanic rocks along the western border. Large granitic masses intrude sedimentary rocks south of the Yukon River

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $11,472,000 - placer gold, placer silver

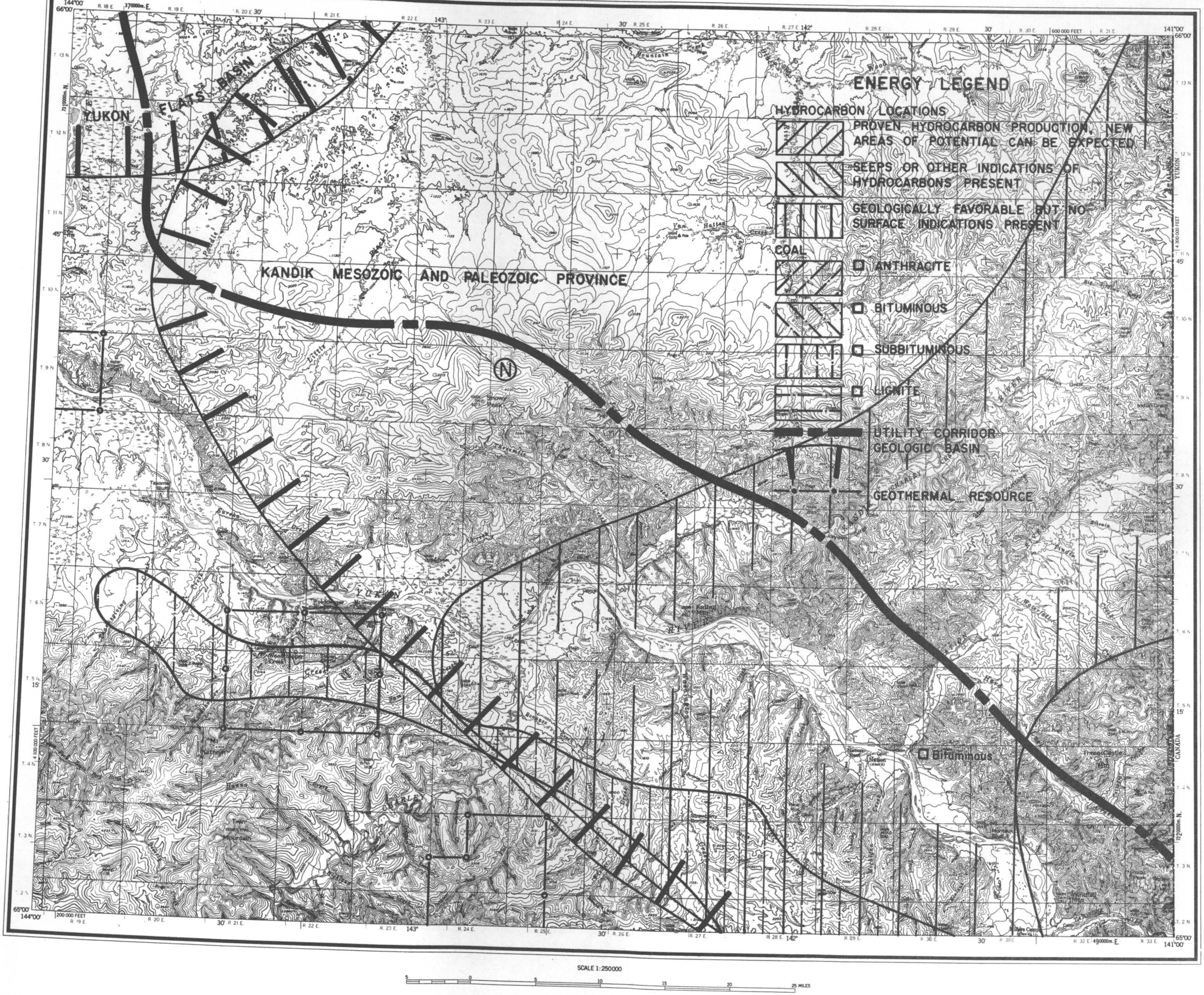
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The eastern three quarters is within the Kandik Mesozoic and Paleozoic Province with much of that area geologically favorable for oil and gas but no surface indications occur
Coal	A large zone of subbituminous coal follows the Yukon River through the southern half of the area
Minerals	Much of the area to the north of the Yukon River is favorable for gold, lead, copper, zinc and tin. The area to the south of the Yukon has good potential for uranium and a high potential for gold. Much of the area south of the Yukon River has been an important placer gold producing region

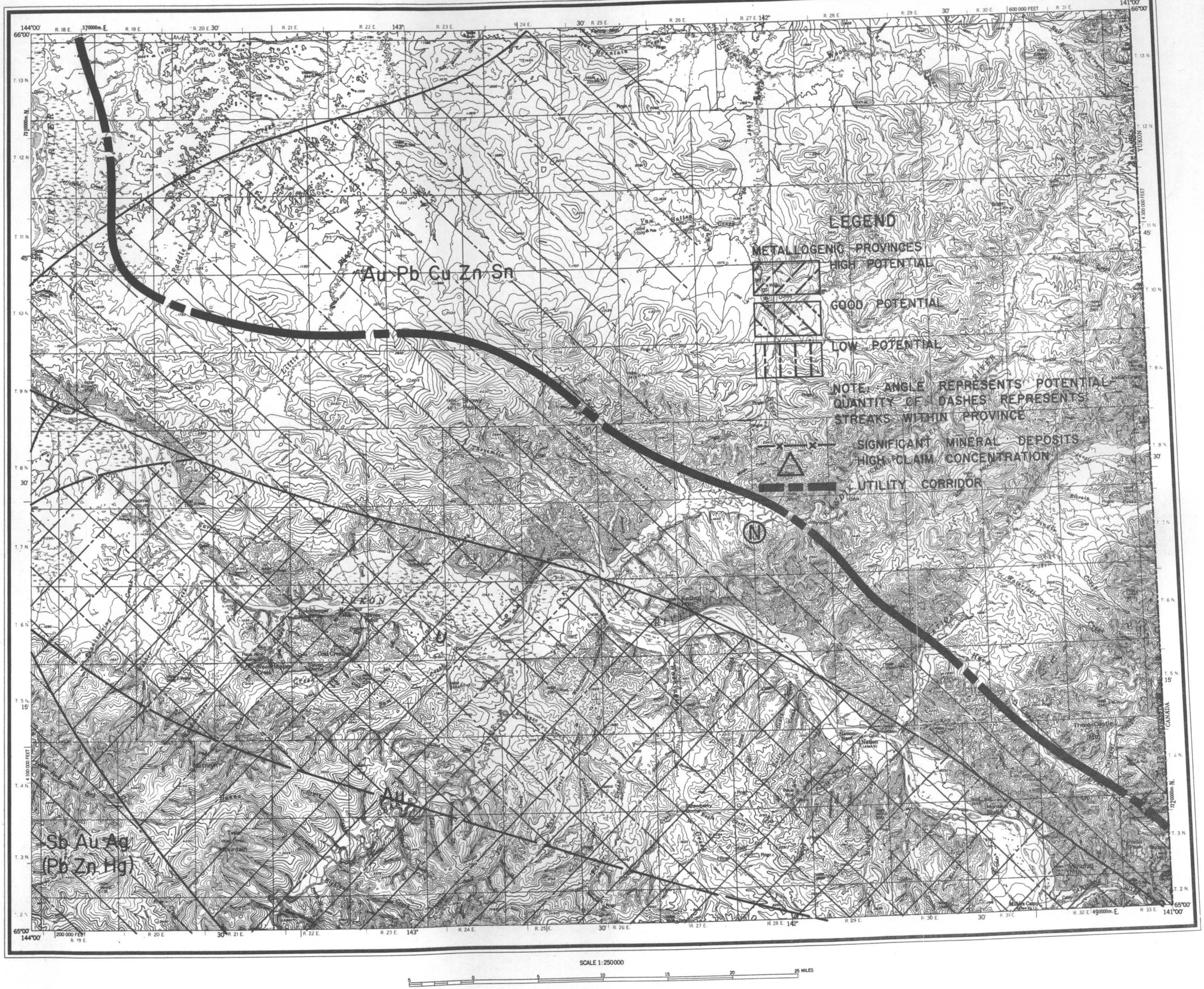
POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	A low potential exists for a large coal mine
Minerals	A high potential exists for large, low-grade uranium deposits and for small and medium-size gold placer deposits. A low potential exists for large, low-grade copper, lead and zinc deposits

CHARLEY RIVER



CHARLEY RIVER



QUADRANGLE: Christian

GEOLOGY: The northeastern quarter consists of limestones and clastic rocks, the southeastern quarter is covered by alluvium and terrace gravel deposits, the southwestern quarter is underlain by metamorphic rocks, and the northwestern quarter consists of limestones and dolomites

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: None

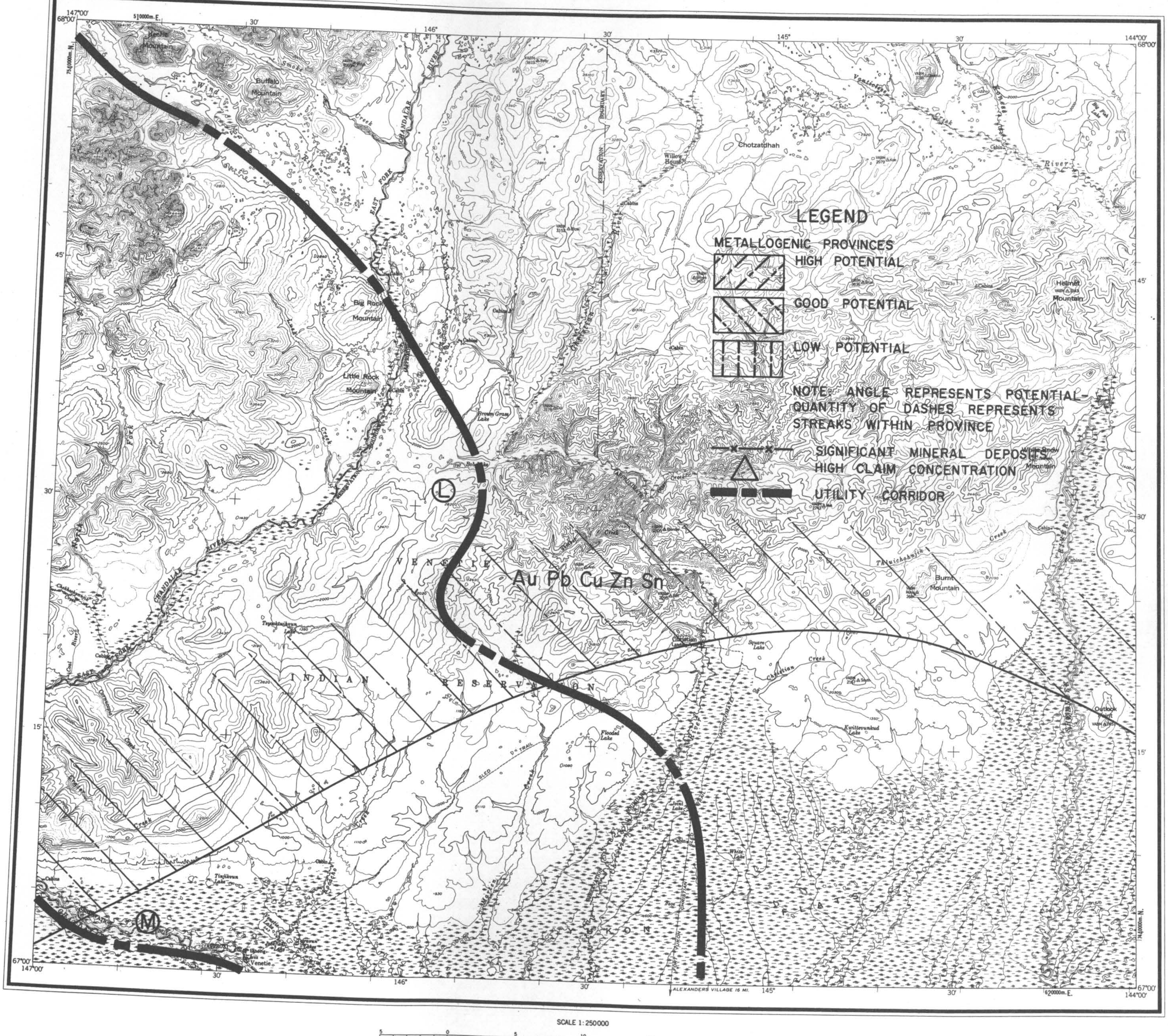
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The southeastern corner contains the Yukon Flats Basin
Coal	No known surface occurrences; may occur in the Yukon Flats Basin
Minerals	The northern two-thirds have good potential for gold, lead, copper and tin deposits

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	Unknown; little exploration to date
Minerals	Unknown; little exploration to date

CHRISTIAN


LEGEND
METALLOGENIC PROVINCES
HIGH POTENTIAL
GOOD POTENTIAL
LOW POTENTIAL
NOTE: ANGLE REPRESENTS POTENTIAL- QUANTITY OF DASHES REPRESENTS STREAKS WITHIN PROVINCE
SIGNIFICANT MINERAL DEPOSITS
HIGH CLAIM CONCENTRATION
UTILITY CORRIDOR
Au Pb Cu Zn Sn
VENETIE INDIAN RESERVATION
Chotzatdhah
Big Rock Mountain
Little Rock Mountain
Buffalo Mountain
Burnt Mountain
Helmet Mountain
Christian
Venetie
ALEXANDERS VILLAGE 16 MI.
SCALE 1:250000
25 MILES

QUADRANGLE: Circle

GEOLOGY: Predominantly metamorphic rocks with minor amounts of limestones and shales, intruded granitics, serpentines and scattered granitic volcanics in the southern three quarters. Sedimentary and ultramafic rocks covered by alluvium occur in the northern quarter

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $16,893,100 - placer gold, placer silver

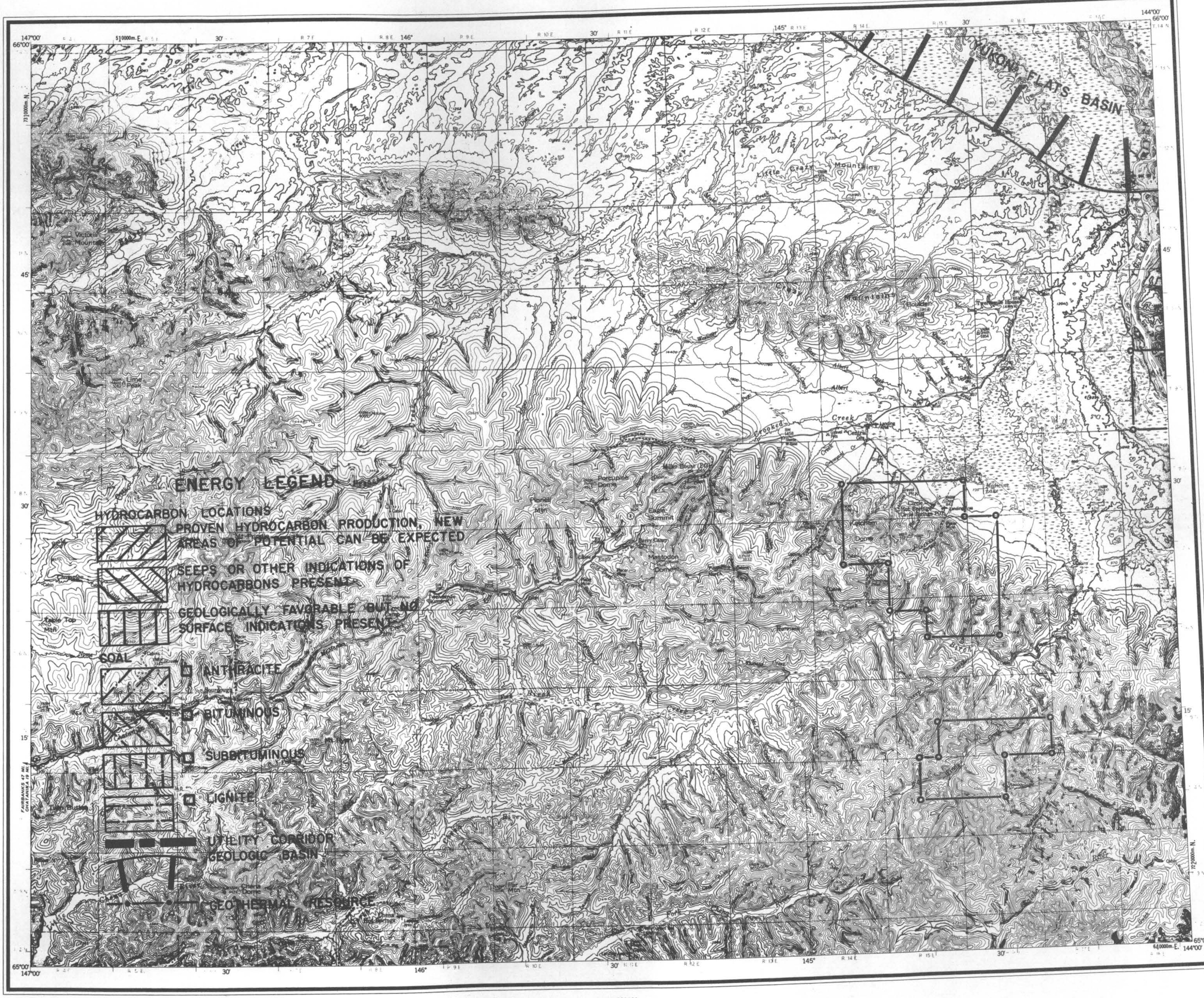
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	Areas along the northern border are geologically favorable for oil and gas, but no surface indications exist
Coal	No surface occurrence known; may exist in favorable oil and gas areas
Minerals	The southern three quarters have good potential for antimony, gold, silver, lead, zinc and mercury. Creeks in the central part of the area have been major placer gold producers

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	Unknown; little exploration to date
Minerals	The potential for small and medium-size placer gold development is high. The potential for small-size lead-zinc deposits in limestones and shales intruded by granitics is fair. The potential for medium-size tin and tungsten deposits in the ultramafic rocks is fair. Small lead-zinc-silver deposits have a fair potential for occurring in the metamorphic rocks

CIRCLE



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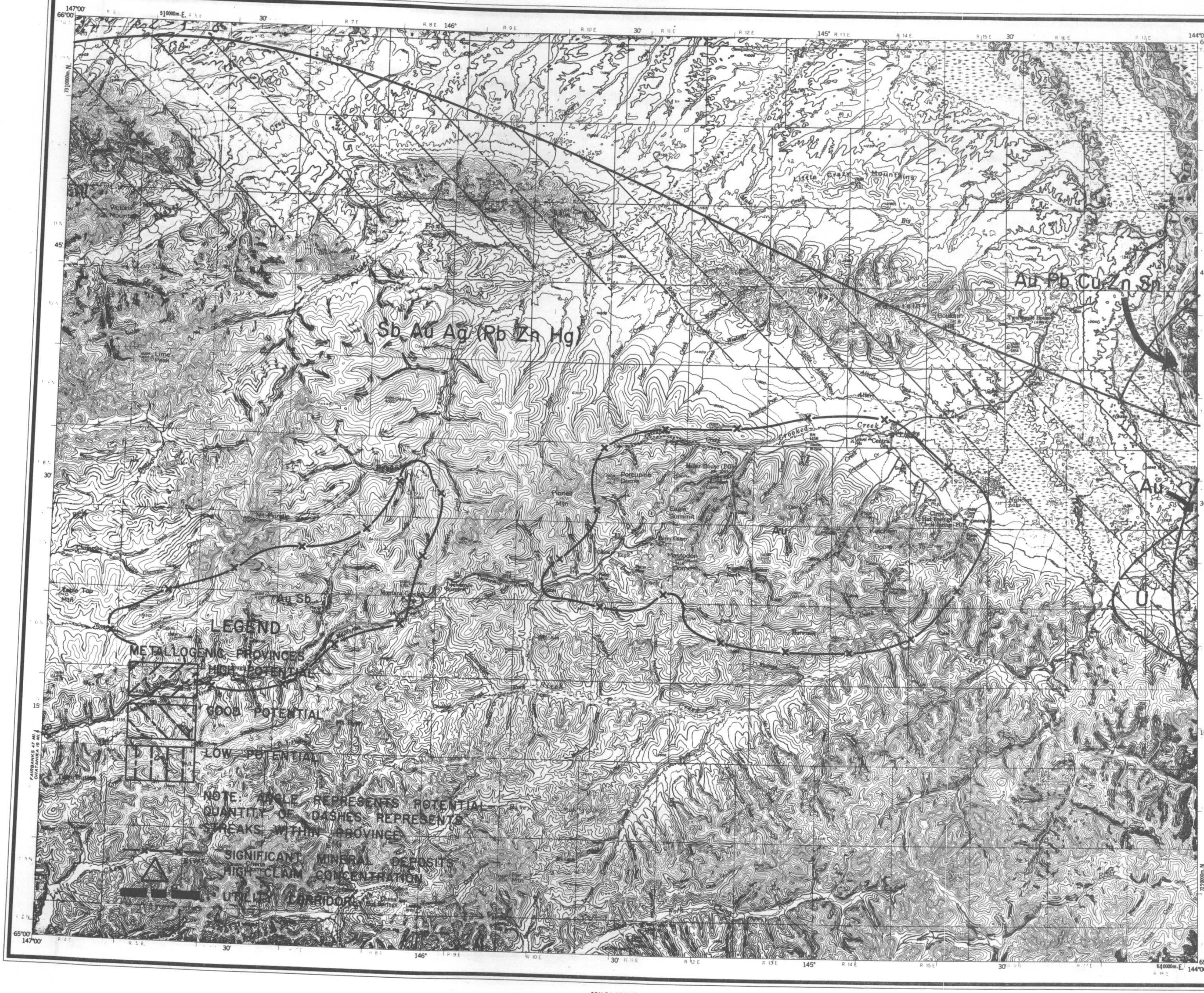
5 0 5 10 15 20 25 MILES

CIRCLE



SCALE 1:250000

5 0 5 10 15 20 25 MILES

QUADRANGLE: Coleen

GEOLOGY: Predominantly sedimentary limestones, dolomites and clastic rocks. Volcanics and intruded granites occur in the eastern area

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: None

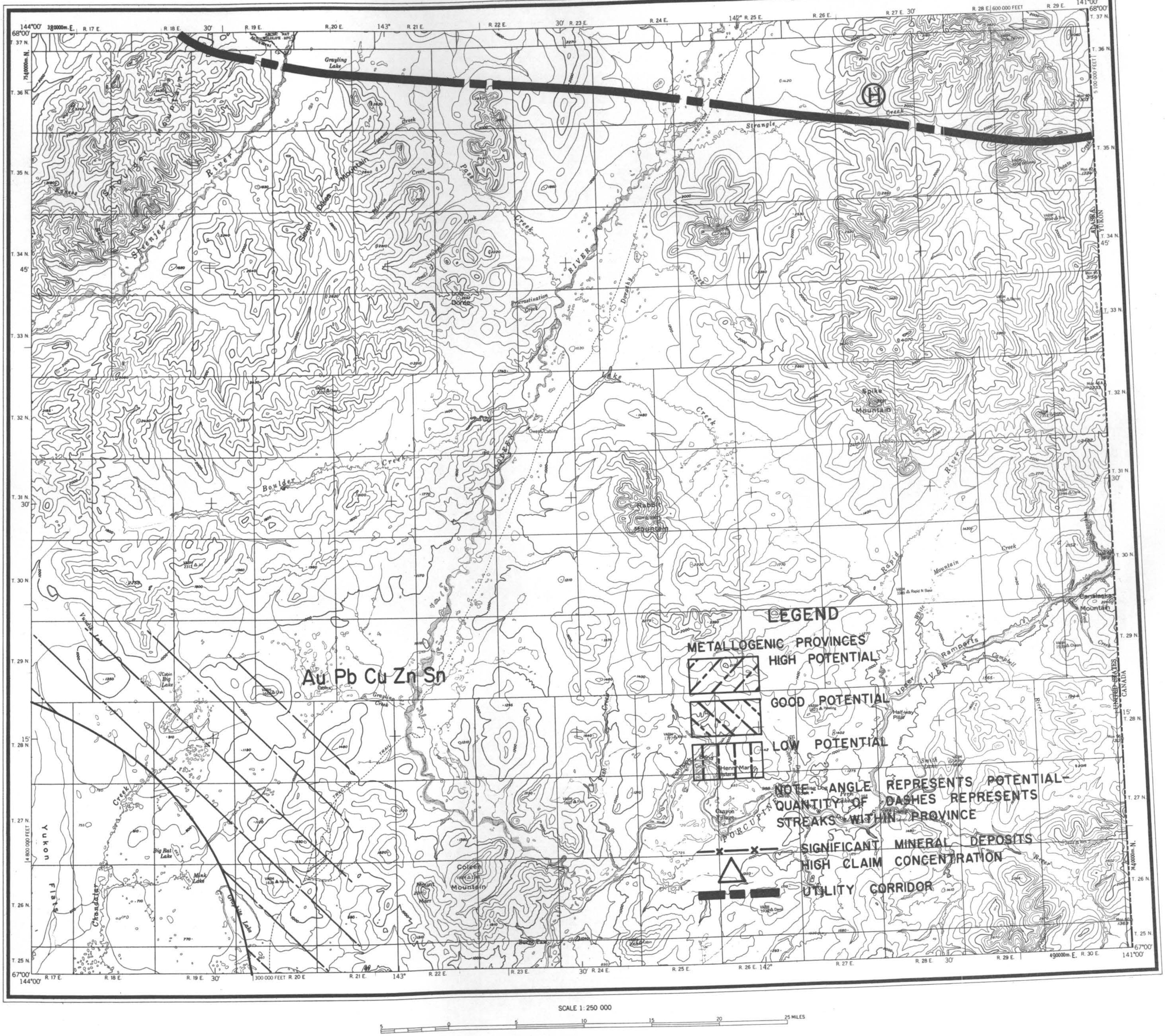
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	None
Coal	None
Minerals	The area has good potential for gold, lead, copper, zinc and tin deposits except for the southwestern corner

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	None
Coal	None
Minerals	Unknown; little exploration to date

COLEEN


LEGEND
METALLOGENIC PROVINCES
HIGH POTENTIAL
GOOD POTENTIAL
LOW POTENTIAL
NOTE: ANGLE REPRESENTS POTENTIAL-
QUANTITY OF DASHES REPRESENTS
STREAKS WITHIN PROVINCE
SIGNIFICANT MINERAL DEPOSITS
HIGH CLAIM CONCENTRATION
UTILITY CORRIDOR
Au Pb Cu Zn Sn
Coleen Mountain
Rabbit Mountain
Spike Mountain
Grayling Lake
Strangle
Sheenjek
Yukon Flats
Porcupine
UNITED STATES
CANADA
144°00'
141°00'
68°00'
67°00'
SCALE 1:250 000

QUADRANGLE: Cordova

GEOLOGY: Predominantly sedimentary rocks such as sandstones and shales with scattered granitic intrusives

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $7,933,300 - copper, lode gold, lode silver, petroleum, coal

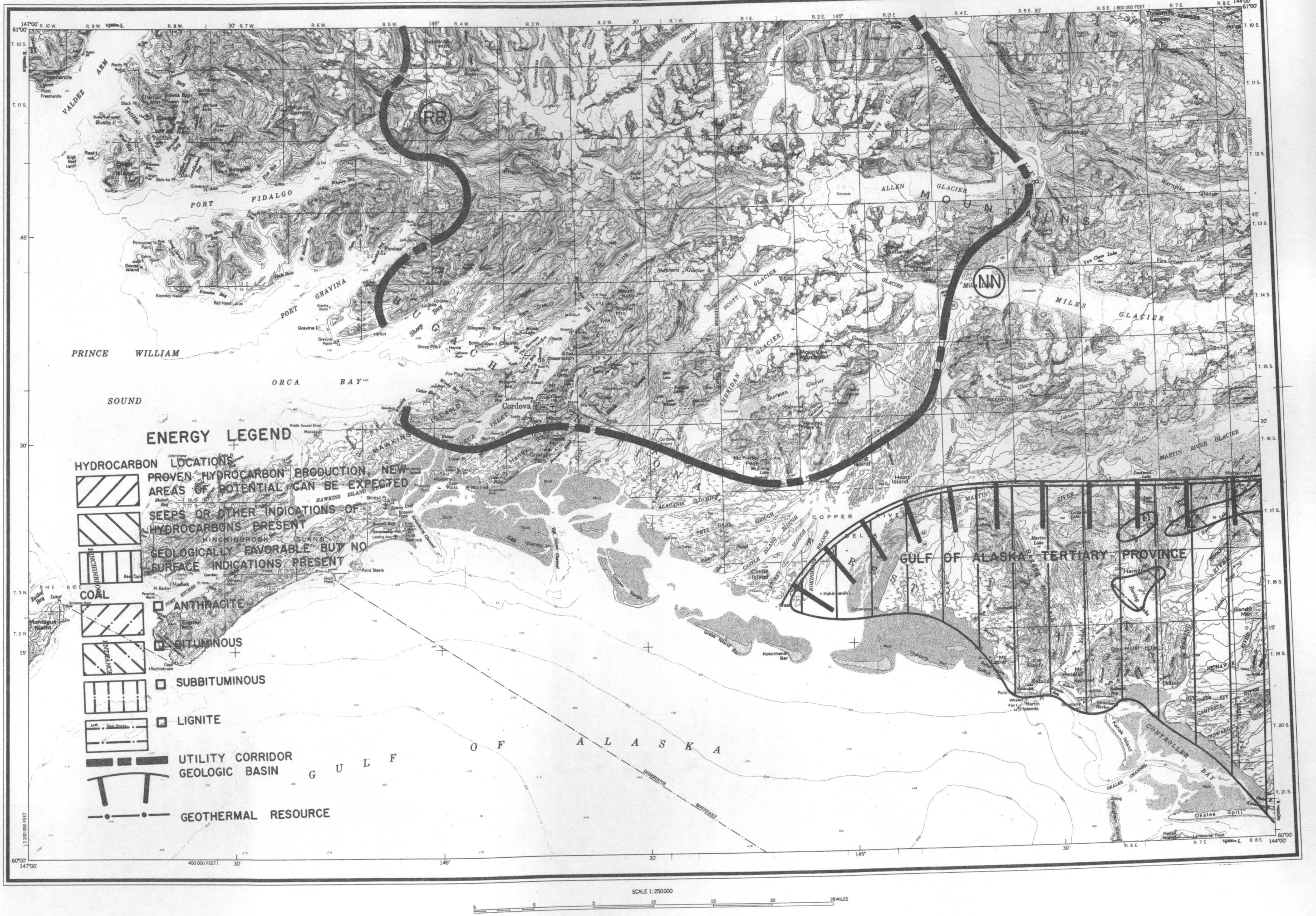
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The southeastern quarter is part of the Gulf of Alaska Tertiary Province and is geologically favorable for oil and gas, although no surface indications exist
Coal	Anthracite and bituminous coals exist in the southeastern corner
Minerals	With the exceptions of the northeastern quarter and eastern border, the quadrangle has a high potential for copper and gold

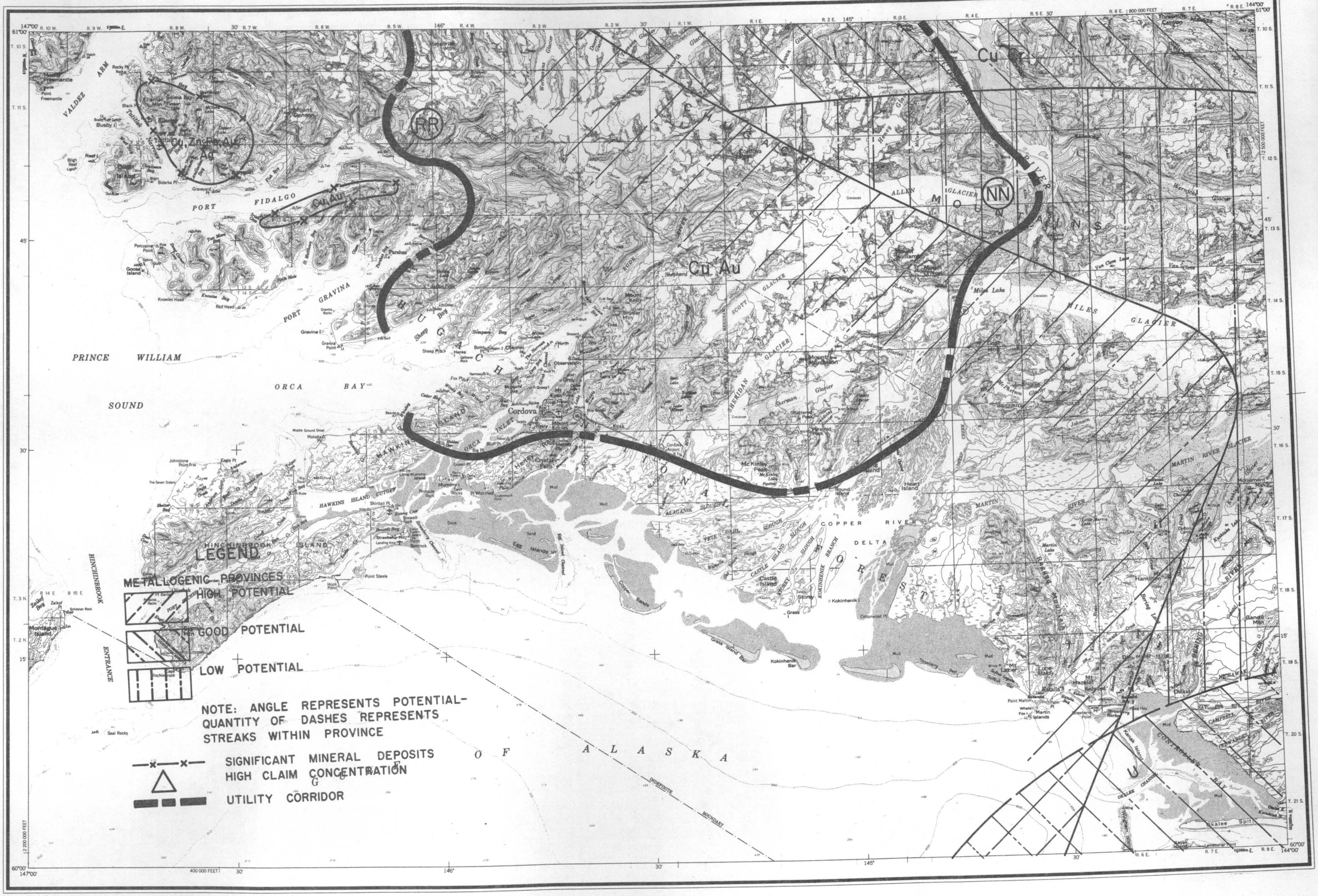
POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	The potential for offshore development is high
Coal	The potential for medium or large deposits being developed is low
Minerals	The potential for small copper and gold deposits is fair

CORDOVA


ENERGY LEGEND
HYDROCARBON LOCATIONS
PROVEN HYDROCARBON PRODUCTION, NEW AREAS OF POTENTIAL CAN BE EXPECTED
SEEPS OR OTHER INDICATIONS OF HYDROCARBONS PRESENT
GEOLOGICALLY FAVORABLE BUT NO SURFACE INDICATIONS PRESENT
COAL
ANTHRACITE
BITUMINOUS
SUBBITUMINOUS
LIGNITE
UTILITY CORRIDOR
GEOLOGIC BASIN
GEOTHERMAL RESOURCE
GULF OF ALASKA TERTIARY PROVINCE
RR
NN
PRINCE WILLIAM SOUND
ORCA BAY
PORT FIDALGO
PORT GRAVINA
VALDEZ ARM
CHUGACH MOUNTAINS
ALLEN GLACIER
MILES GLACIER
SCOTT GLACIER
SHERIDAN GLACIER
MARTIN RIVER GLACIER
COPPER RIVER
CONTROLLER BAY
HAWKINS ISLAND
HINCHINBROOK ISLAND
Cordova
Okalee Spit
GULF OF ALASKA
INDEFINITE BOUNDARY
SCALE 1:250 000
25 MILES

CORDOVA



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0 5 10 15 20 25 MILES

QUADRANGLE: Demarcation Point

GEOLOGY: The northern third consists of nonmarine sediments overlain by alluvium and beach and terrace deposits. The southern two-thirds are marine deposits such as limestones, shales, and dolomites. A belt of mafic intrusives trends east-west through the central part of the quadrangle

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: None

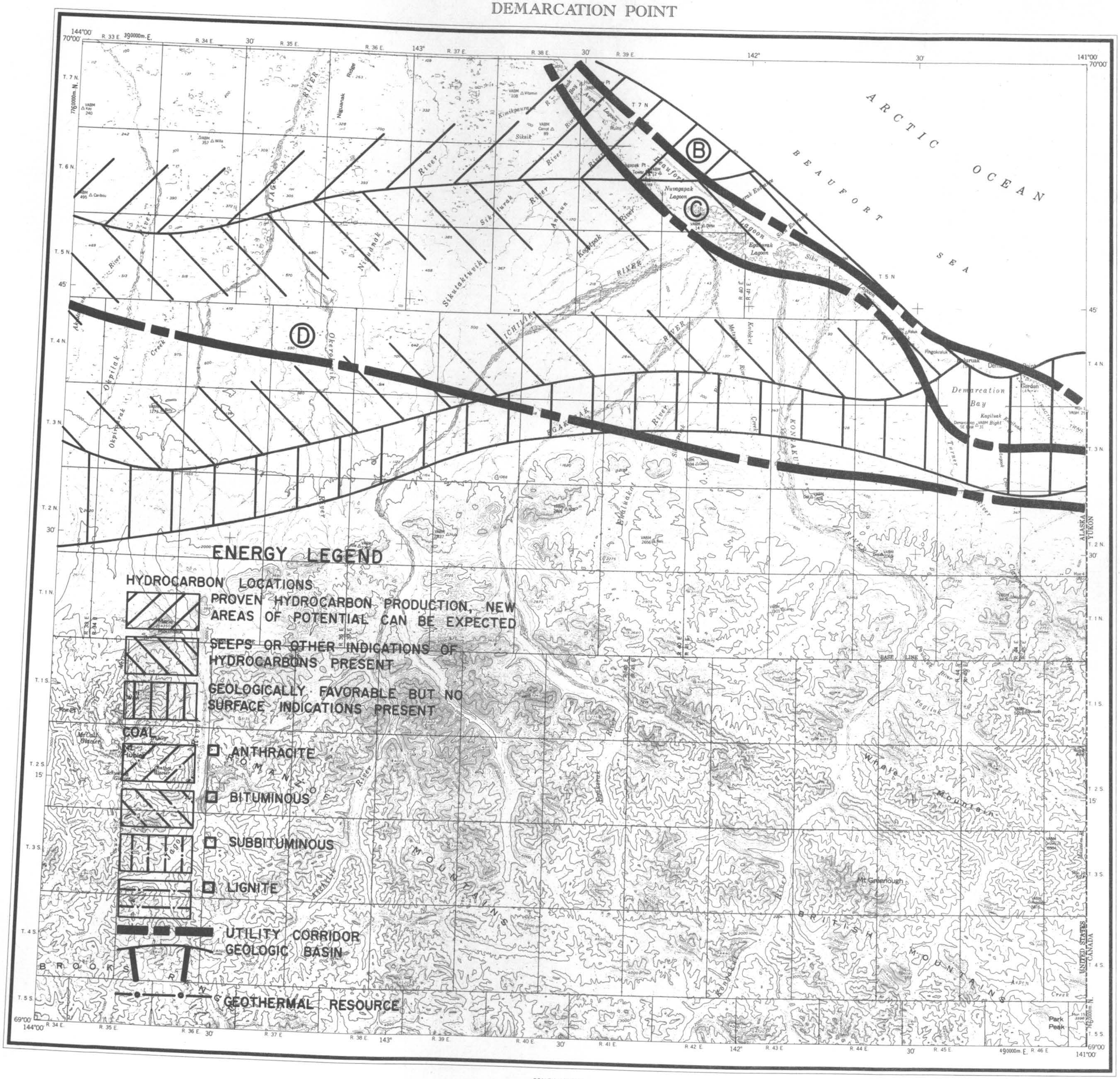
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	Land in the northern half grades from high potential to low potential going away from the coast
Coal	No surface occurrences known; may occur in areas with oil and gas
Minerals	The southern two-thirds is geologically favorable for occurrence of tin, tungsten, fluoride, gold, lead, copper and zinc deposits

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	The area in the northern half has good potential but it has been largely unexplored
Coal	Unknown; little exploration to date
Minerals	Unknown; little exploration to date

DEMARCATION POINT



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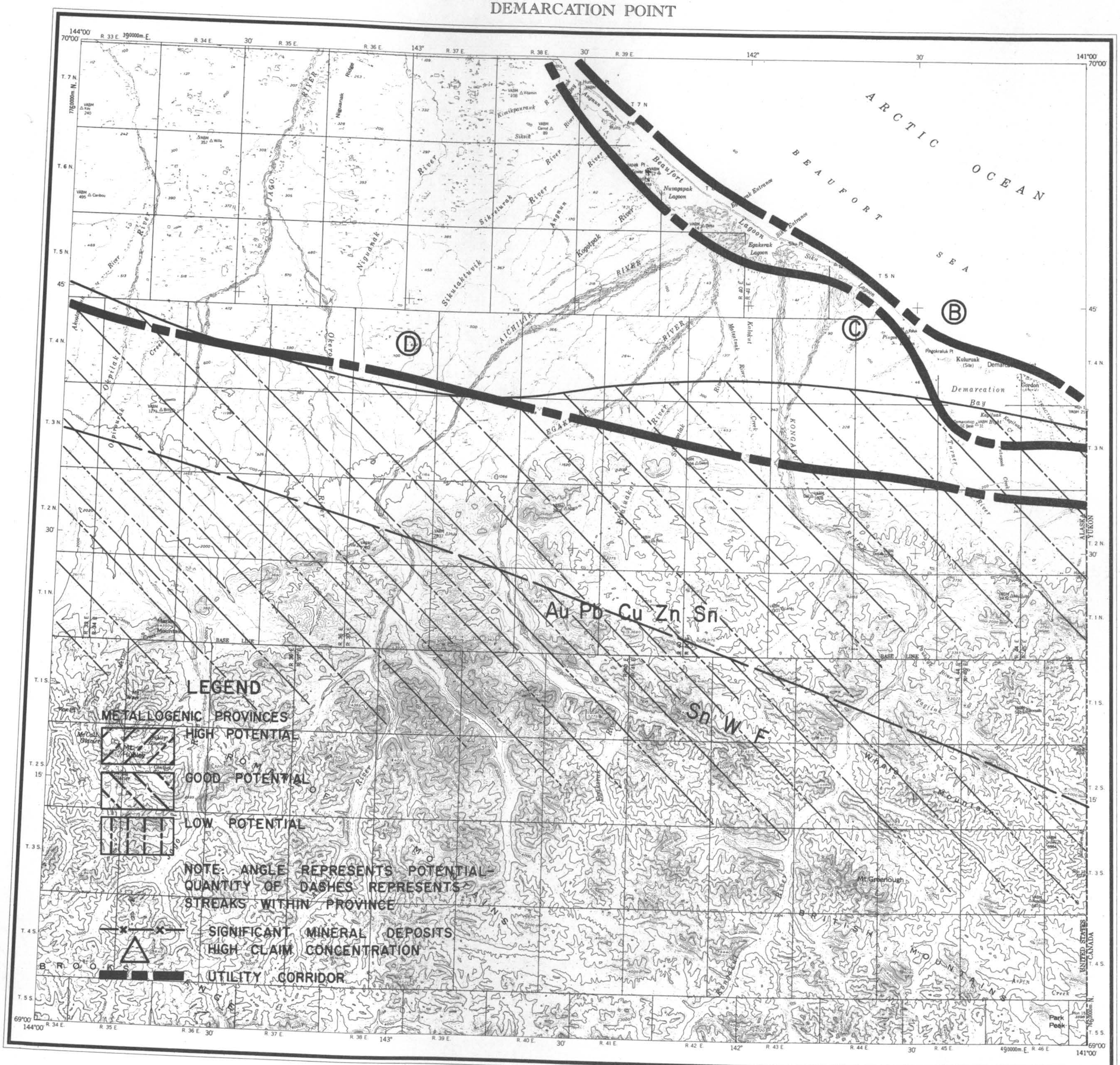
DEMARCATION POINT



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QUADRANGLE: Eagle

GEOLOGY: Predominantly metamorphic rocks with mostly granitic intrusives plus some ultramafic intrusives. The northeastern quarter consists of sedimentary limestones and dolomites

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $14,210,400 - placer gold, placer silver

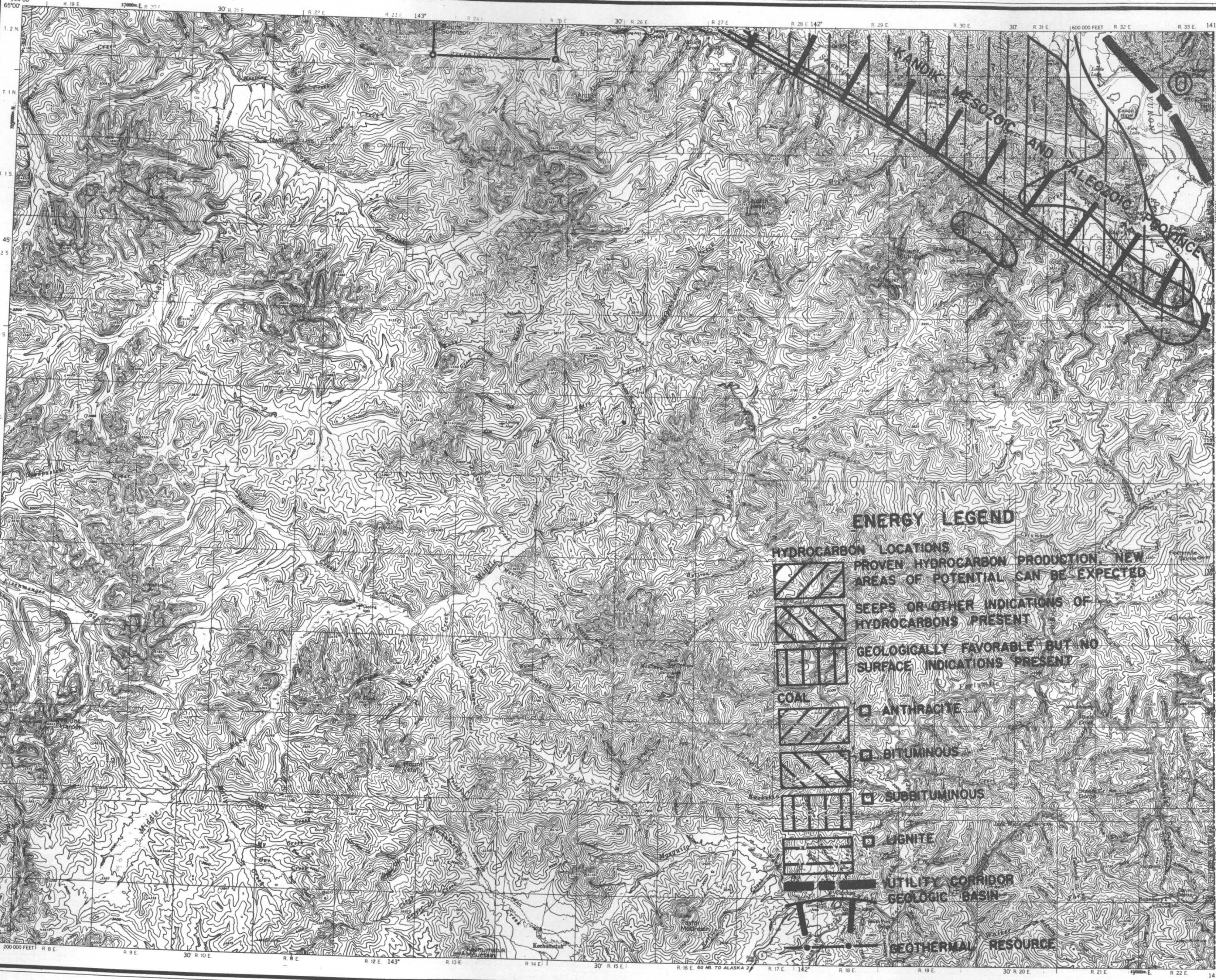
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The northeastern quarter is part of the Kandik Mesozoic and Paleozoic Province and it geologically is favorable for oil and gas although no surface indications are present
Coal	Subbituminous coal occurs along the southern border
Minerals	The western third has good potential for antimony, gold, silver, lead, zinc and mercury. The eastern two-thirds has a high potential for gold. The northeastern quarter has a good potential for uranium. Much of the eastern half has been an important gold placer producing area

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	The potential for a large-scale coal mine is low
Minerals	The potential for small, medium and large placer gold producers is high. The potential for a medium-size asbestos deposit in the ultramafic rocks is rated good. The potential for a large, low-grade copper-nickel or uranium deposit is rated fair

EAGLE



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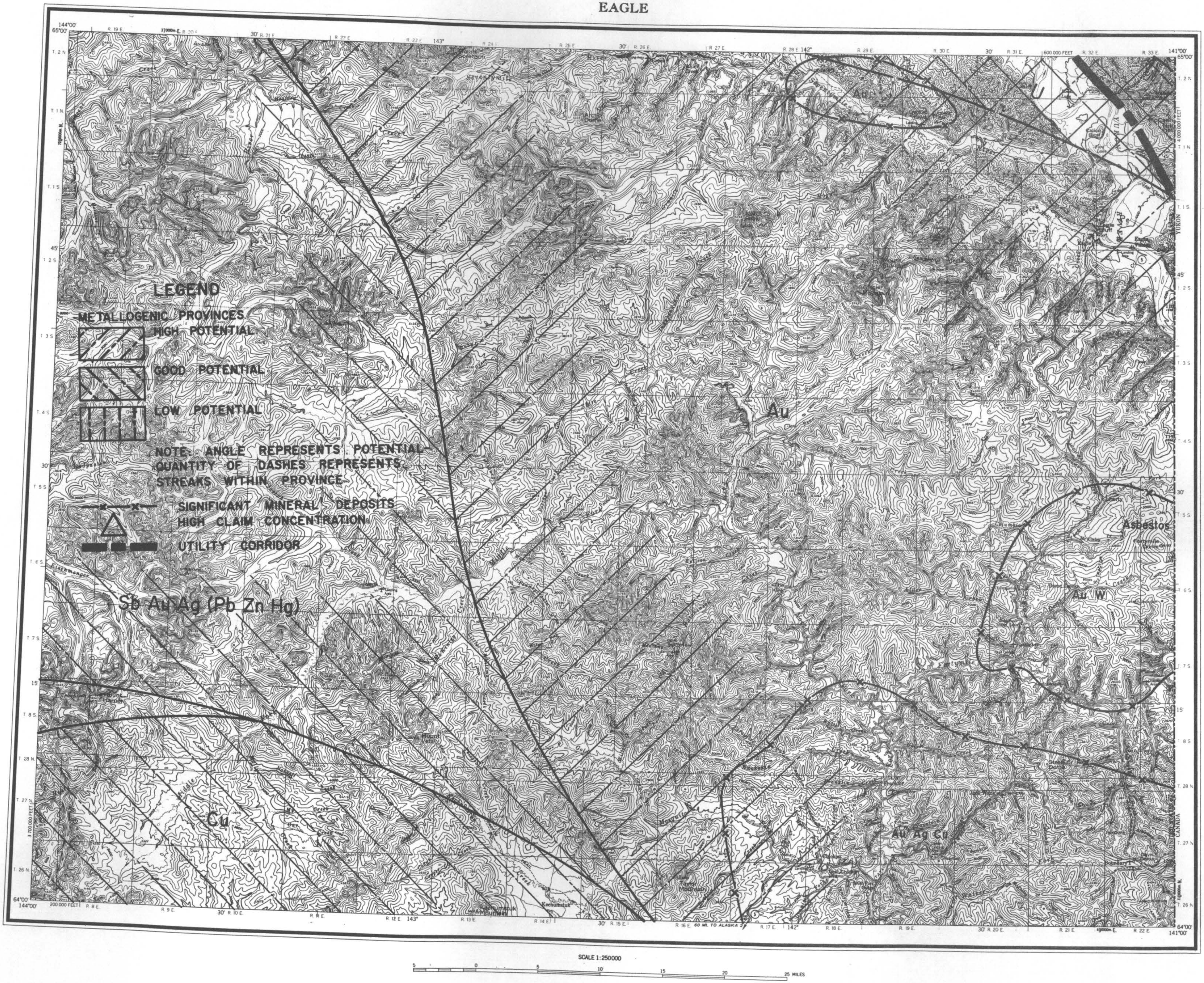

LEGEND
METALLOGENIC PROVINCES
HIGH POTENTIAL
GOOD POTENTIAL
LOW POTENTIAL
NOTE: ANGLE REPRESENTS POTENTIAL
QUANTITY OF DASHES REPRESENTS
STREAKS WITHIN PROVINCE
SIGNIFICANT MINERAL DEPOSITS
HIGH CLAIM CONCENTRATION
UTILITY CORRIDOR
Au
Au
Asbestos
Au W
Sb Au Ag (Pb Zn Hg)
Cu
Au Ag Cu
YUKON
CANADA
SCALE 1:250000
25 MILES

QUADRANGLE: Fairbanks

GEOLOGY: The northern half consists predominantly of metamorphic rocks partially obscured by stream alluvium. The southern half of the area consists of mostly sedimentary rocks partially overlain by alluvium. The southern border lies within a metamorphic rock zone

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $170,653,400 - placer gold, placer silver, lode gold, tungsten, lode silver

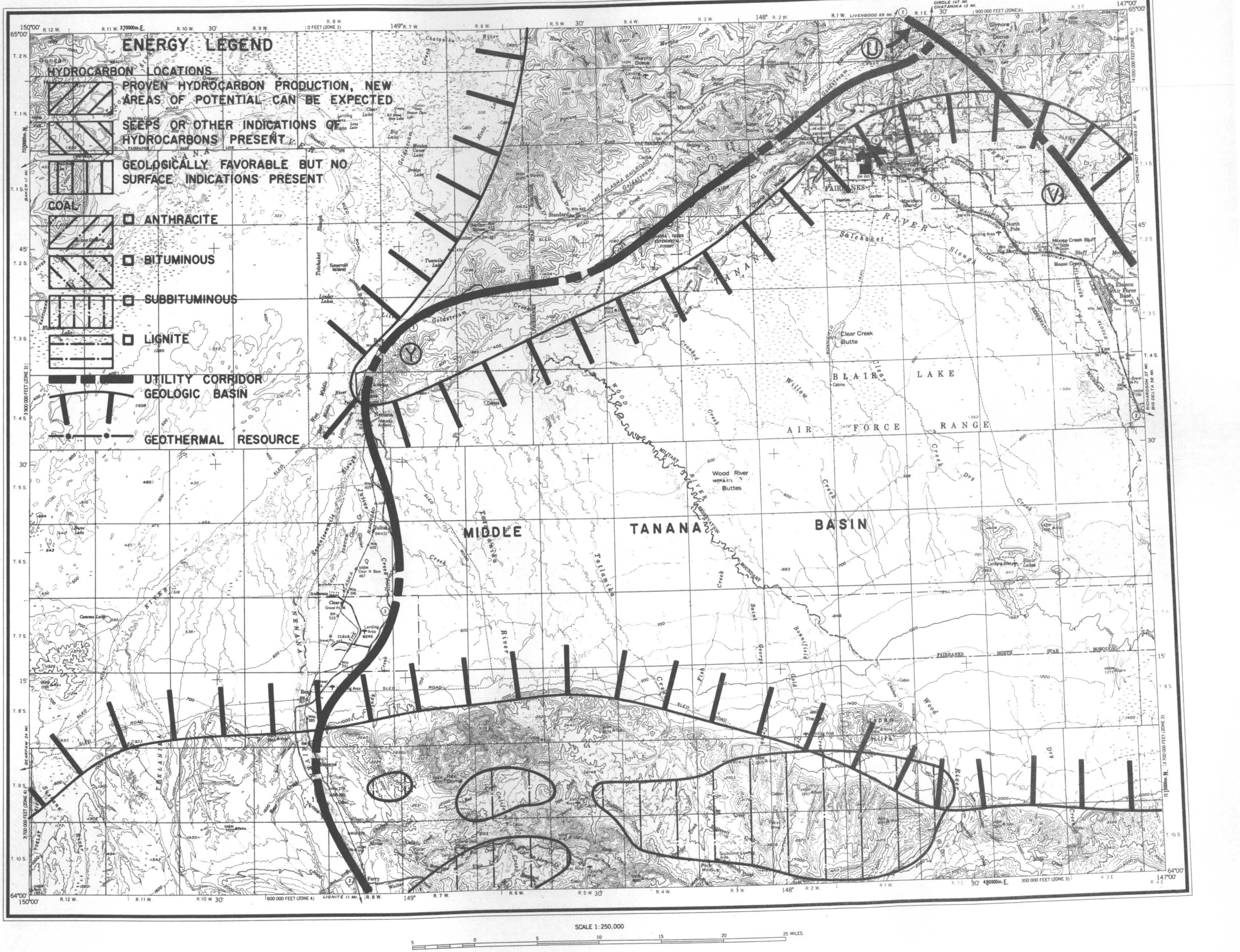
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	Much of the area lies within the Middle Tanana Basin and may have oil and gas potential
Coal	Subbituminous coal occurs in several areas in the southern quarter of the area
Minerals	The northeastern quarter has good potential for antimony, gold, silver, lead, zinc and mercury. The southern half has good potential for uranium. In addition, the southern quarter has high potential for copper, gold, lead and zinc. The northeastern quarter has been an important placer gold producer

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	No known production potential established to date
Coal	No known production potential
Minerals	The potential for small, medium and large placer gold deposits is high. The potential for small and medium-size gold deposits in the metamorphic rocks is good as is the potential for small gold-antimony deposits. Small massive sulfide deposits containing gold, silver and copper deposits in metamorphic rocks have good potential for occurring

FAIRBANKS


ENERGY LEGEND
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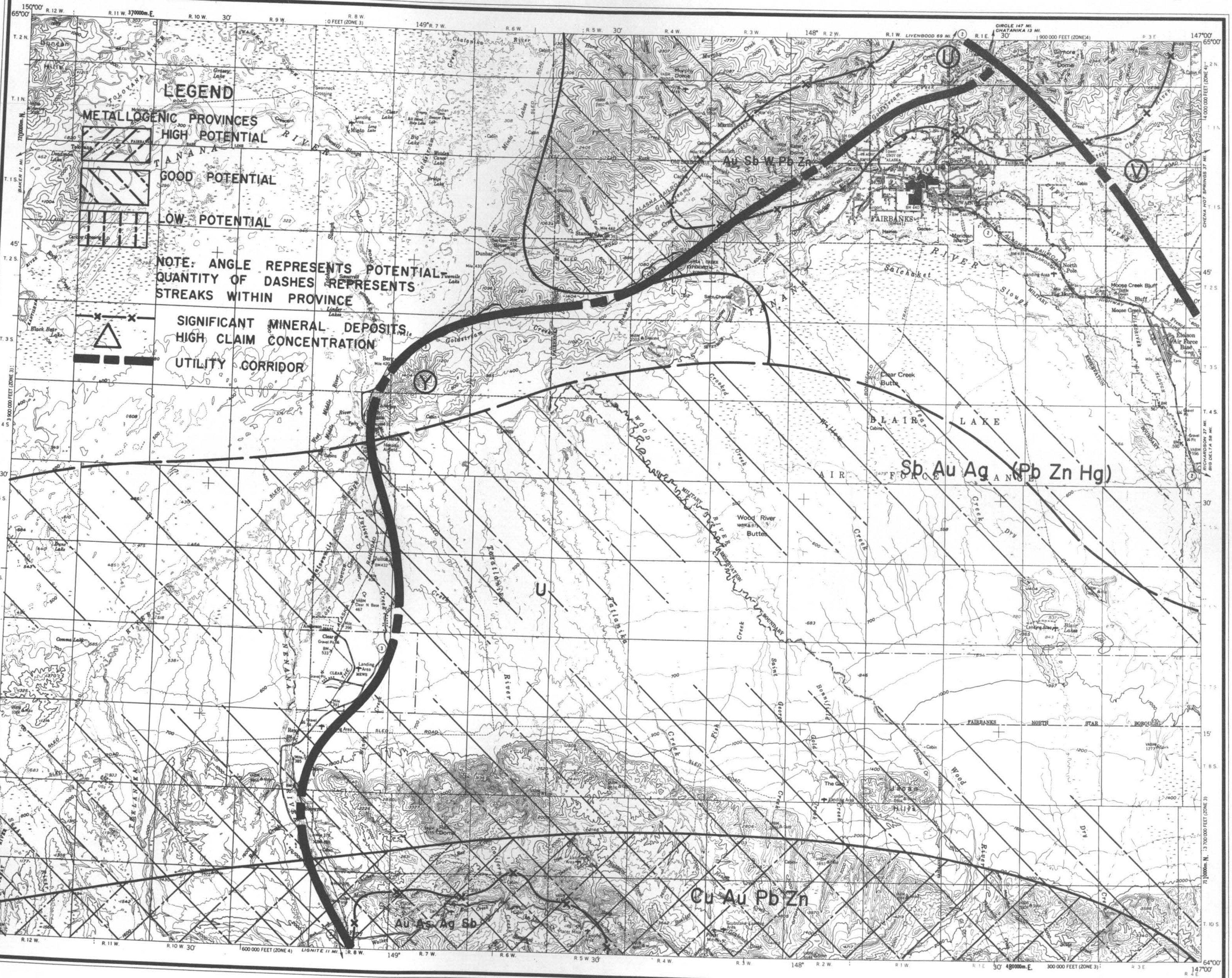
COAL
ANTHRACITE
BITUMINOUS
SUBBITUMINOUS
LIGNITE
UTILITY CORRIDOR
GEOLOGIC BASIN
GEOTHERMAL RESOURCE
MIDDLE TANANA BASIN
BLAIR LAKE
AIR FORCE RANGE
FAIRBANKS
Clear Creek Butte
Wood River Buttes
SCALE 1:250,000
25 MILES

FAIRBANKS



SCALE 1:250,000

5 0 5 10 15 20 25 MILES

QUADRANGLE: Flaxman Island

GEOLOGY: Marine and nonmarine sediments overlain by alluvium and beach deposits

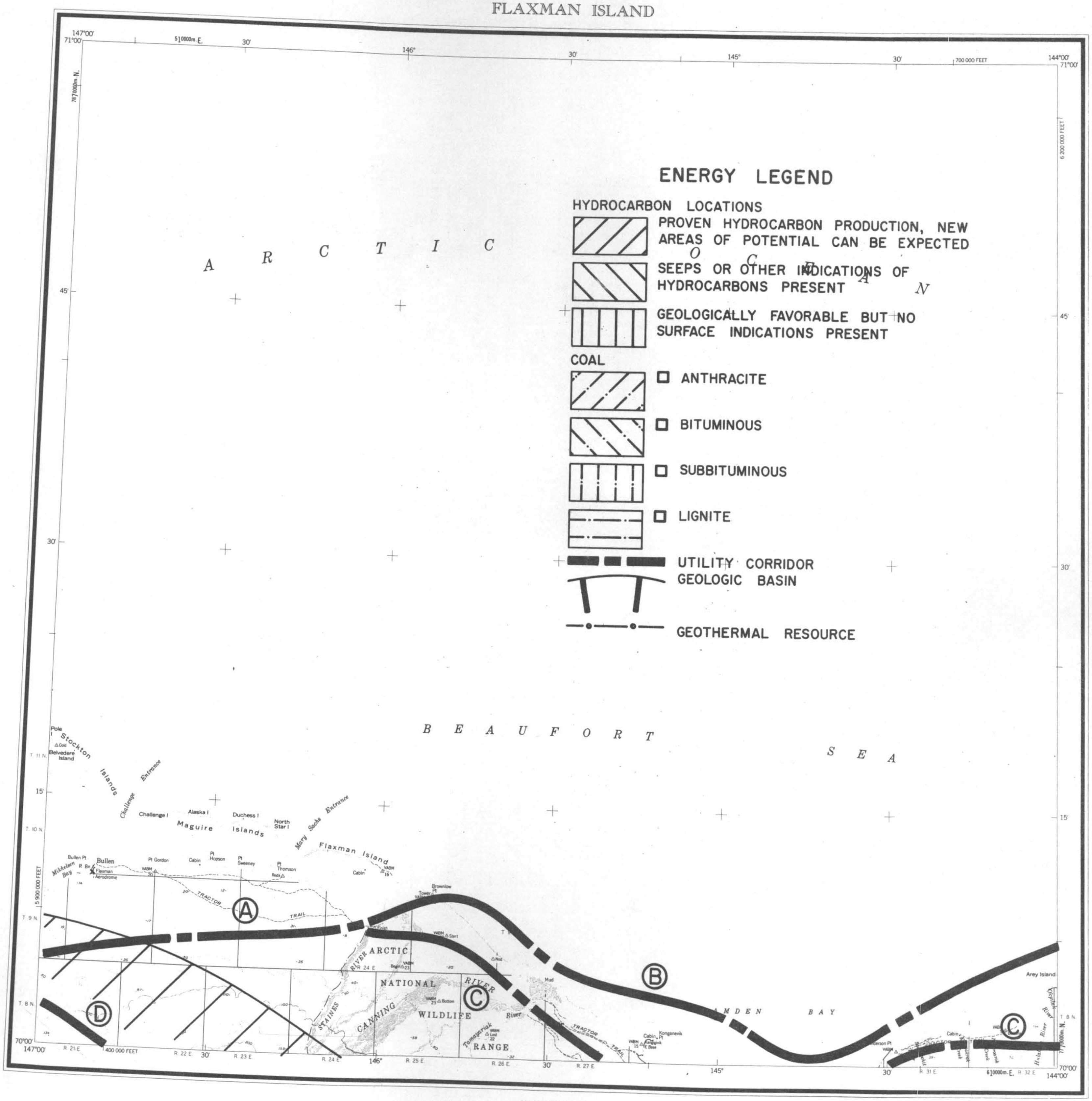
MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: None

MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The land area has proven production or is an area of high potential
Coal	No surface occurrences known; may occur in areas with oil and gas
Minerals	None

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	The potential for finding and developing additional hydrocarbons, especially gas, is high
Coal	Unknown; little exploration to date
Minerals	None



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QUADRANGLE: Ft. Yukon

GEOLOGY: Alluvium and glaciofluvial deposits overlay sedimentary rocks

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: None

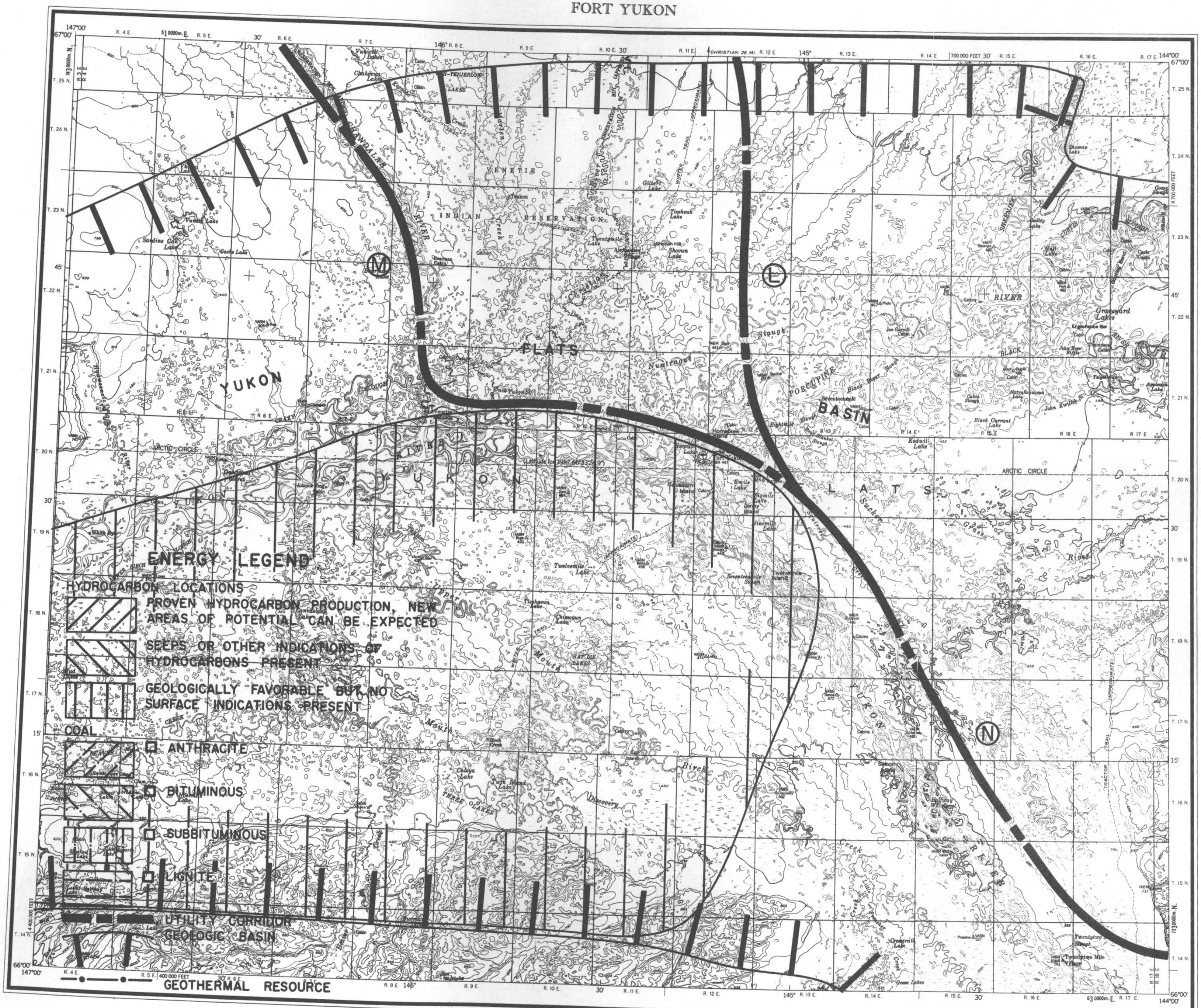
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The entire area lies within the Yukon Flats Basin and may have hydrocarbon potential. Much of the southern half is geologically favorable for oil and gas but no surface indications are present
Coal	No surface exposures known; may occur in the Yukon Flats Basin
Minerals	None

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	Unknown; little exploration to date
Minerals	None

FORT YUKON



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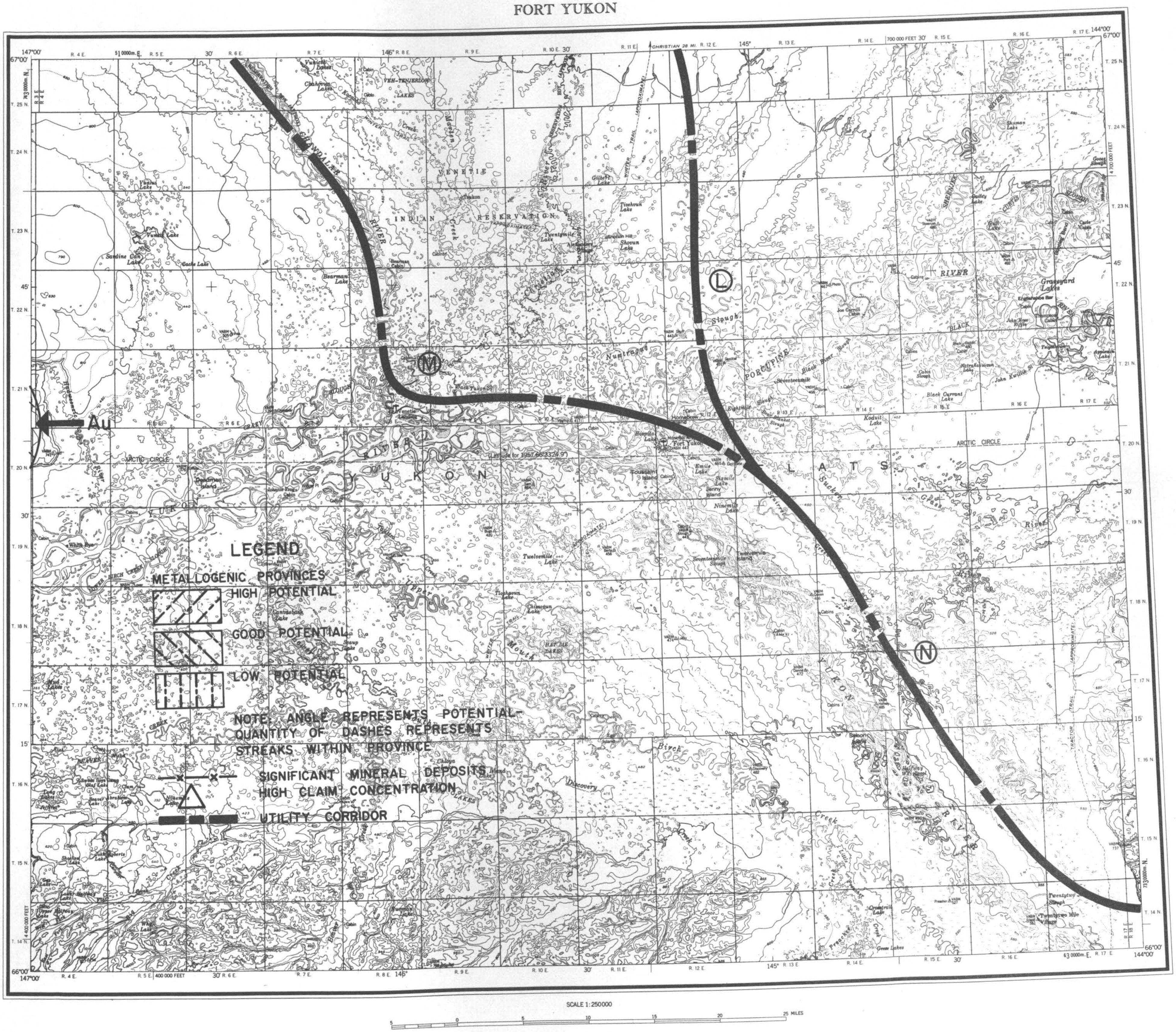
FORT YUKON


LEGEND
METALLOGENIC PROVINCES
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NOTE: ANGLE REPRESENTS POTENTIAL
QUANTITY OF DASHES REPRESENTS
STREAKS WITHIN PROVINCE
SIGNIFICANT MINERAL DEPOSITS
HIGH CLAIM CONCENTRATION
UTILITY CORRIDOR
Au
L
M
N
YUKON
FLATS
ARCTIC CIRCLE
Fort Yukon
PORCUPINE
SCALE 1:250000
25 MILES

QUADRANGLE: Gulkana

GEOLOGY: The central and southcentral area is overlain by alluvium and terrace deposits while the western, northern, and eastern borders consist predominantly of volcanic rocks. Mafic intrusives occur in the northeastern corner

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $13,000 - placer gold, placer silver

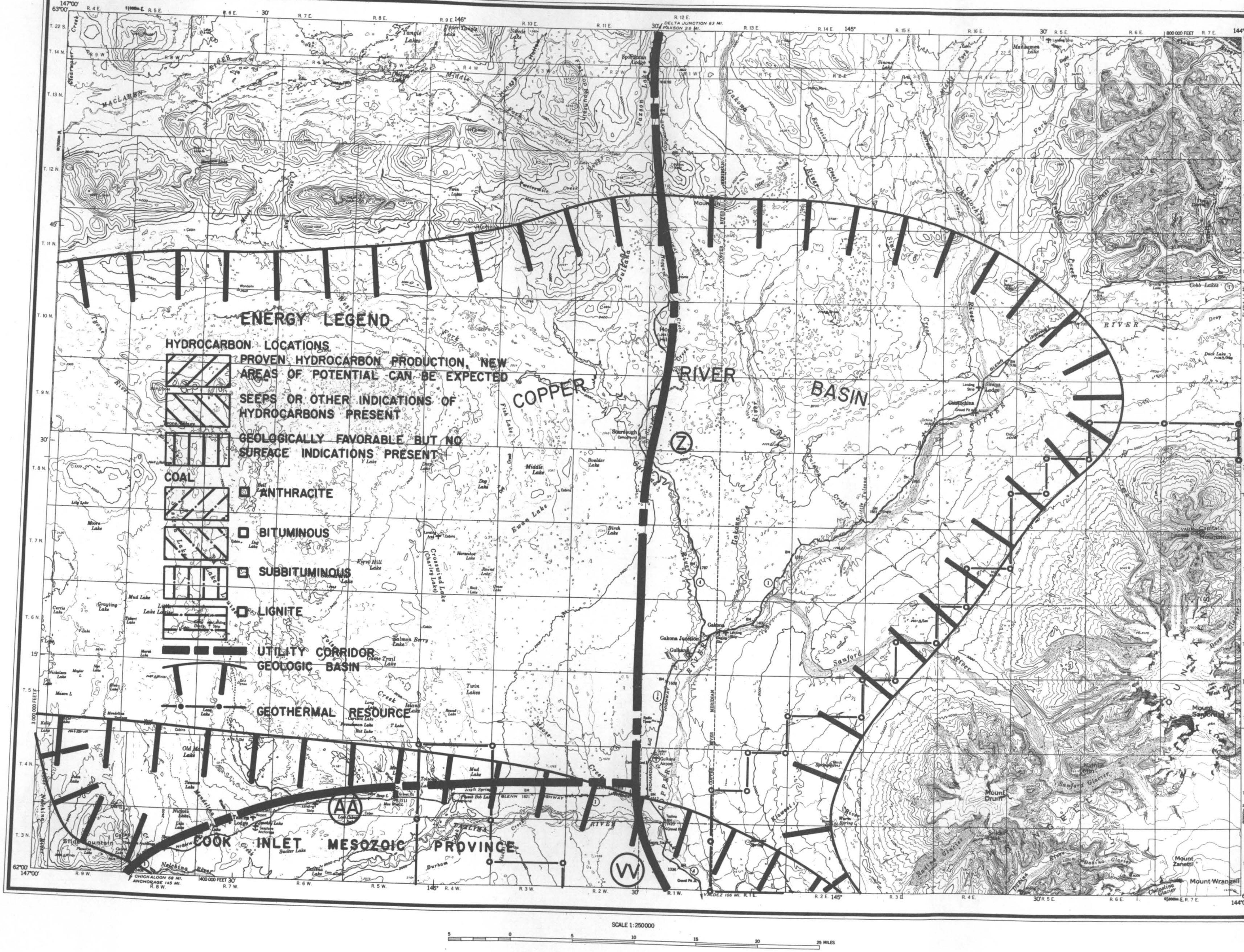
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	All of the quadrangle is within the Copper River Basin except the northern and eastern borders, hence oil and gas may have some potential
Coal	No surface exposures known; may occur in the Copper River Basin
Minerals	The northwestern corner has good potential for copper, gold, silver, lead and zinc; and the northeastern corner has high potential for copper and molybdenum

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	Unknown; little exploration to date
Minerals	The potential for large, low-grade copper-molybdenum deposits is fair

GULKANA



ENERGY LEGEND
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GEOLOGICALLY FAVORABLE BUT NO SURFACE INDICATIONS PRESENT
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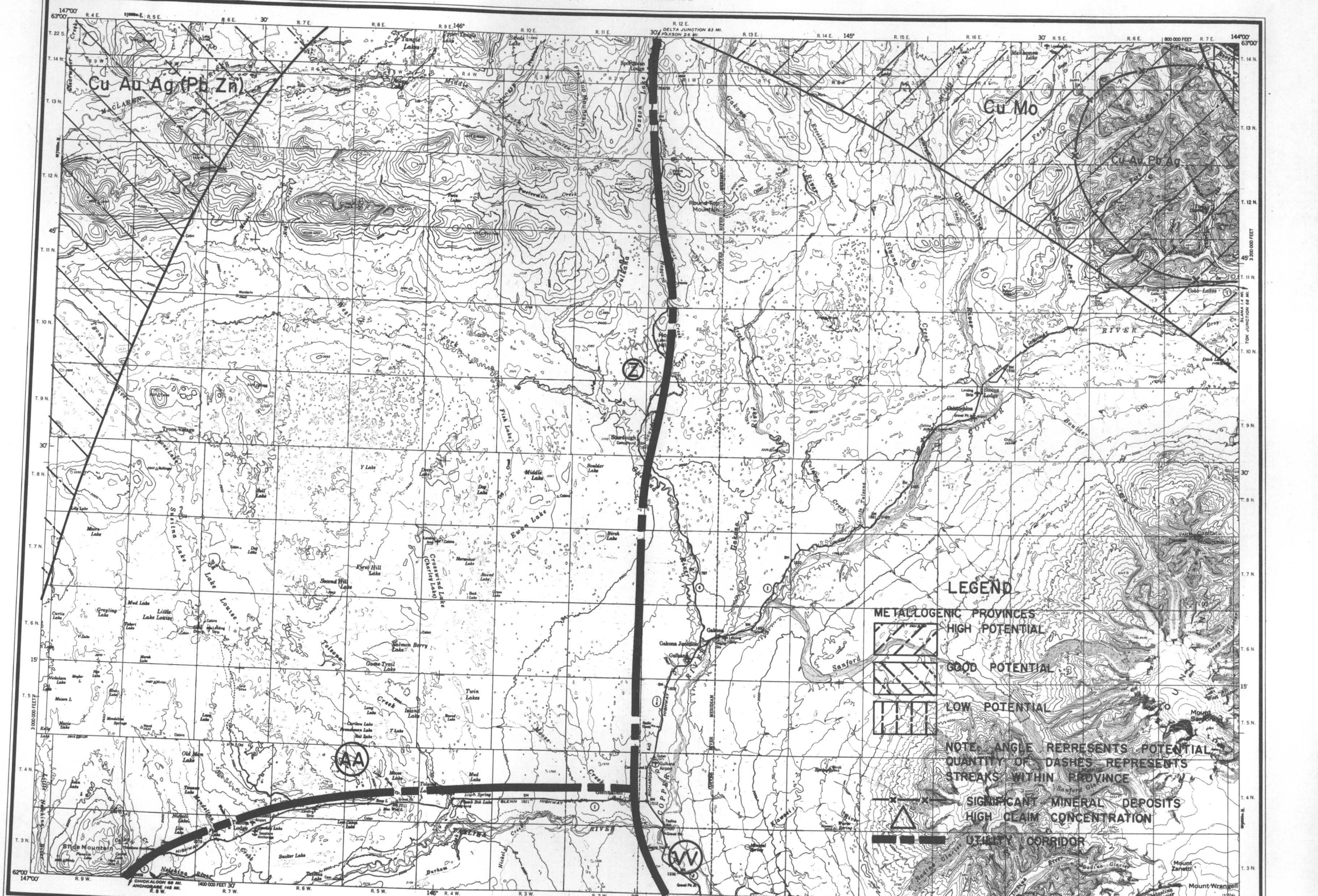
LIGNITE
UTILITY CORRIDOR
GEOLOGIC BASIN
GEOTHERMAL RESOURCE
COPPER RIVER BASIN
COOK INLET MESOZOIC PROVINCE
Z
AA
W
DELTA JUNCTION 83 MI.
PAXSON 2.6 MI.
CHICKALOON 68 MI.
ANCHORAGE 145 MI.
VALDEZ 106 MI.
SLANA 14 MI.
TOK JUNCTION 58 MI.
Gakona Junction
Gulkana
Mount Sanford
Mount Drum
Mount Wrangell
Mount Zanetti
Capital Mountain
Sanford Glacier
Sourdough
Chistochina
SCALE 1:250000
25 MILES

GULKANA



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QUADRANGLE: Healy

GEOLOGY: A complex area of sedimentary, volcanic and metamorphic rocks with granitic intrusives. The northern third consists of metamorphic rocks with local coal basins. The southern third is mostly sedimentary rocks cut by small granitic intrusives. Ultramafic rocks occur near major faults

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $84,044,500 - coal, placer gold, lode gold, copper, lode silver, placer silver, lead

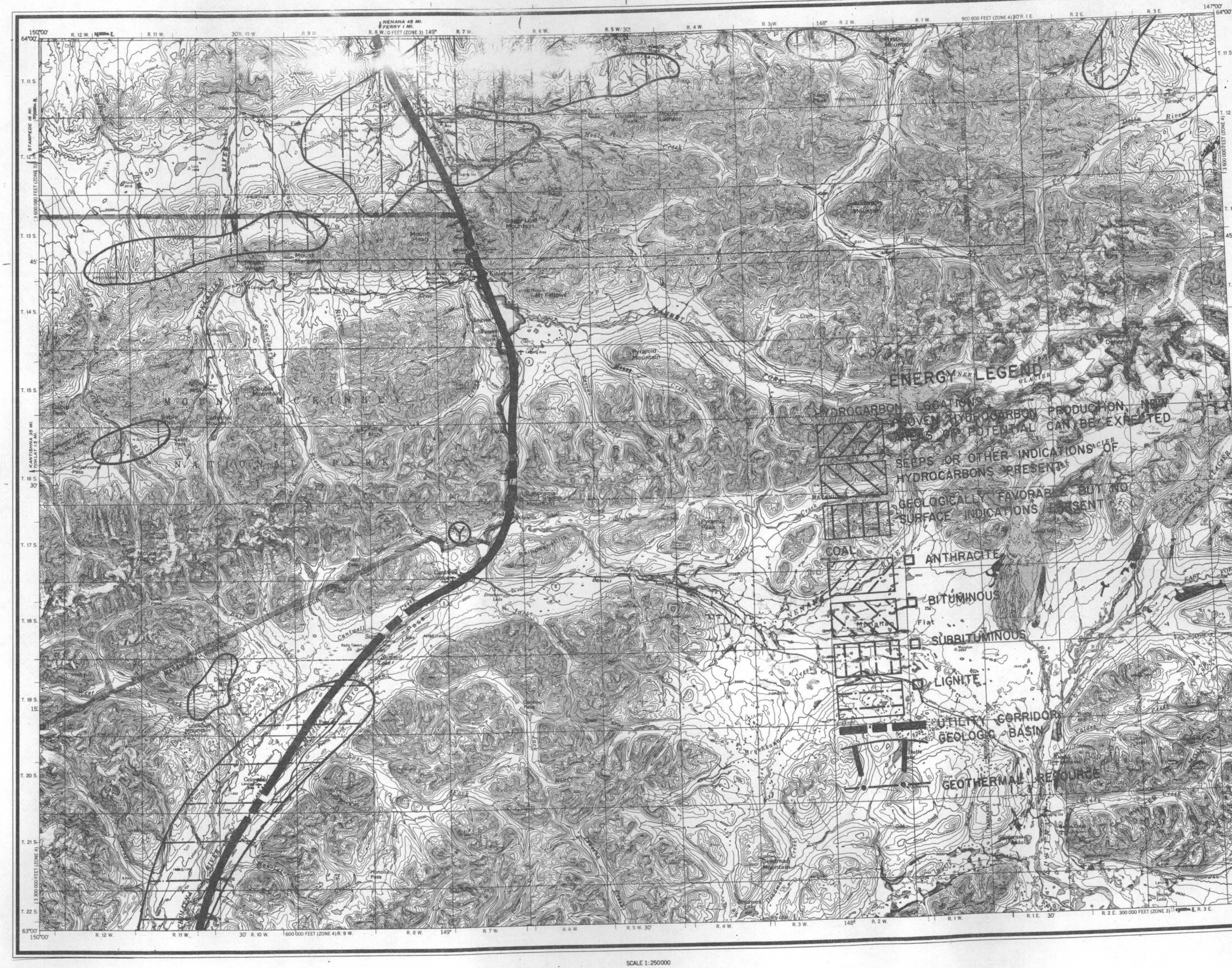
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	None
Coal	Subbituminous coal occurs along the northern and western quarters. Lignite is found in the southwestern corner
Minerals	The northern quarter has good potential for uranium. Most of the quadrangle has a high potential for copper, gold, lead, zinc and molybdenum

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	None
Coal	Approximately 5,547 million tons of low sulfur subbituminous coal exists within the corridor. The potential for large open pit mines is high
Minerals	The potential for medium-size, high-grade gold-silver-copper deposits is good. The potential for large, low-grade copper-molybdenum, gold and uranium deposits is good

HEALY



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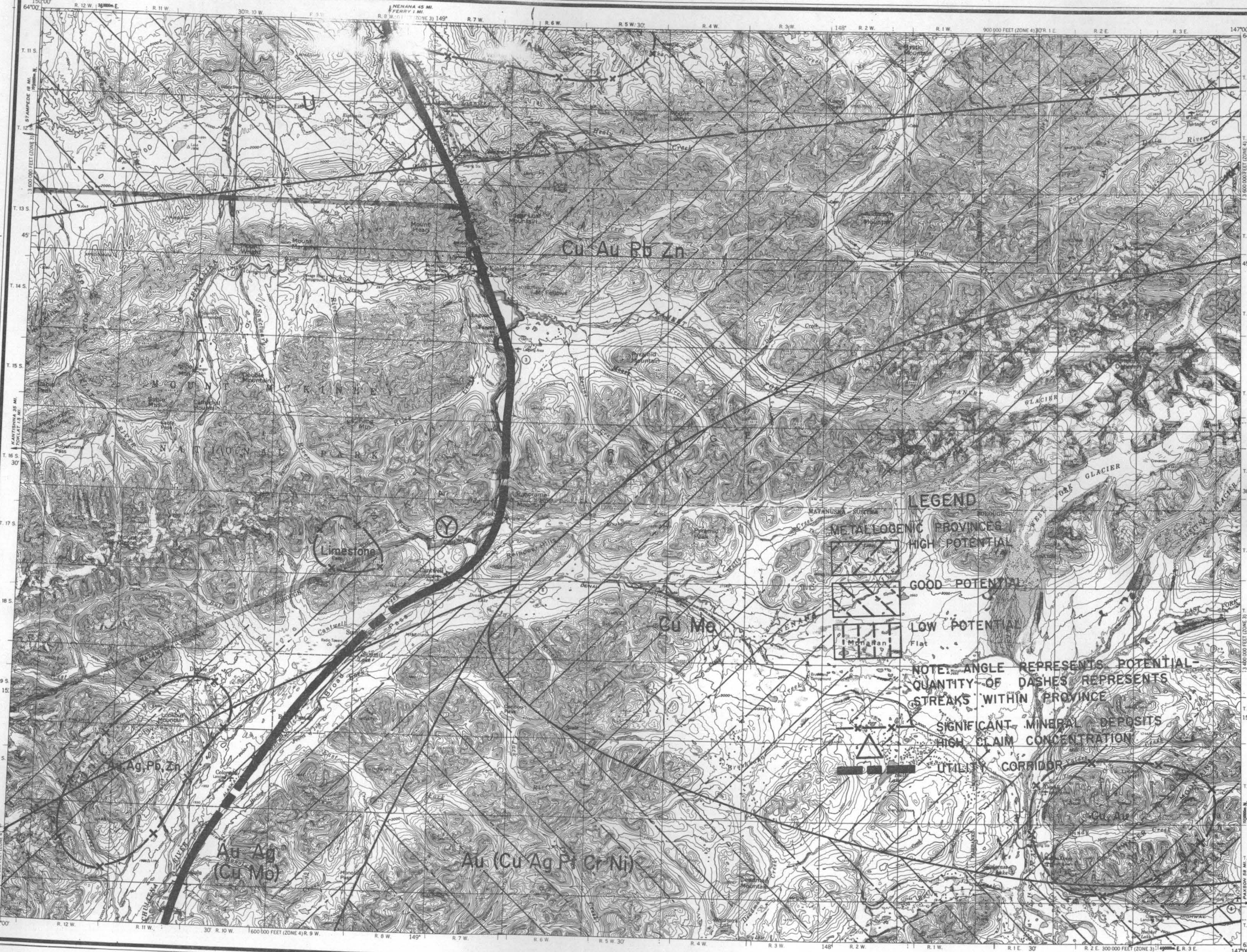
HEALY



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QUADRANGLE: Hughes

GEOLOGY: Predominantly sandstones and shales intruded by granitic rocks in scattered locations. Metamorphic and volcanic rocks occur along the northern border. Alluvium and glaciofluvial deposits cover the bedrock along major drainages. Intrusives and volcanics occur in the southern area

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: Concealed (large) - placer gold, placer silver

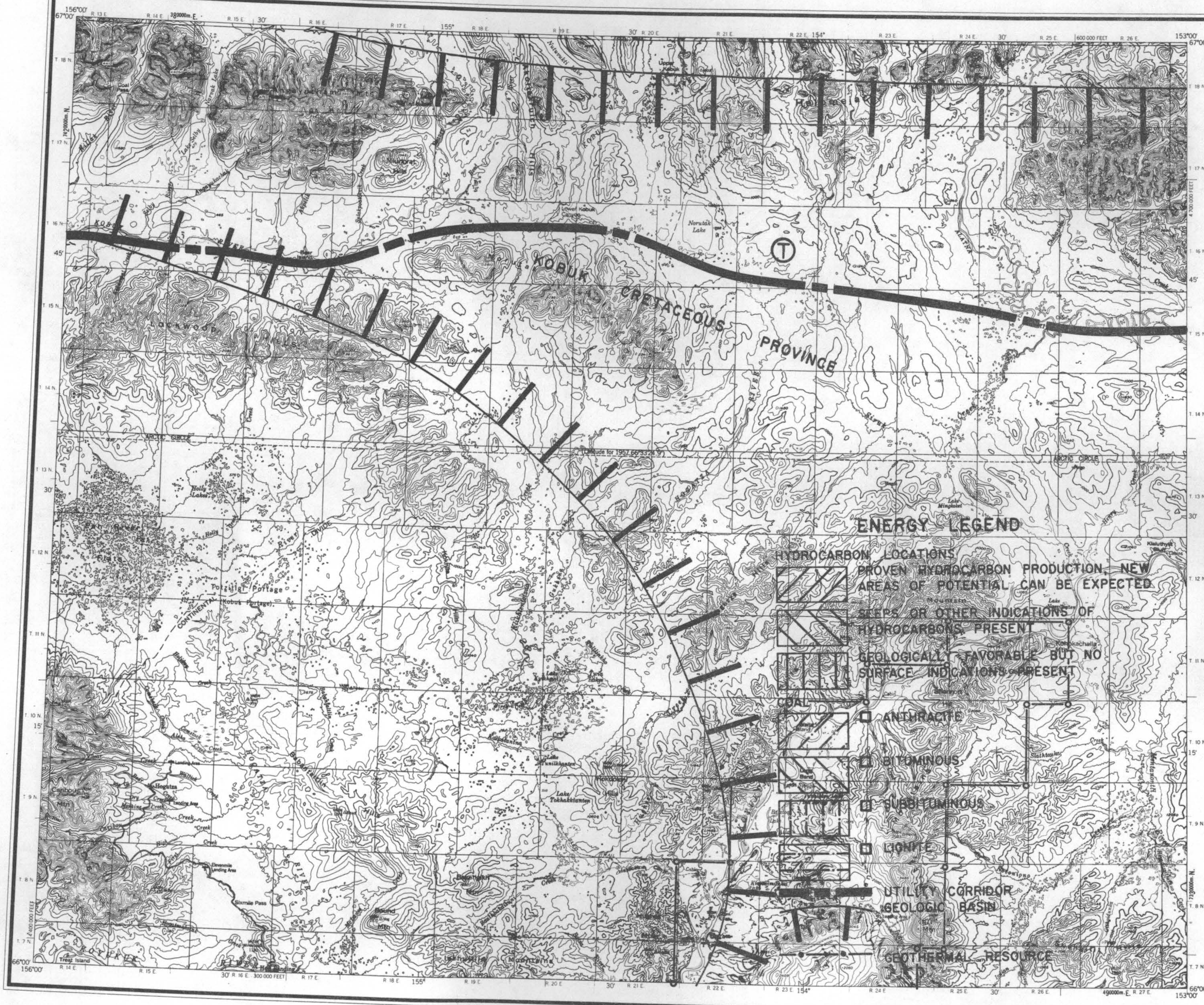
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The Kobuk Cretaceous Province includes all but the southwestern third, thus oil and gas have some potential
Coal	No surface occurrences known; may occur in the Kobuk Cretaceous Province
Minerals	Most of the area has good potential for gold, lead, silver, tungsten and mercury deposits. Tin and fluorite also have a good potential in the central third. The potential for placer gold is high in the southern quarter and there is a good potential for uranium and thorium there, too

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	Unknown; little exploration to date
Minerals	The potential for continued placer gold mining is high. The potential is considered low for small-size lead-zinc deposits

HUGHES



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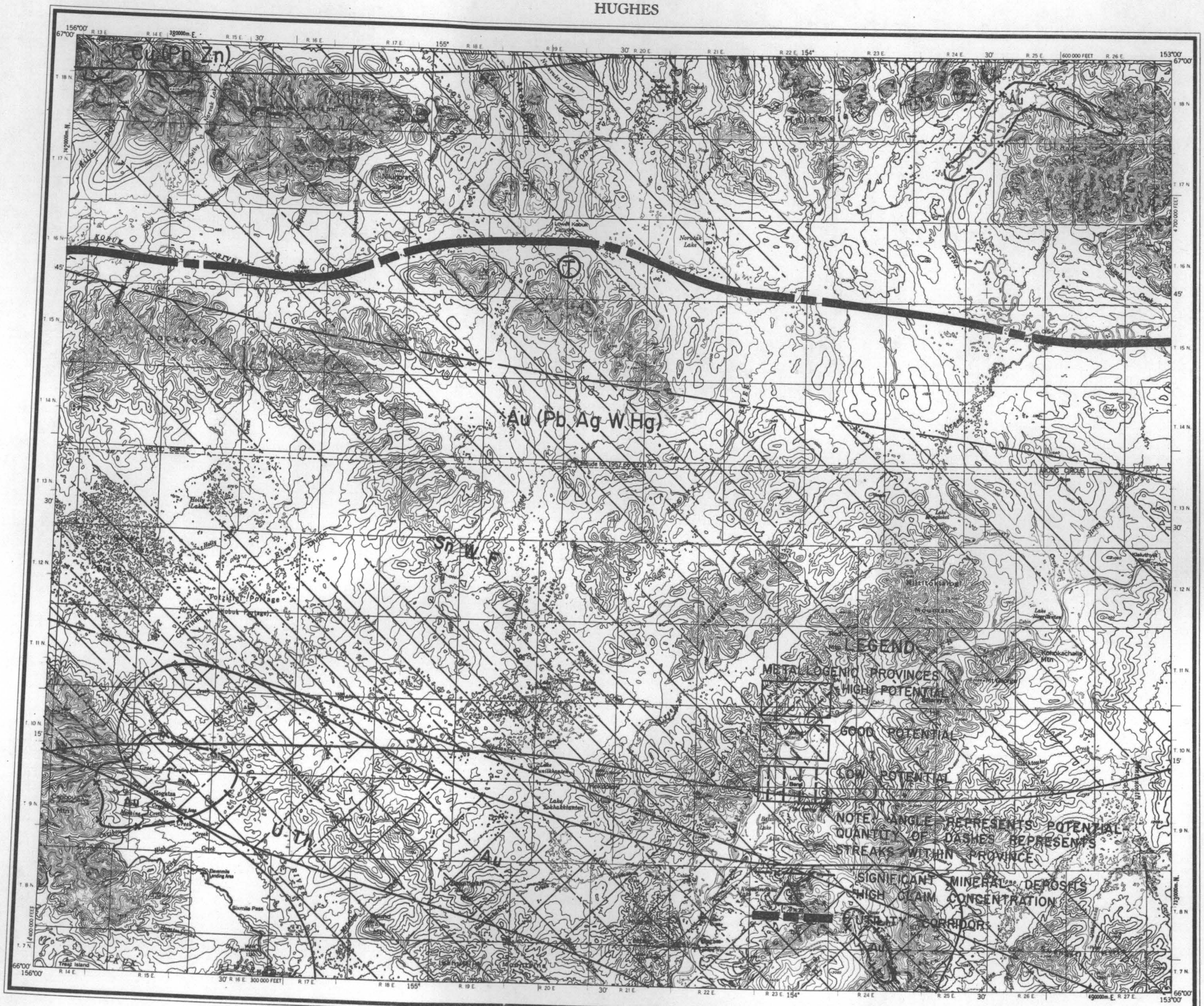
HUGHES



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QUADRANGLE: Kantishna River

GEOLOGY: Predominantly sedimentary rocks and volcanics partially overlain by alluvium along the major drainages

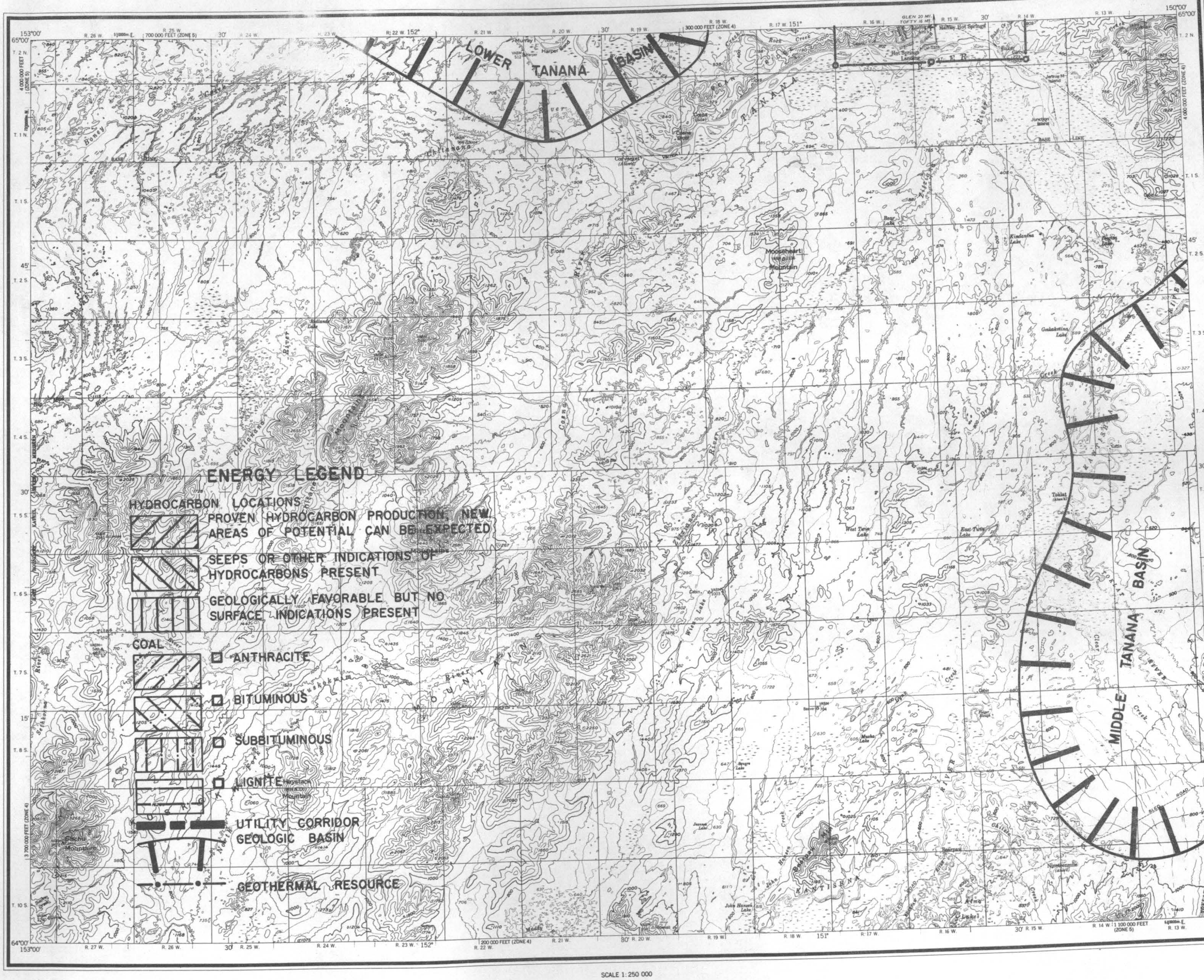
MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: None

MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The Lower Tanana Basin and Middle Tanana Basin impinge on this area along the northern and eastern borders; hence, oil and gas may have potential
Coal	No surface exposures known; may occur in areas favorable for oil and gas
Minerals	Most of the western two thirds have good potential for antimony, gold, silver, lead, zinc and mercury. The southeastern quarter has good potential for uranium

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	Unknown; little exploration to date
Minerals	Unknown; little exploration to date



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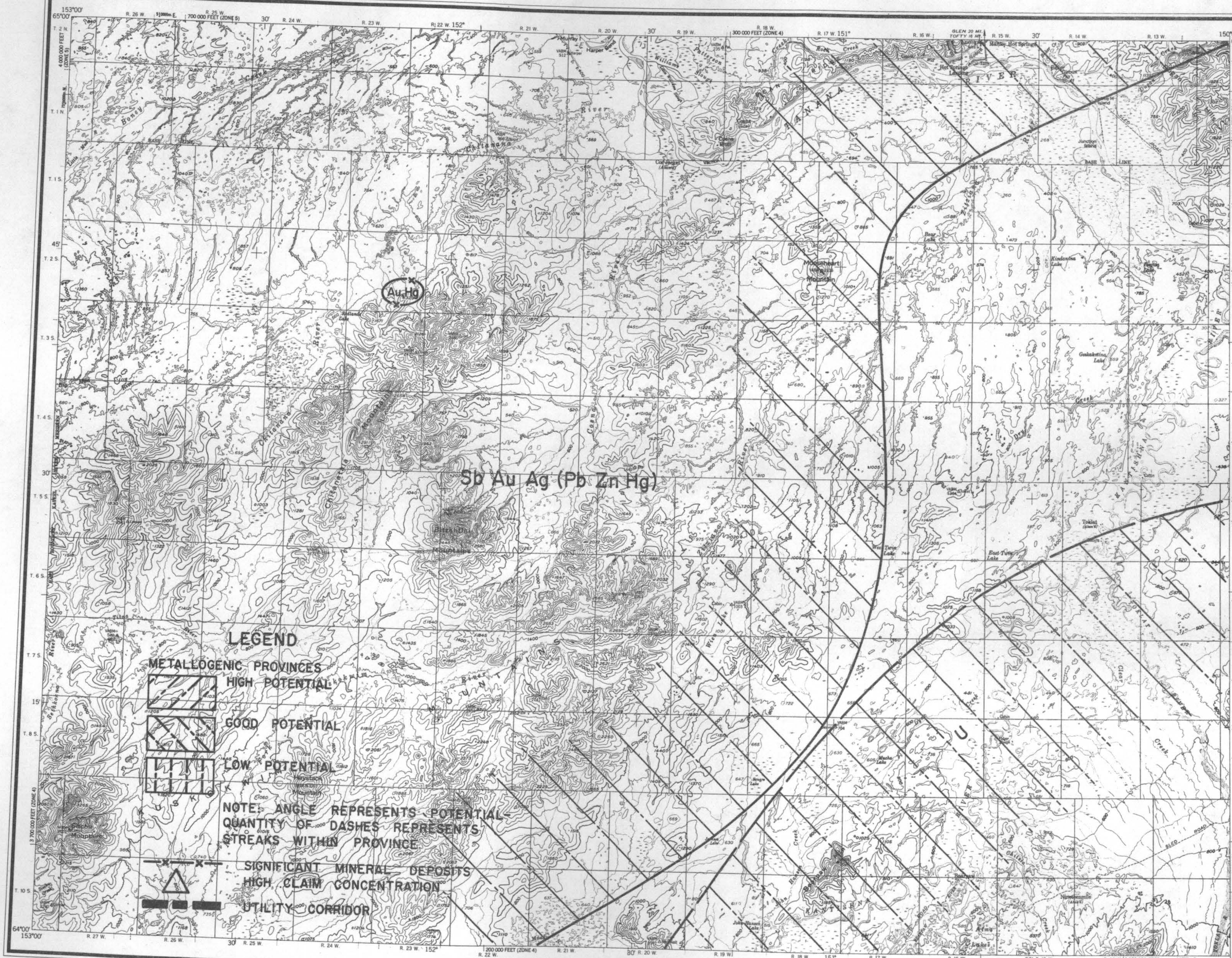
KANTISHNA RIVER



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QUADRANGLE: Kateel River

GEOLOGY: Predominantly shales and sandstones occur in the western third with scattered granitic intrusives. The remaining two-thirds consist largely of sedimentary rocks overlain by alluvium

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: None

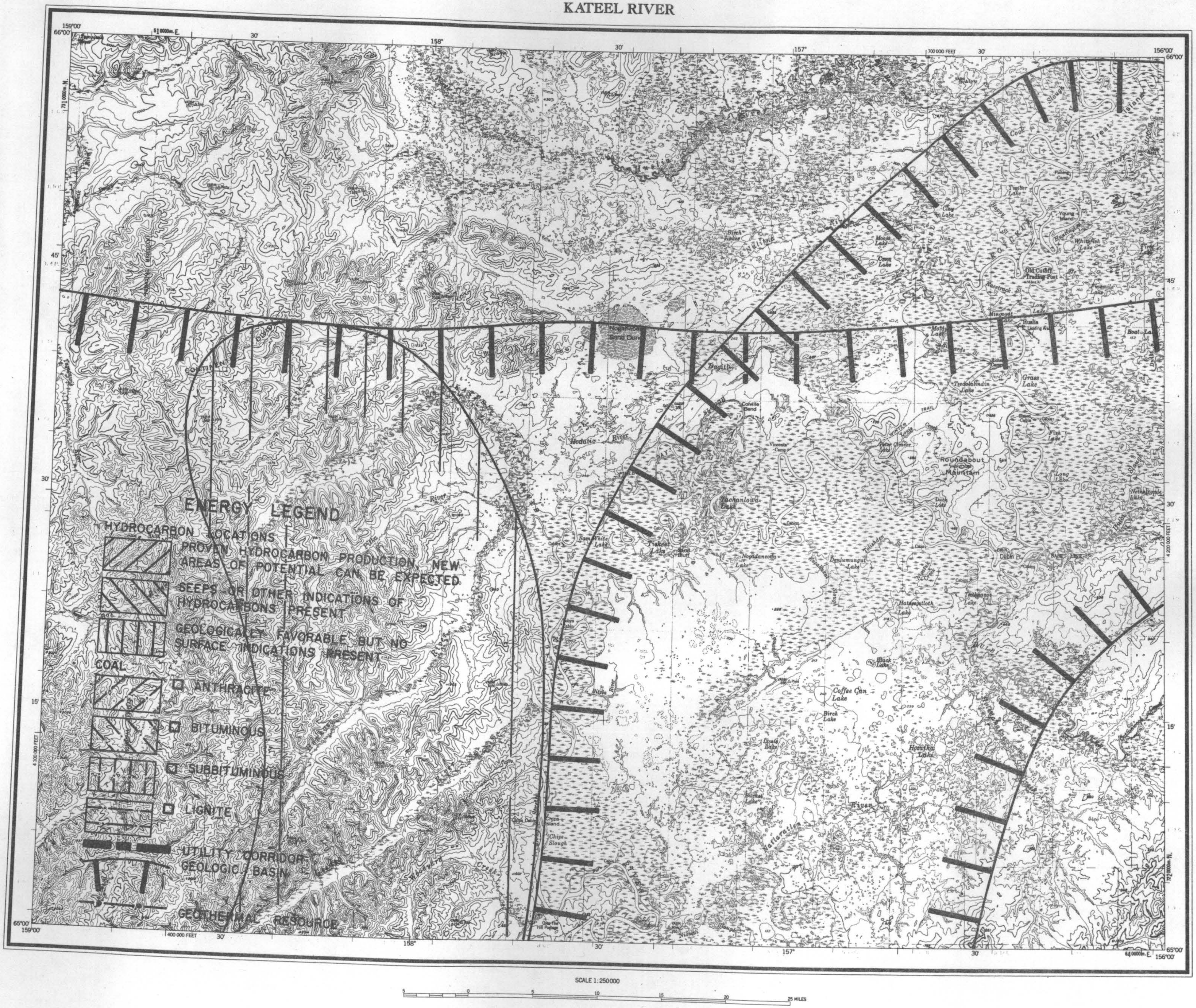
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The southern three quarters lie within the Yukon-Koyukuk Cretaceous Province and the Galena Basin and, hence, have potential for oil and gas. The central area is geologically favorable for oil and gas but no surface indications are present.
Coal	No surface explosures known; may occur in the Yukon-Koyukuk Cretaceous Province and the Galena Basin

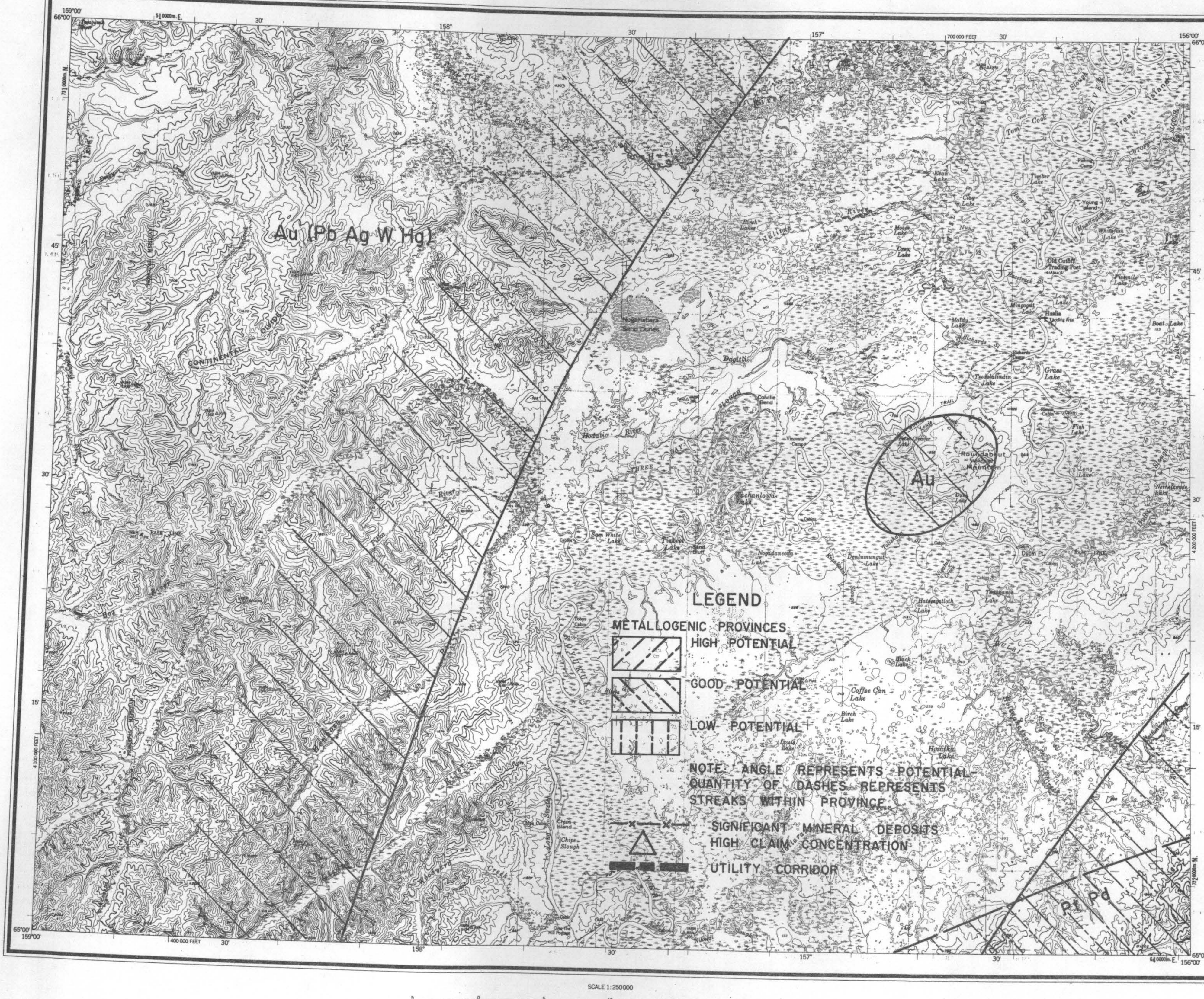
POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	Unknown; little exploration to date
Minerals	Unknown; little exploration to date

KATEEL RIVER



KATEEL RIVER



QUADRANGLE: Kenai

GEOLOGY: The western third is predominantly granitic intrusives. The majority of the land area on the Kenai Peninsula within this quadrangle is overlain by glacial and glaciofluvial deposits. The eastern border and southern quarter are predominantly sandstone and shale with minor amounts of volcanics and limestone

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $1,004,069,800 - petroleum, natural gas, placer gold, placer silver

MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas — With the exception of the northwestern quarter and southeastern corner, this quadrangle lies within the Cook Inlet Mesozoic Province and Cook Inlet Tertiary Province. This area has proven hydrocarbon production or new productive areas of potential can be expected

Coal — Much of the eastern half is underlain by subbituminous coals

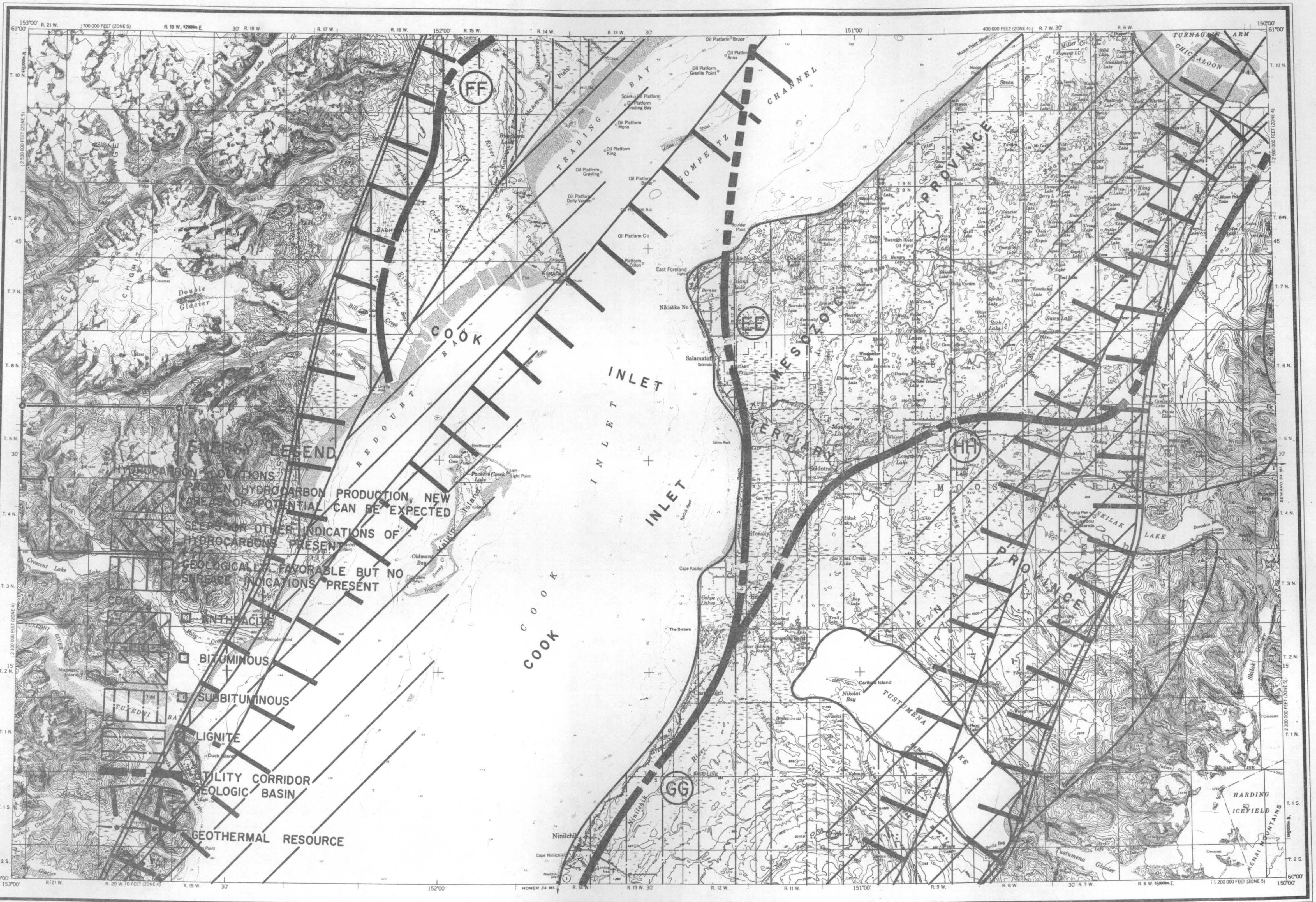
Minerals — The western border has a high potential for copper, gold, lead and zinc; the southeastern corner has a good potential for copper, gold, lead, zinc, silver and tungsten. The remaining land area has a good potential for uranium

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas — The continued development of oil and gas deposits is high

Coal — Approximately 64 million tons of subbituminous coal occurs within the pipeline corridor. The potential for large underground mines is good

Minerals — No production potential in the corridor



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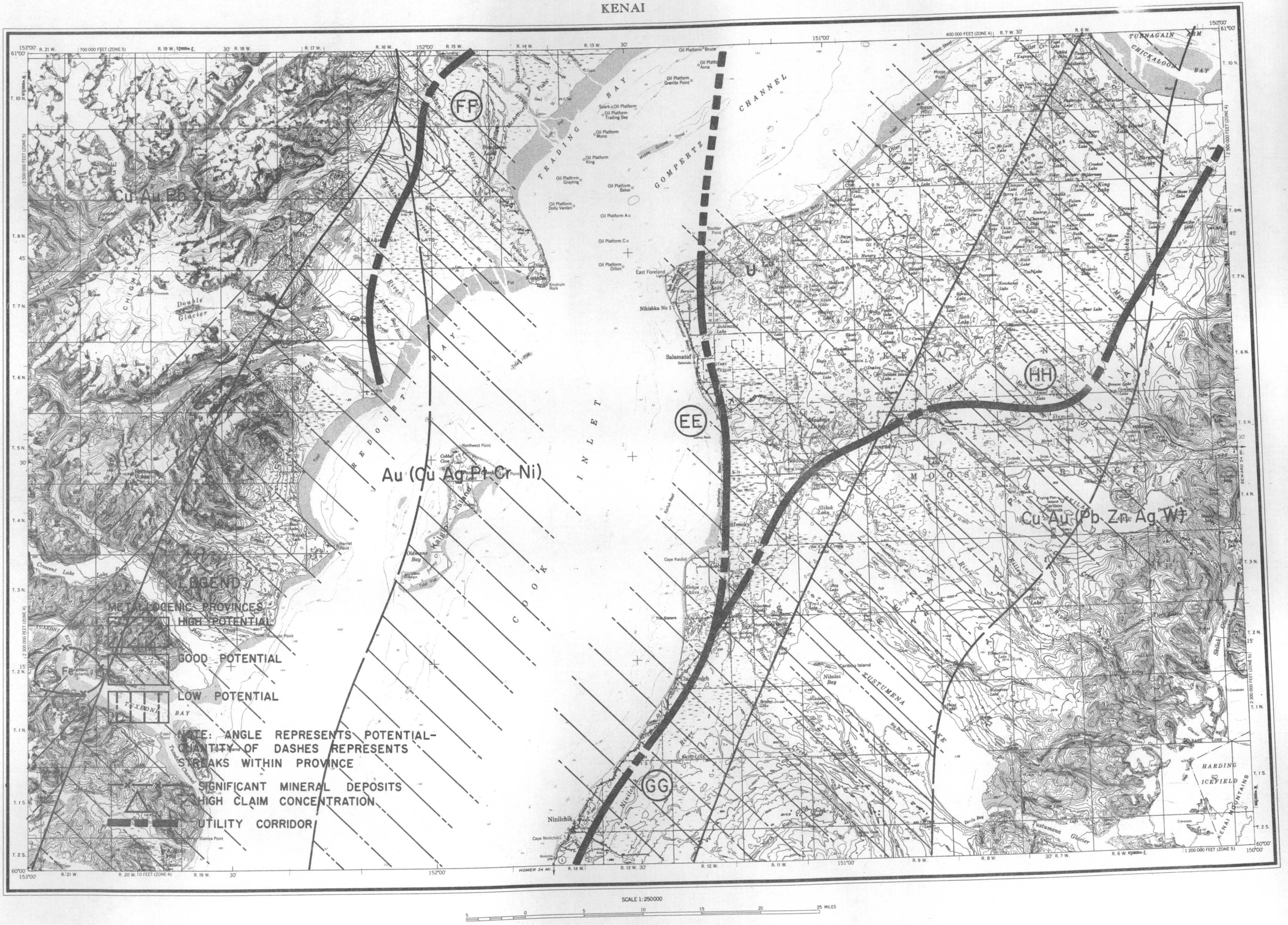


FF
EE
GG
HH
Cu Au Pb Zn
Au (Cu Ag Pt Cr Ni)
Cu Au (Pb Zn Ag W)
Fe
LEGEND
METALLOGENIC PROVINCES
HIGH POTENTIAL
GOOD POTENTIAL
LOW POTENTIAL
NOTE: ANGLE REPRESENTS POTENTIAL-
QUANTITY OF DASHES REPRESENTS
STREAKS WITHIN PROVINCE
SIGNIFICANT MINERAL DEPOSITS
HIGH CLAIM CONCENTRATION
UTILITY CORRIDOR
TRADING BAY
GOMPERTZ CHANNEL
COOK INLET
REDOUBT BAY
TURNAGAIN ARM
CHICKALOON BAY
TUSTUMENA LAKE
HARDING ICEFIELD
SCALE 1:250000

QUADRANGLE: Killik River

GEOLOGY: Marine and nonmarine sediments such as sandstones and shales with scattered volcanic regions in the eastcentral area

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: None

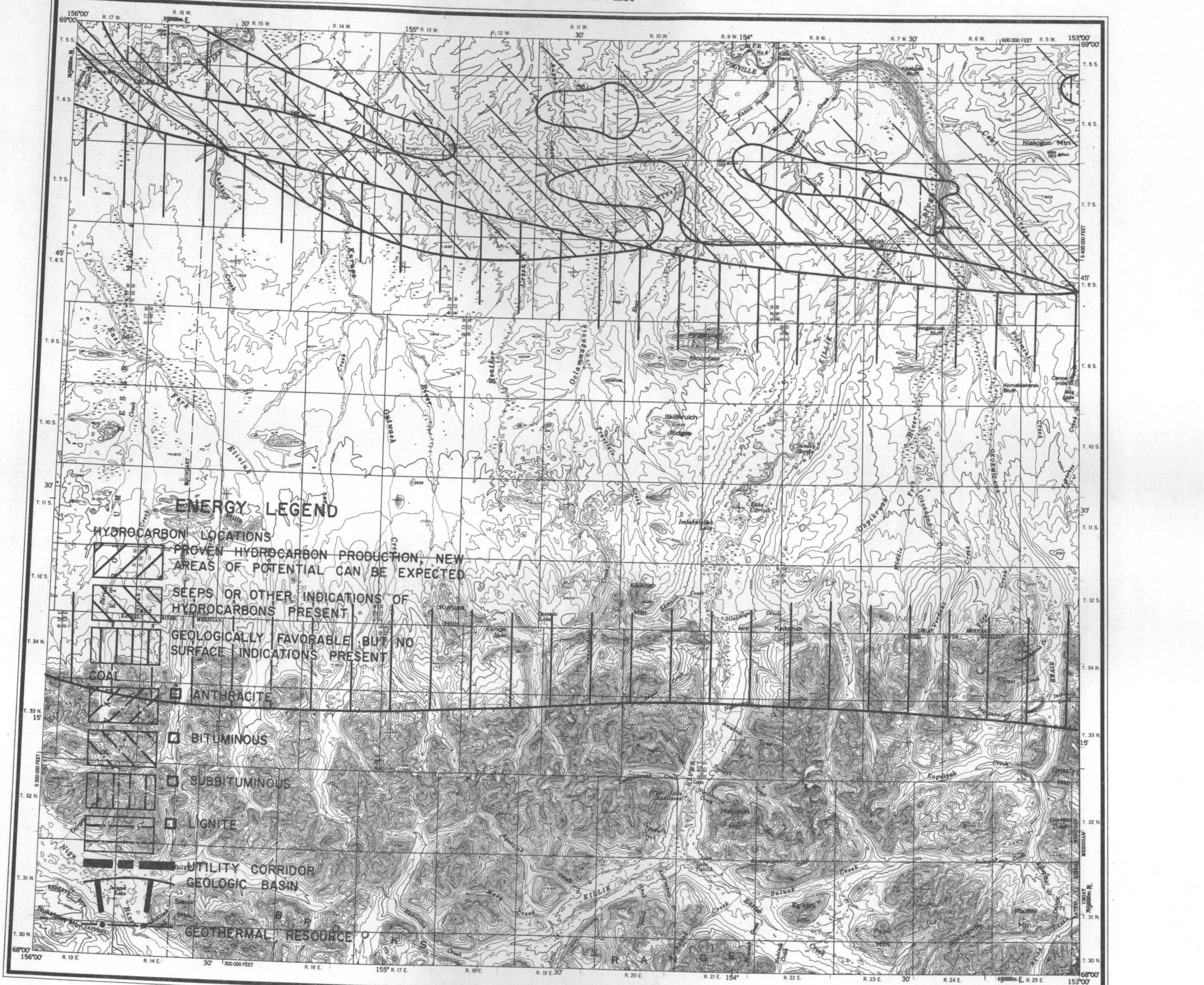
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	Northern quarter may have good potential based on seeps or other indications; the central area may have potential but no surface indications are present
Coal	The northern third is underlain by bituminous coal and scattered areas of subbituminous coal
Minerals	The southern third is less favorable to favorable for minerals such as gold, lead, copper, zinc and tin

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	The development of approximately 325 million tons of bituminous and subbituminous coal is considered low
Minerals	Unknown; little exploration to date

KILLIK RIVER



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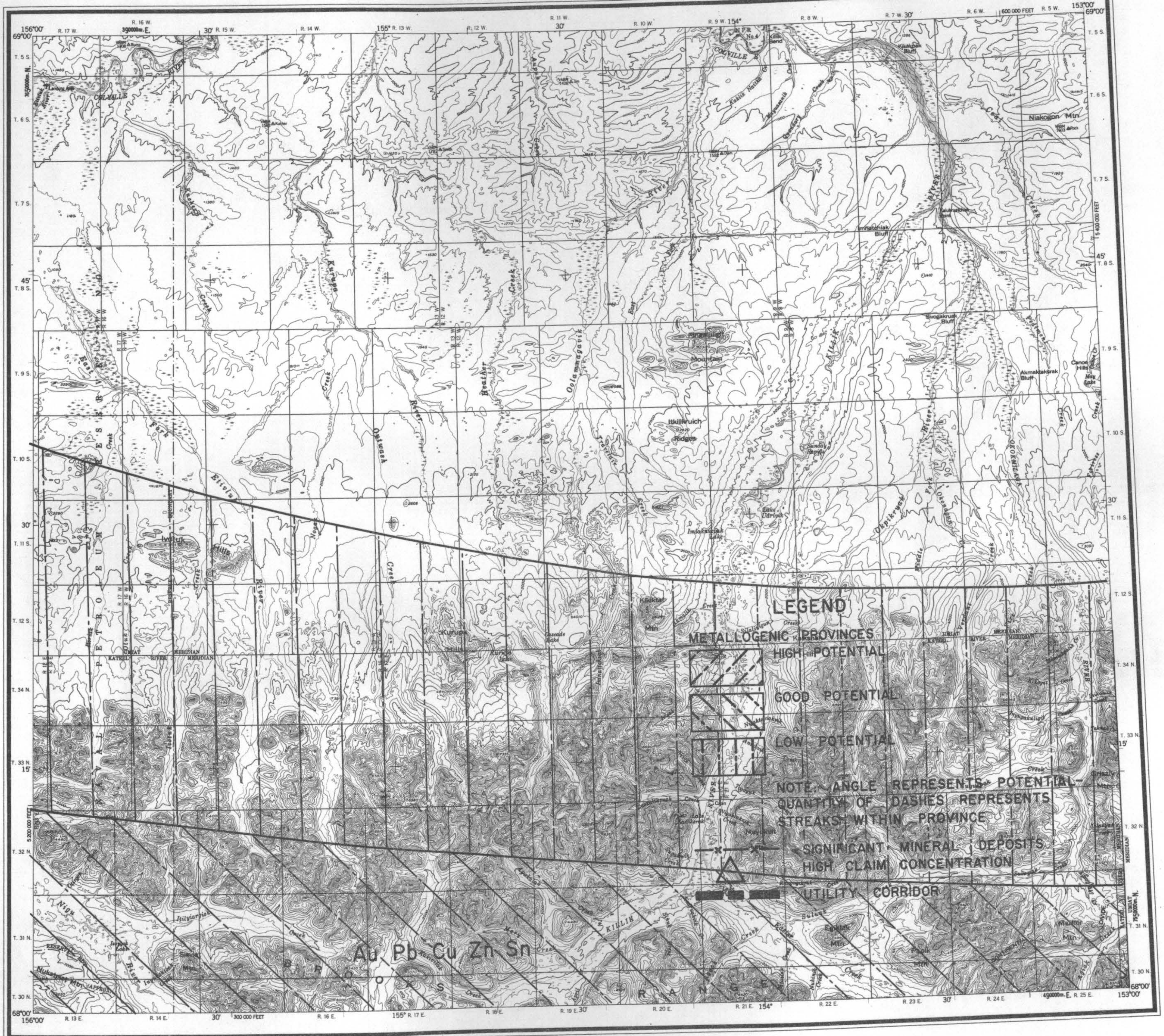
KILLIK RIVER



SCALE 1: 250 000

5 0 5 10 15 20 25 MILES

QUADRANGLE: Livengood

GEOLOGY: Predominantly limestones and shales intruded by small ultramafic and granitic intrusives. Southeastern third is predominantly metamorphic rocks

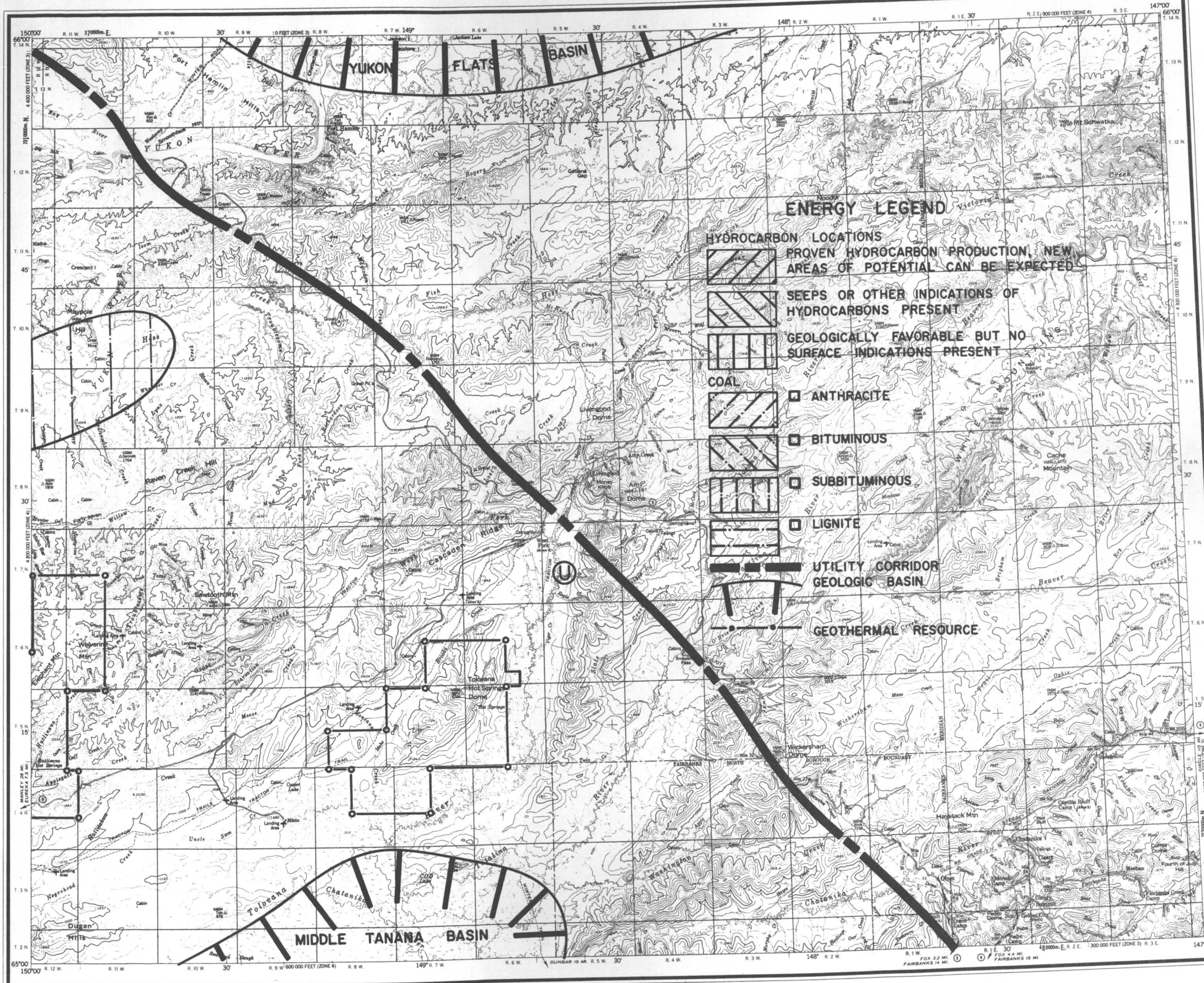
MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $44,315,600 - placer gold, lode gold, placer silver, tungsten, lode silver, lead, copper

MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The Yukon Flats Basin touches the area on the north and the Middle Tanana Basin touches the area on the south so oil and gas may have potential in these areas
Coal	Subbituminous coal occurs along the western border
Minerals	Most of the area has good potential for antimony, gold, silver, lead, zinc and mercury. Major past gold placer production has occurred in the central and western section

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	Unknown; little exploration to date
Minerals	A high potential exists for small gold mines in the metamorphic rocks, and for small, medium and large-size gold placer operations nearby in permafrost zones. The limestones and shales have good potential for medium-sized lead and zinc deposits where they are associated with granitic intrusives. The potential for small copper and antimony deposits in metamorphic rocks is fair



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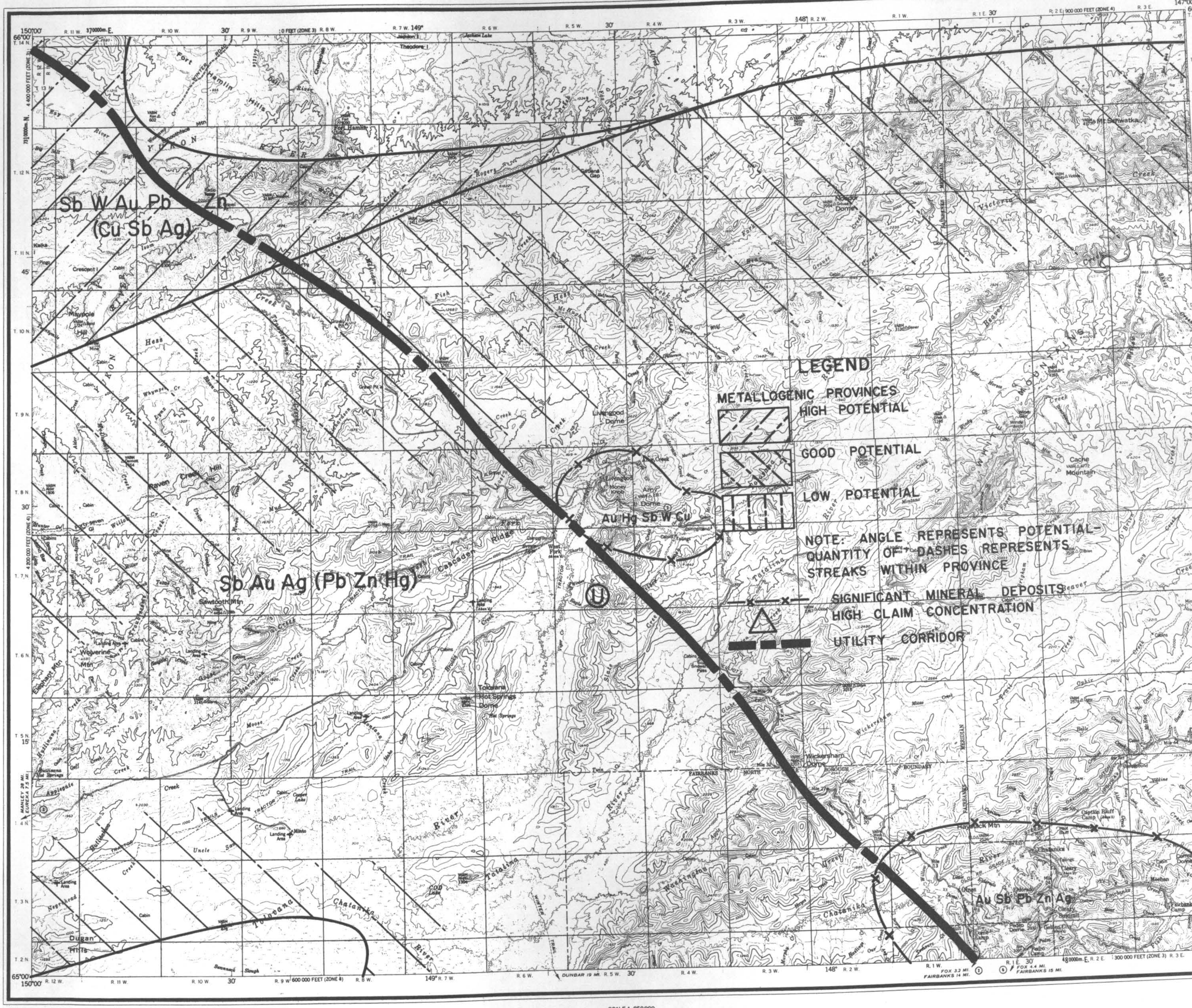
LIVENGOOD



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QUADRANGLE: McCarthy

GEOLOGY: Predominantly sedimentary and volcanic rocks with granitic intrusives. Glacial and glaciofluvial deposits overlay the rocks along major drainages

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $201,075,400 - copper, lode silver, placer gold, lead, lode gold, placer silver

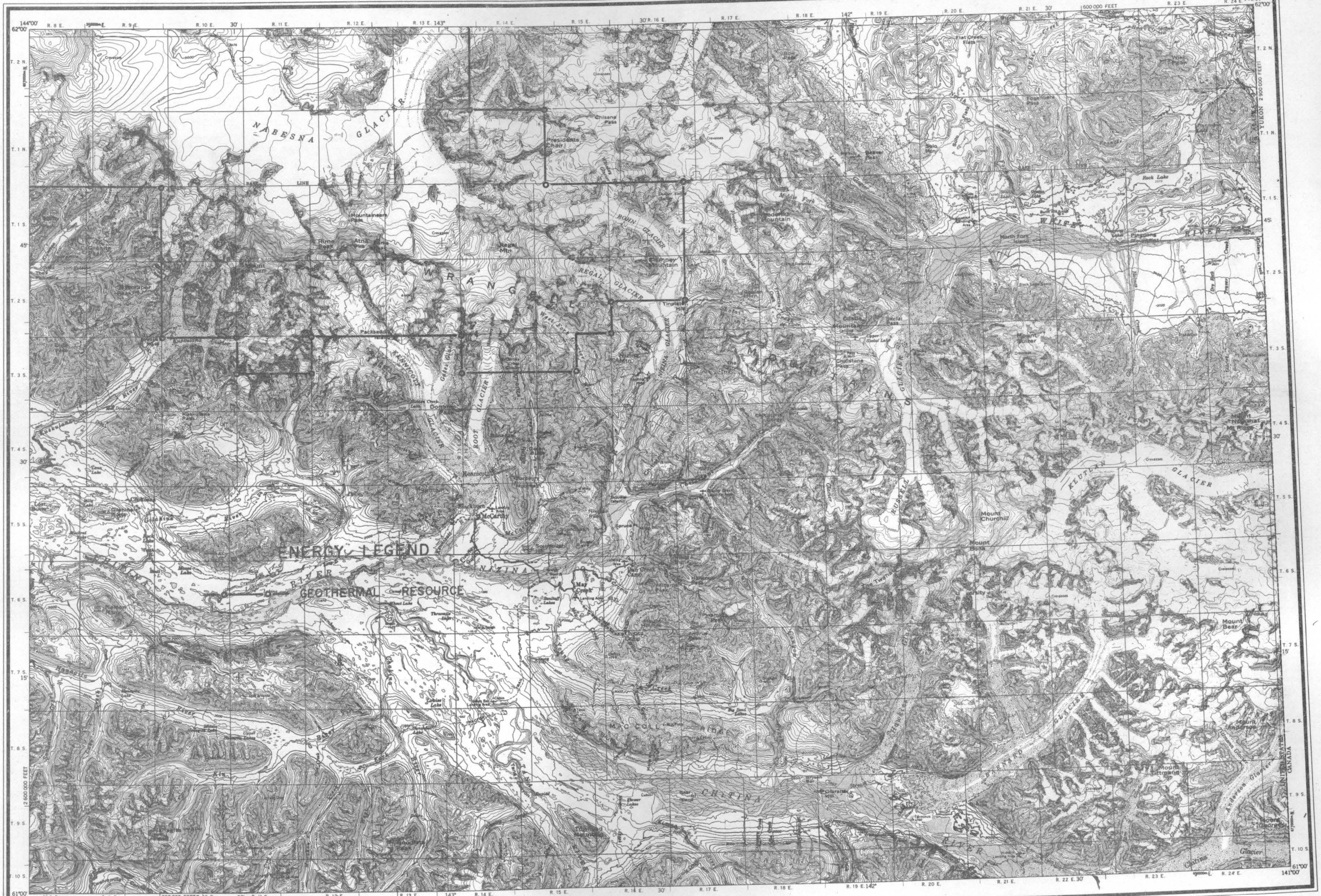
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	None
Coal	None
Minerals	The northeastern quarter has a high potential for copper and molybdenum. Generally, the southwestern half has a high potential for copper, silver, gold and molybdenum

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	None
Coal	None
Minerals	The potential for small placer gold deposits is high. The potential for medium-size copper and gold deposits is good

MC CARTHY



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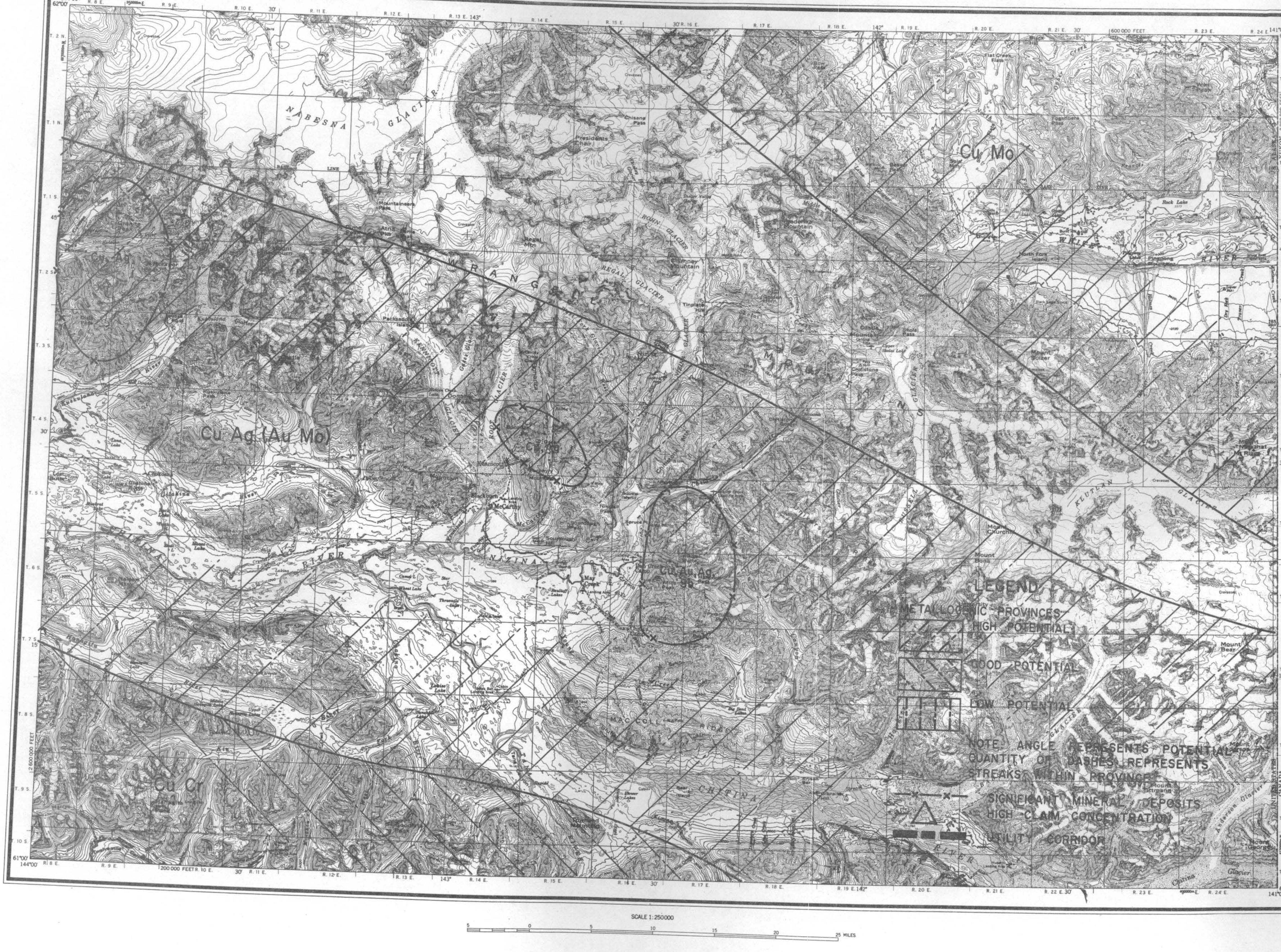
MC CARTHY


LEGEND
METALLOGENIC PROVINCES
HIGH POTENTIAL
GOOD POTENTIAL
LOW POTENTIAL
NOTE: ANGLE REPRESENTS POTENTIAL QUANTITY OF DASHES REPRESENTS STREAKS WITHIN PROVINCE
SIGNIFICANT MINERAL DEPOSITS
HIGH CLAIM CONCENTRATION
UTILITY CORRIDOR
Cu Mo
Cu Ag (Au Mo)
Cu Au Ag
Cu Cr
NABESNA GLACIER
WRANGELL MOUNTAINS
NIZINA RIVER
CHITINA RIVER
KLUTLAN GLACIER
McCarthy
SCALE 1:250000
25 MILES

QUADRANGLE: Mt. Hayes

GEOLOGY: The northeastern half consists mostly of metamorphic rocks cut by intrusives. The southwestern half has both volcanic and sedimentary rocks. Ultramafic rocks are found near the Denali Fault

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $3,260,000 - placer gold, placer silver

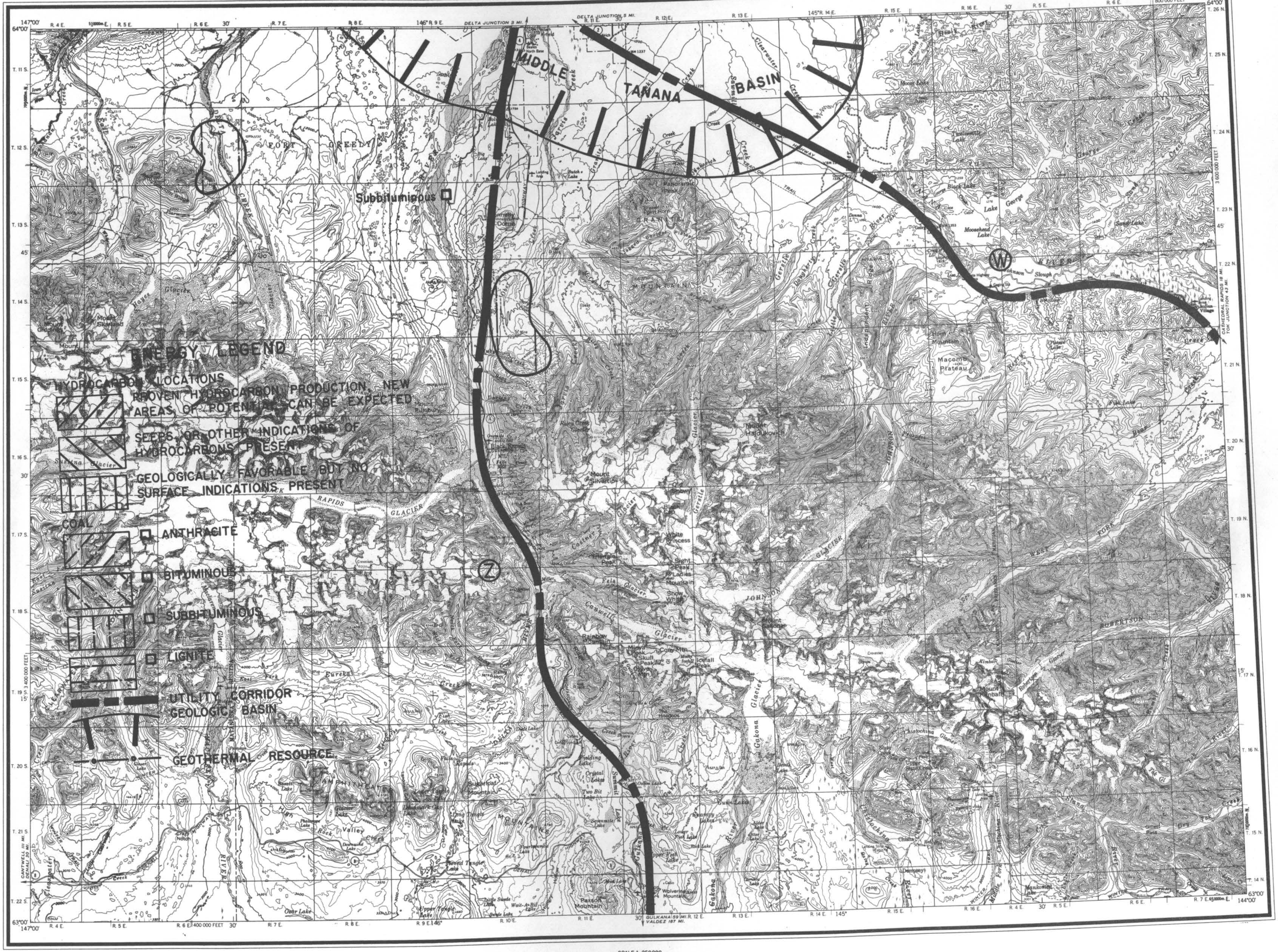
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The Middle Tanana Basin includes part of the northeastern quarter, so that area may have some potential
Coal	Several areas of subbituminous coal occur in the northwestern quarter
Minerals	The southwestern half has high potential for copper and molybdenum. A good potential for uranium exists in the northwestern corner. Placer gold has been produced in the southeastern corner

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	The potential for developing the estimated 76.5 million tons of coal reserves is rated good
Minerals	The development of small and medium-size placer gold deposits is high. The potential for small copper-nickel vein deposits or small disseminated copper-nickel deposits occurring in the ultrabasic rocks is fair

MT. HAYES



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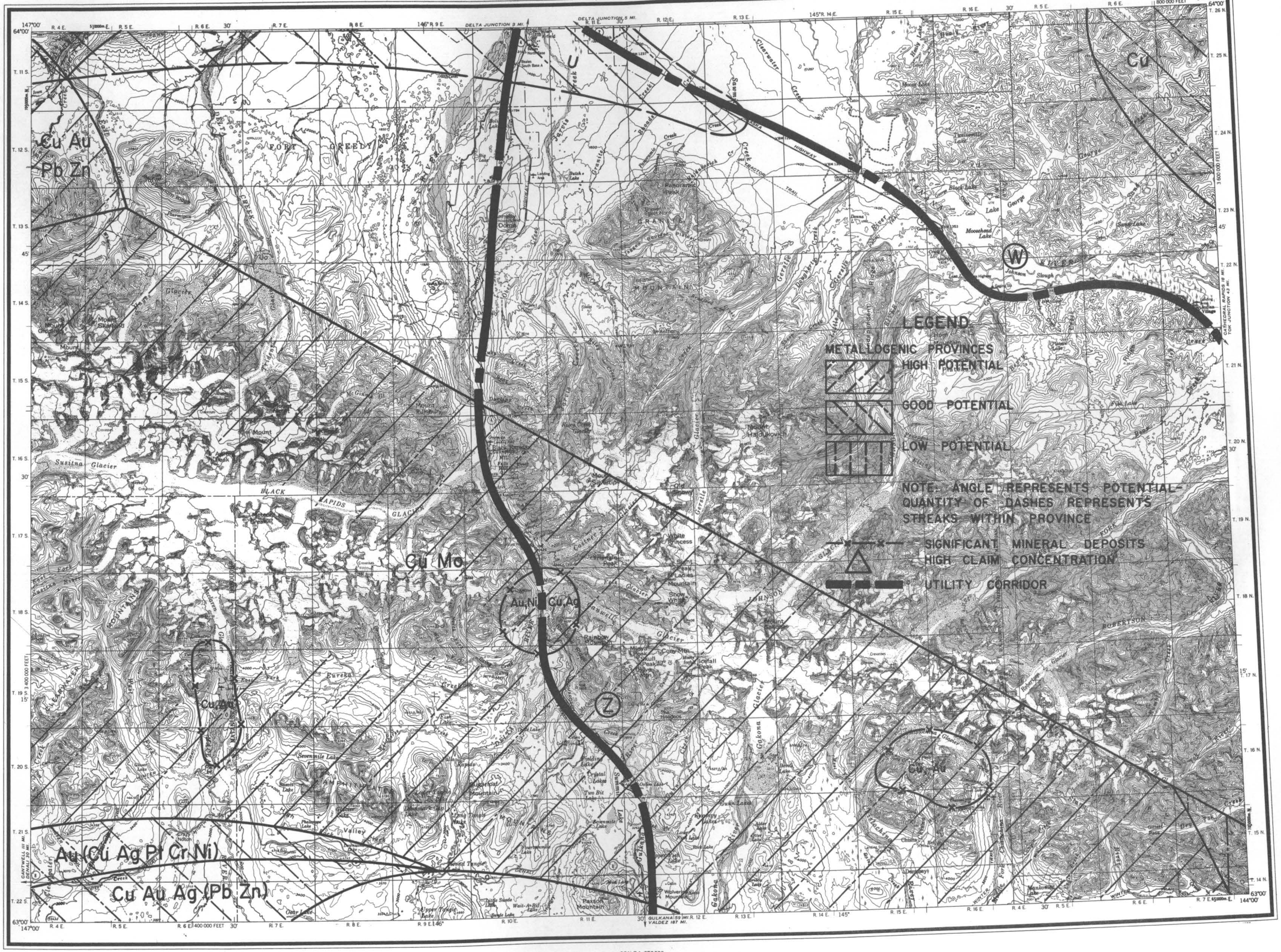
MT. HAYES



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QUADRANGLE: Mt. McKinley

GEOLOGY: A complex area of sedimentary and metamorphic rocks with granitic intrusives

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $1,069,500 - placer gold, lode gold, placer silver, lode silver, lead, copper, zinc

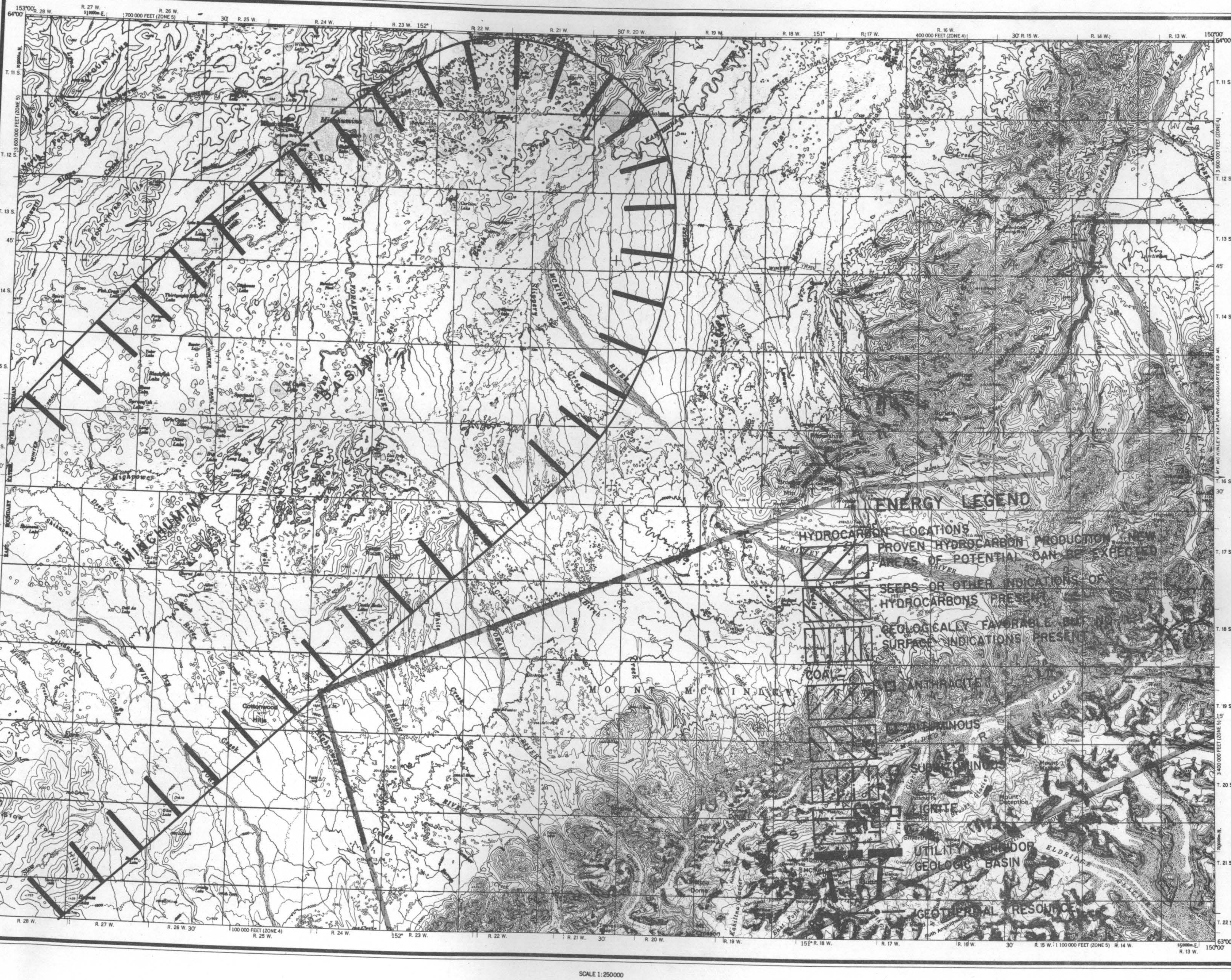
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	Much of the western half of this quadrangle lies within the Minchumina Basin, hence oil and gas may have potential
Coal	No surface occurrences known; may occur in the Minchumina Basin
Minerals	The eastern half has a high potential for copper, gold, lead and zinc. The northeastern quarter has a good potential for sedimentary uranium. The Kantishna district to the west of Mt. McKinley National Park has been a producer of antimony, gold, silver and lead

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	Unknown; little exploration to date
Minerals	The potential for continued placer gold mining in the Kantishna area is high. The potential for the development of small-size lead-zinc deposits is good

MT. MC KINLEY



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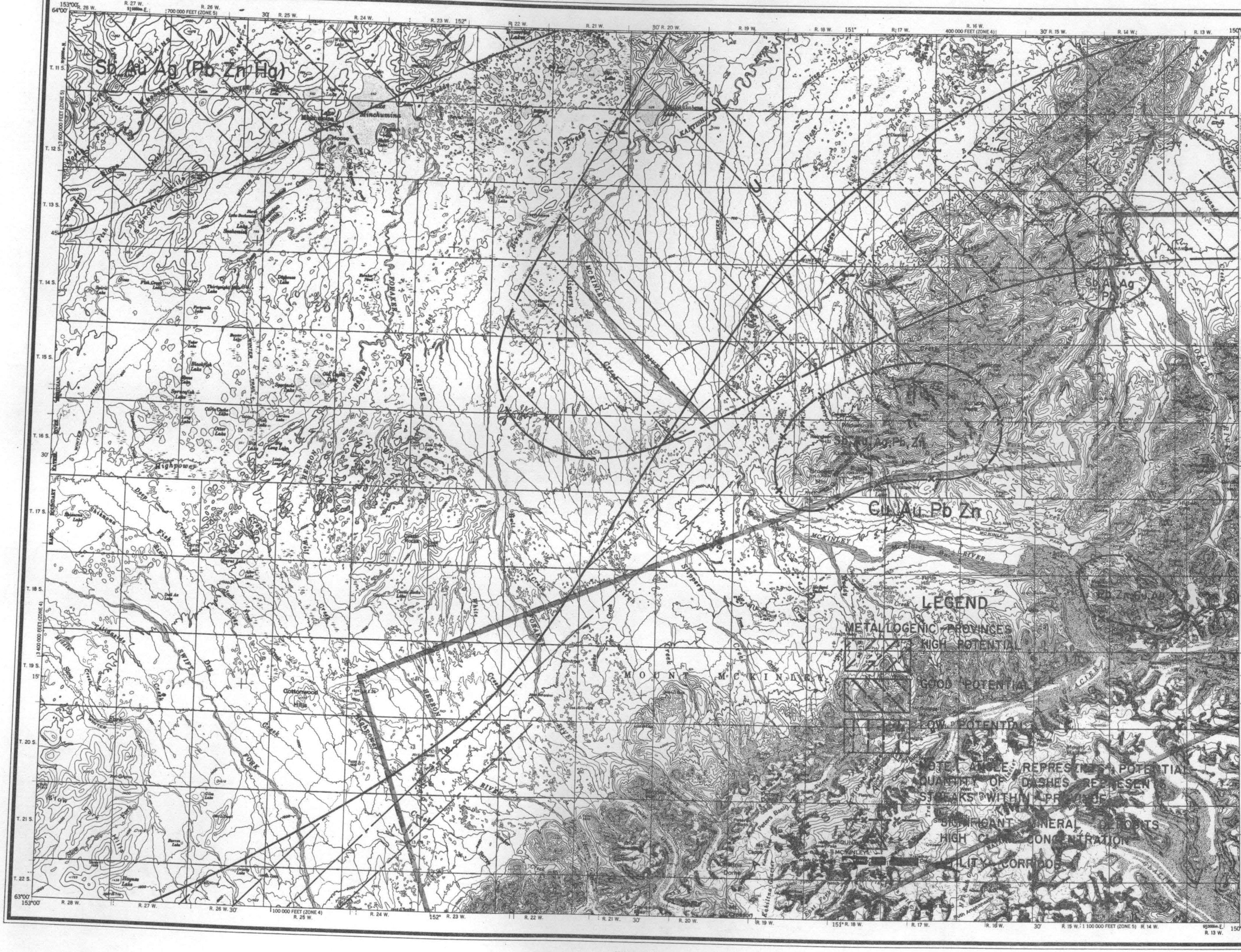
MT. MC KINLEY



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QUADRANGLE: Mt. Michelson

GEOLOGY: Undifferentiated marine and nonmarine rocks in northern quarter; limestones, shales, graywackes in remaining areas; granitic intrusive area occurs on the eastern border

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: None

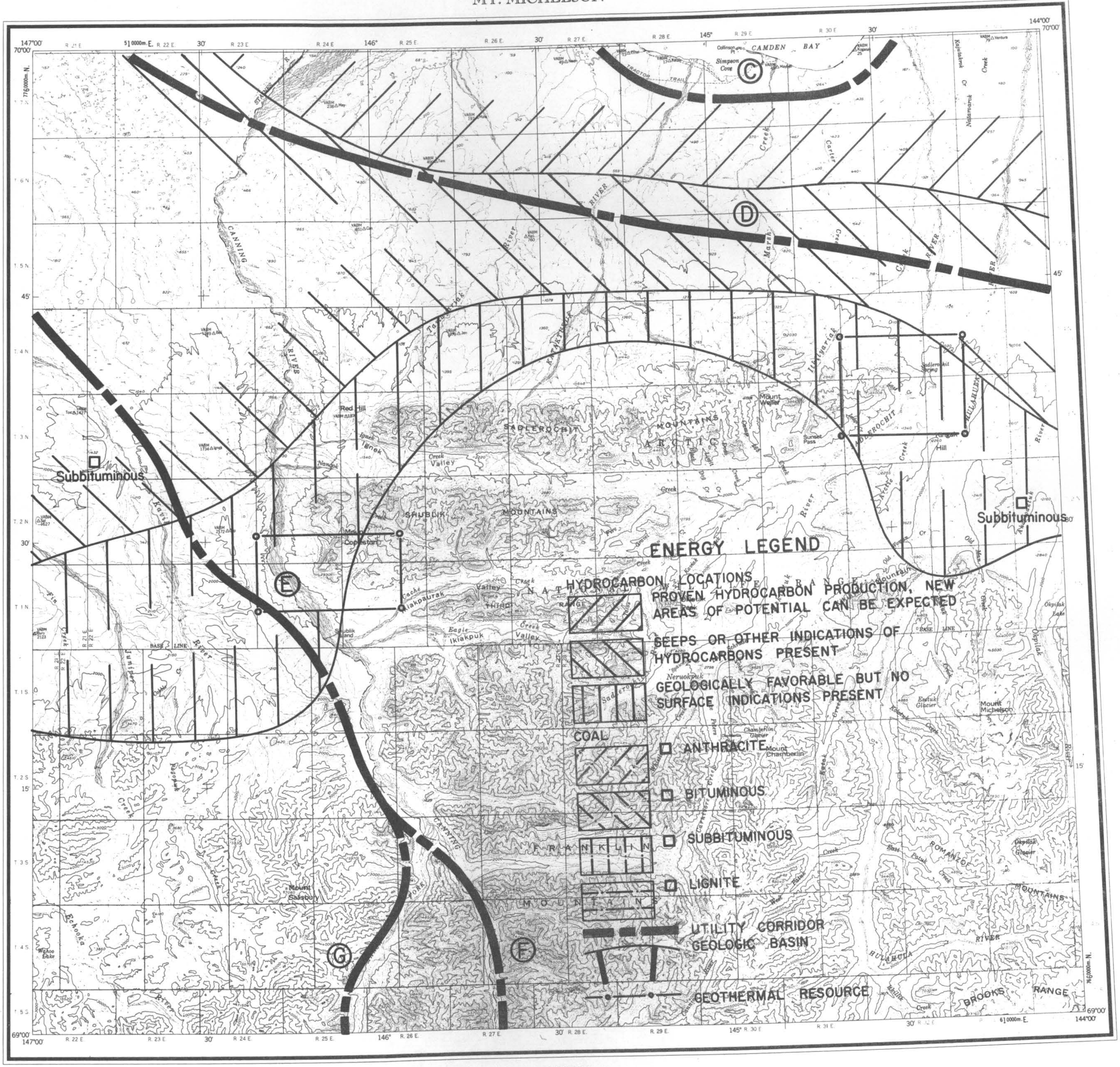
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	Northern quarter has proven potential or high potential; the remaining northern half has good potential based on oil seeps or other indications
Coal	Two subbituminous areas occur in the northern half
Phosphate	Scattered deposits occur in an east-west band across the central area of the quadrangle
Minerals	The southern half has good potential for tin, tungsten, flourite, gold, lead, copper and zinc deposits

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	A gas field exists in the middle of the proposed corridor, and the potential for development is high
Coal	The potential for development of large coal deposits is low
Minerals	The potential for developing medium-size copper, lead and zinc deposits associated with the igneous intrusives is low. The potential for developing the medium-size, low-grade phosphate deposits is low

MT. MICHELSON



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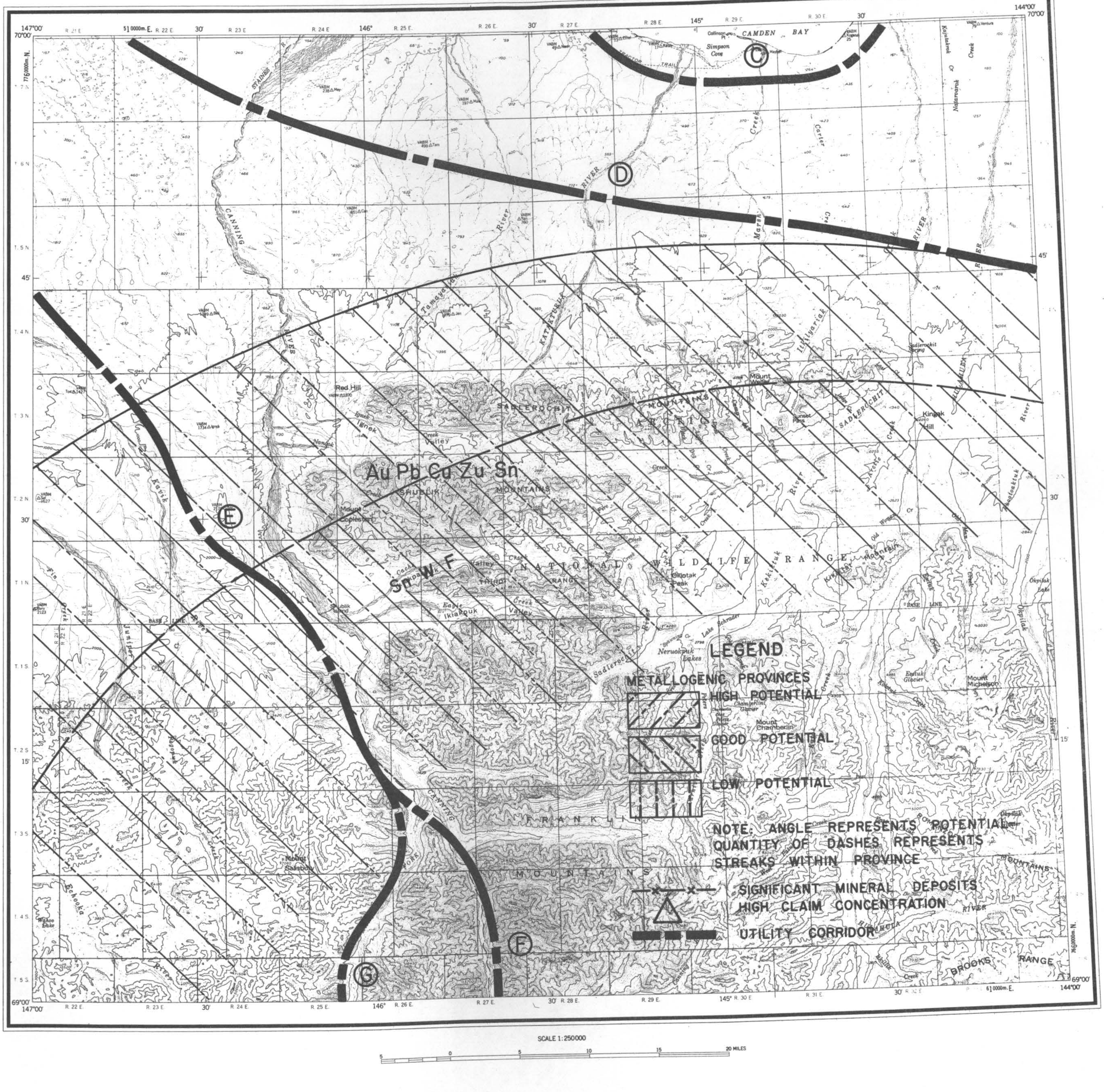
MT. MICHELSON



QUADRANGLE: Nabesna

GEOLOGY: Much of the northeastern area is covered by alluvium. The remaining area consists of sedimentary and volcanic rocks with granitic intrusives. Ultramafic rocks occur parallel to the Denali Fault which cuts the quadrangle from northwest to southeast

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $3,140,500 - lode gold, placer gold, lode silver, copper, lead, placer silver

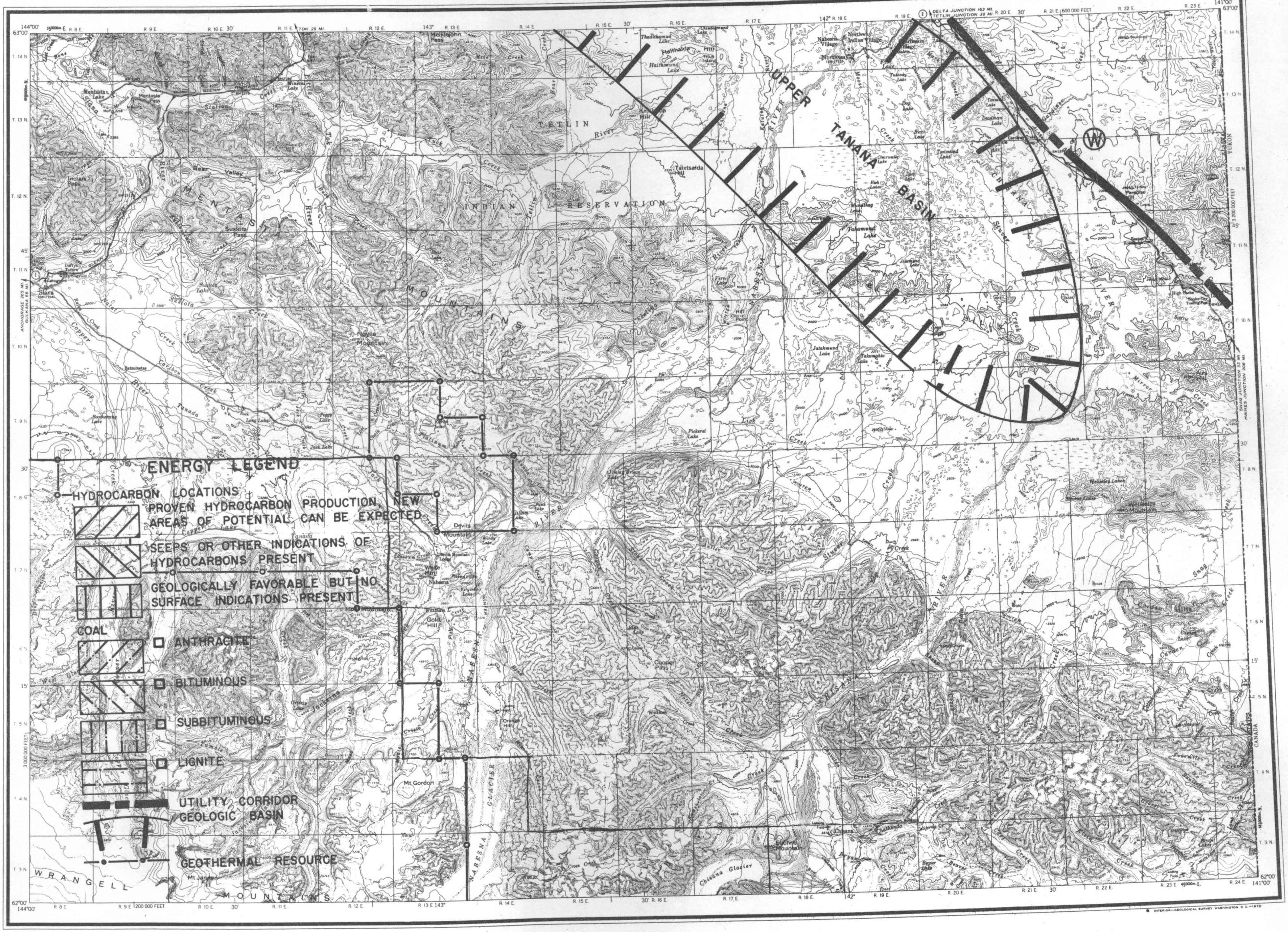
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The northeastern quarter is within the Upper Tanana Basin and may have potential for oil and gas
Coal	No known surface occurrences; may occur in the Upper Tanana Basin
Minerals	A band through the central part of the quadrangle from northwest to southeast has high potential for copper and molybdenum. Placer gold has been produced in the south and central areas

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	Unknown; little exploration to date
Minerals	The potential for the development of small and large placer deposits is high. The potential for large, low-grade copper-molybdenum deposits is good

NABESNA



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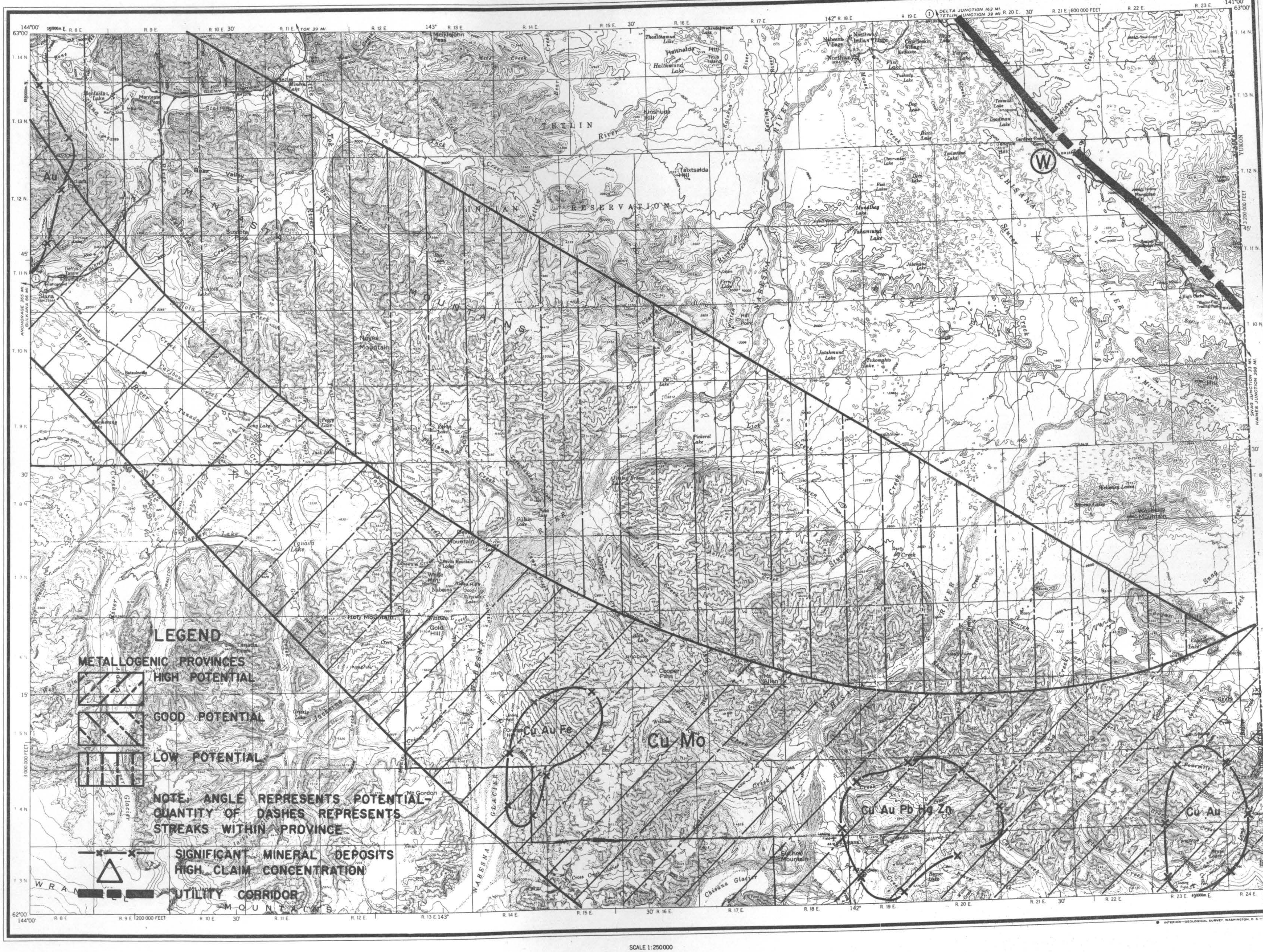
NABESNA



LEGEND
METALLOGENIC PROVINCES
HIGH POTENTIAL
GOOD POTENTIAL
LOW POTENTIAL
NOTE: ANGLE REPRESENTS POTENTIAL-
QUANTITY OF DASHES REPRESENTS
STREAKS WITHIN PROVINCE
SIGNIFICANT MINERAL DEPOSITS
HIGH CLAIM CONCENTRATION
UTILITY CORRIDOR
Au
Cu Au Fe
Cu Mo
Cu Au Pb Hg Zn
Cu Au
W
TETLIN
INDIAN RESERVATION
SCALE 1:250000
25 MILES

QUADRANGLE: Norton Bay

GEOLOGY: The northwestern quarter has predominantly metamorphic rocks while the remainder of the area is underlain with sandstones and shales with some volcanic rocks

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $1,647,800 - placer gold, placer silver

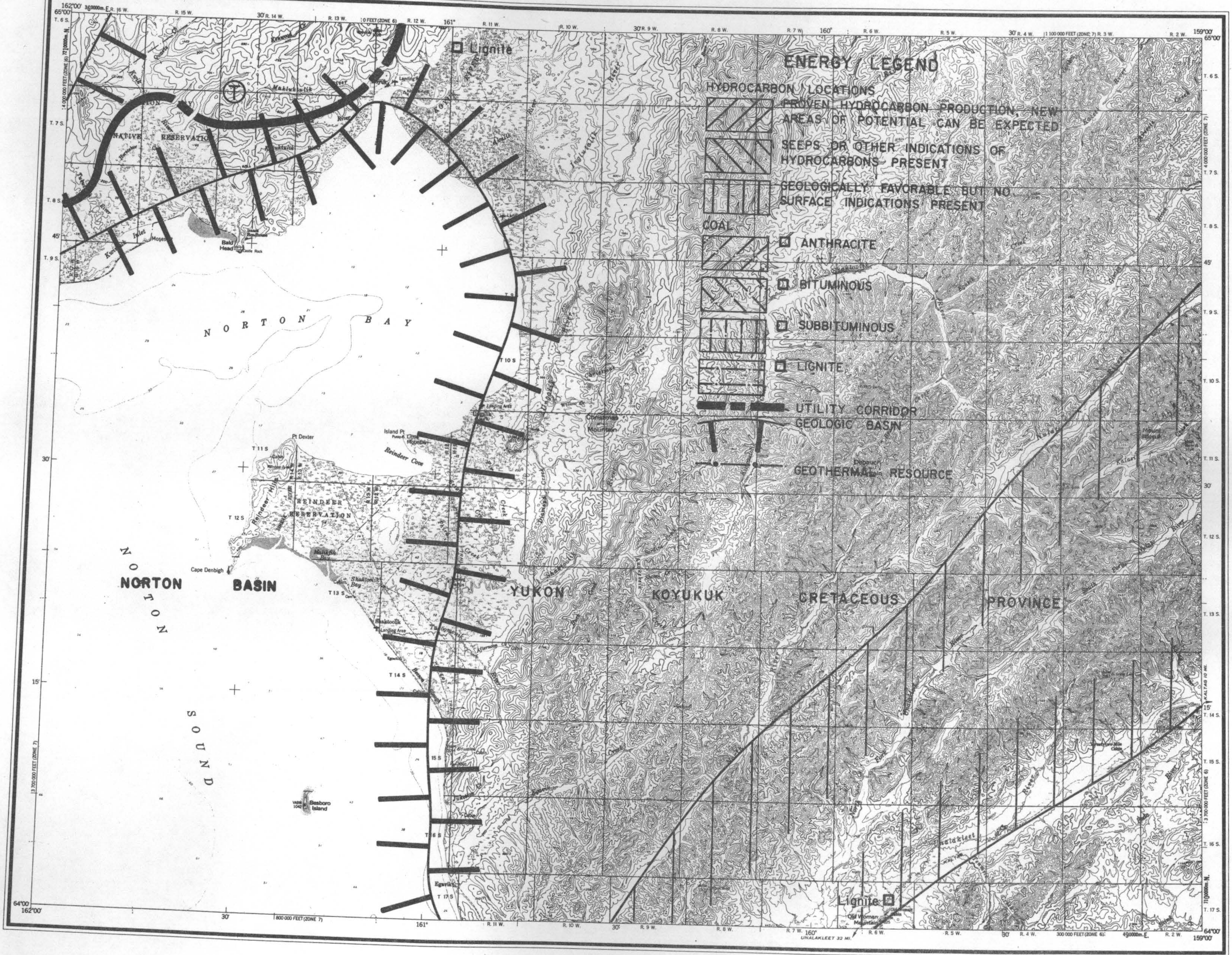
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The eastern two thirds are within the Yukon-Koyukuk Cretaceous Province and may have potential for oil and gas. The southeastern quarter is geologically favorable for oil and gas although no surface indications are present
Coal	Scattered outcrops of lignite occur in the area
Minerals	The northwestern quarter has good potential for platinum and palladium while the remaining area has good potential for gold, lead, silver, tungsten and mercury

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	Unknown; little exploration to date
Minerals	The potential for small placer gold deposits is high

NORTON BAY



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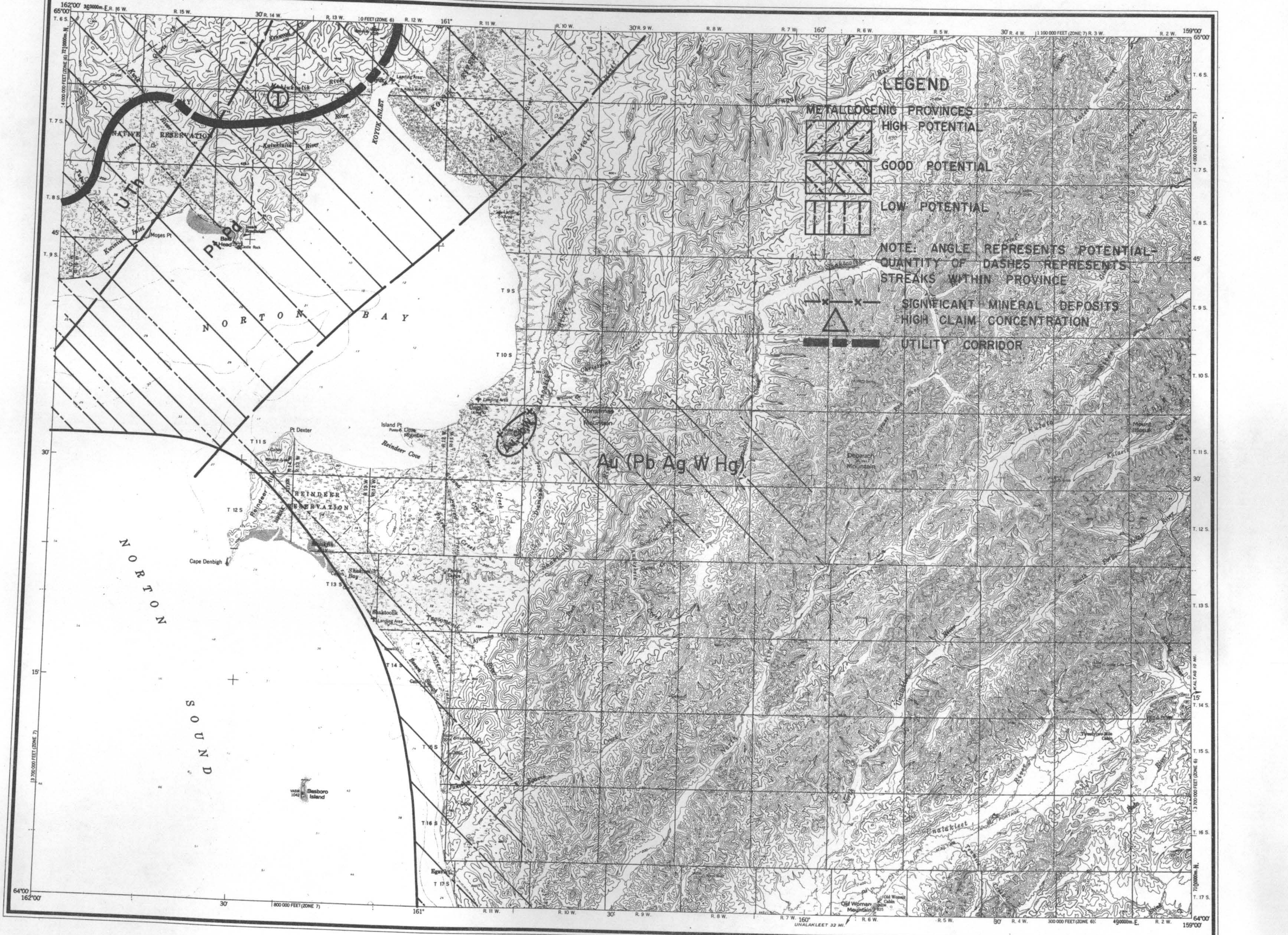
NORTON BAY



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QUADRANGLE: Phillip Smith Mt.

GEOLOGY: Predominantly sedimentary rocks - sandstones, shales, limestones and dolomites. An area of metamorphic rocks occurs in the southeast corner

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: None

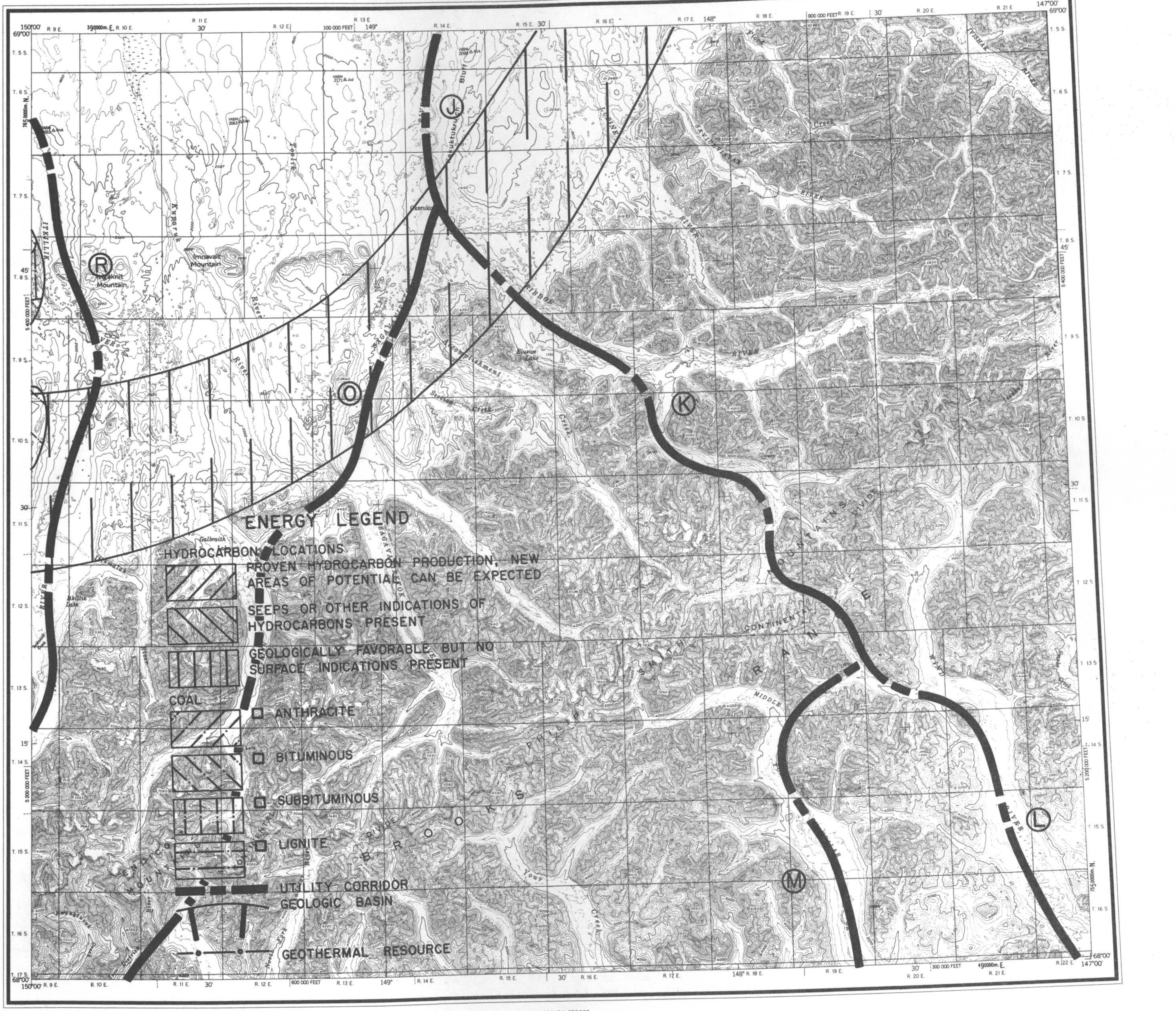
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The northwestern quarter is geologically favorable. Surface indications occur in some areas
Coal	Subbituminous coal occurs along the western border
Minerals	The northwestern third has low potential. Most of the remaining area has good potential for gold, lead, copper, zinc and tin. The southeastern corner has high potential for copper, lead and zinc

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	The northwestern corner of the quadrangle has good potential for development
Coal	The potential for development is considered low
Minerals	The potential for medium-size copper, lead and zinc vein-type deposits in the limestones is high

PHILIP SMITH MOUNTAINS



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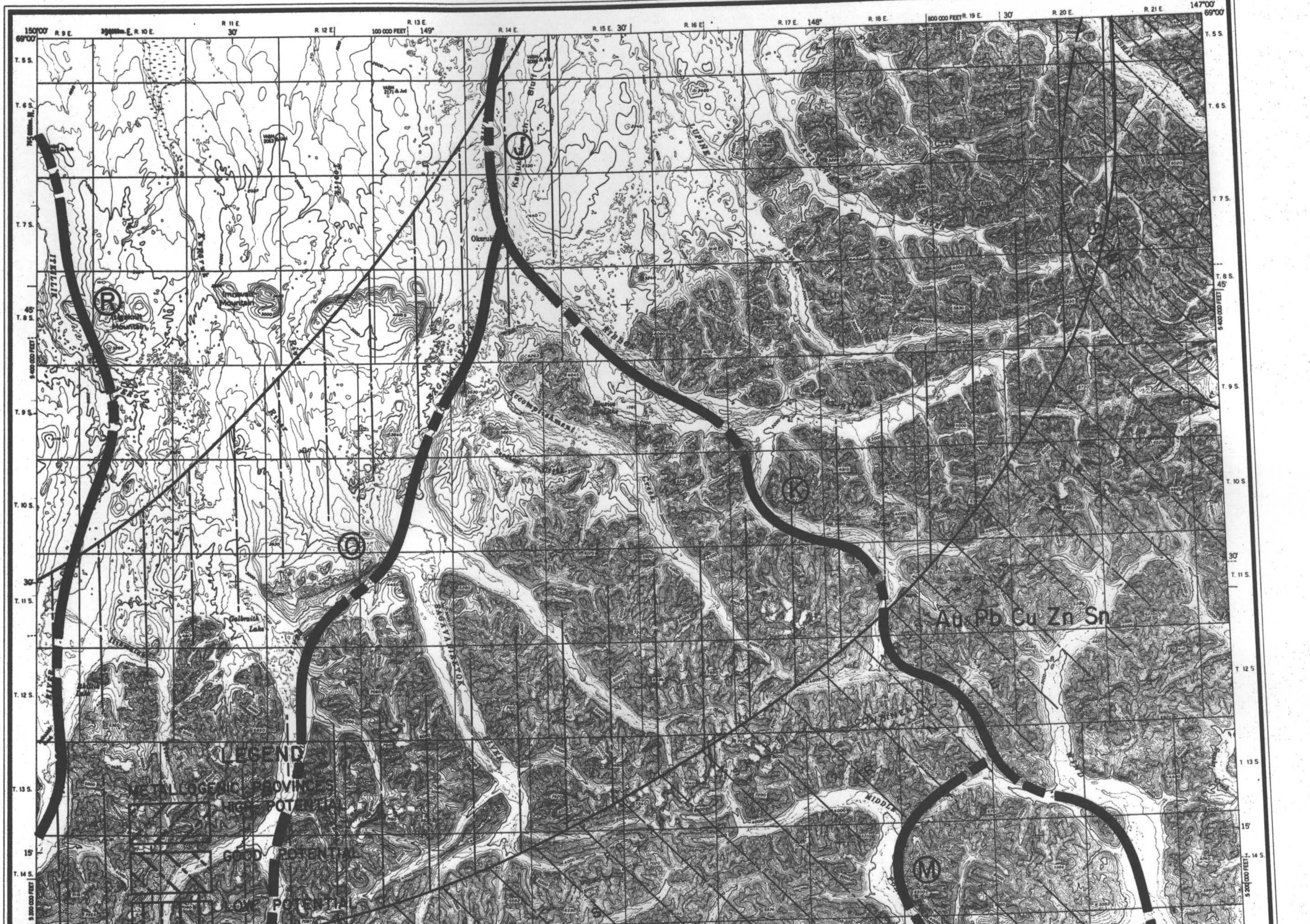
PHILIP SMITH MOUNTAINS



QUADRANGLE: Sagavanirktok

GEOLOGY: Predominantly sandstone, graywacke and shales changing to nonmarine rocks towards the north. Northern half covered by beach and terrace deposits and alluvium. Southeastern quarter consists of limestones and other marine deposits

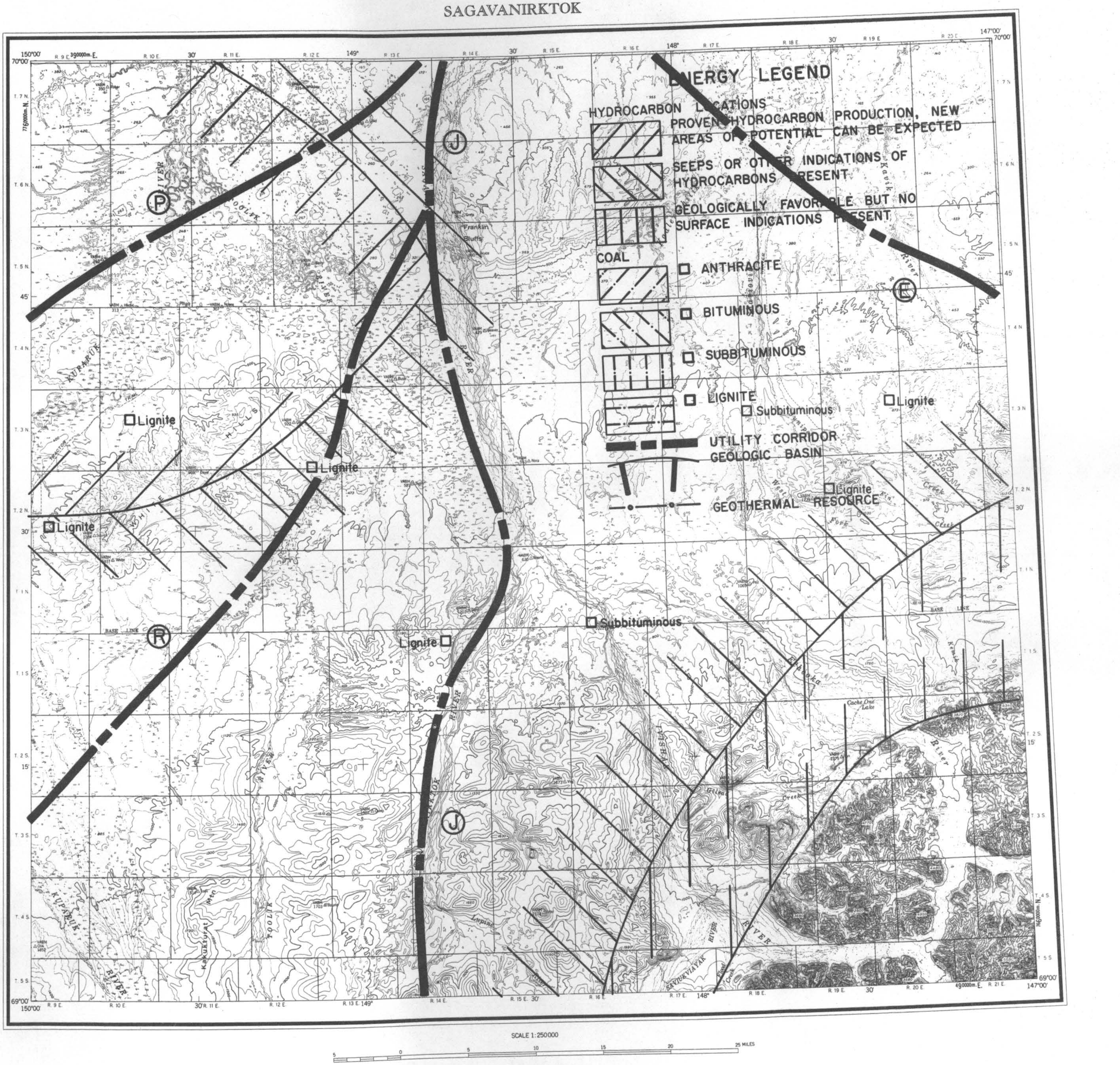
MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: None

MINERAL POTENTIAL WITHIN THE QUADRANGLE:

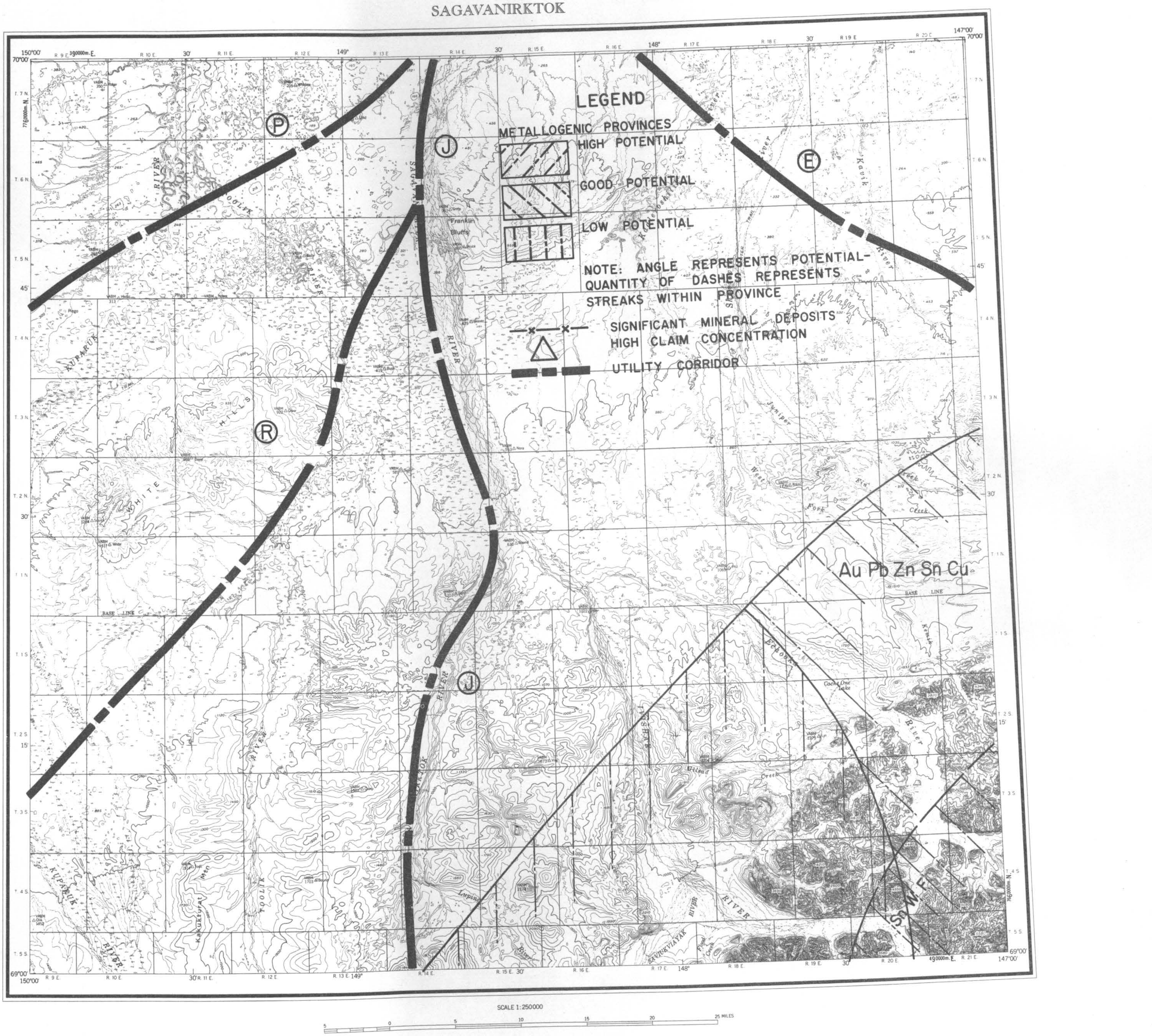
Oil and gas	Northwestern quarter has proven production or high potential; remaining areas have good potential based on oil seeps or other indications
Coal	Subbituminous and lignitic coals occur in scattered outcrops over the northern half
Minerals	Southeastern quarter has low to good potential for gold, lead, copper, zinc, tin, tungsten and flourite deposits

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	The potential is high for the development of hydrocarbons, particularly natural gas
Coal	The potential for developing a large coal deposit is low
Minerals	The development of small to medium-size copper, lead and zinc deposits in the limestones is considered low


ENERGY LEGEND
HYDROCARBON LOCATIONS
PROVEN HYDROCARBON PRODUCTION, NEW AREAS OF POTENTIAL CAN BE EXPECTED
SEEPS OR OTHER INDICATIONS OF HYDROCARBONS PRESENT
GEOLOGICALLY FAVORABLE BUT NO SURFACE INDICATIONS PRESENT
COAL
ANTHRACITE
BITUMINOUS
SUBBITUMINOUS
LIGNITE
UTILITY CORRIDOR
GEOLOGIC BASIN
GEOTHERMAL RESOURCE
Lignite
Subbituminous
Franklin Bluffs
J
P
E
R
150°00'
149°
148°
147°00'
70°00'
69°00'
SCALE 1:250000
25 MILES

SAGAVANIRKTOK



QUADRANGLE: Selawik

GEOLOGY: Predominantly sandstone and shale mostly covered by alluvium and glacial terrace deposits. Metamorphic and sedimentary rocks interfinger along the northern border

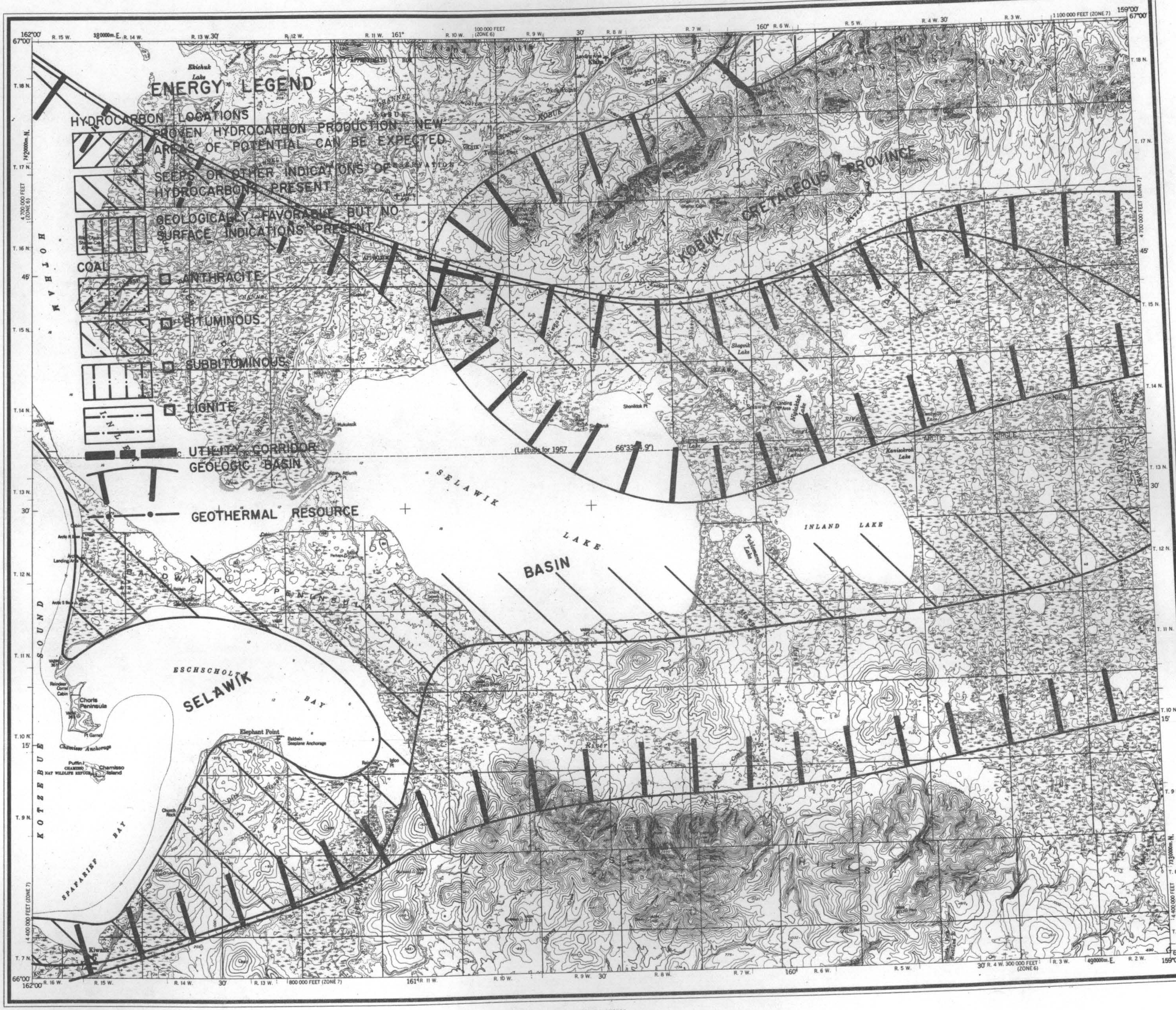
MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $3,100 - placer gold, placer silver

MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	Most of the quadrangle lies within either the Selawik Basin or the Kobuk Cretaceous Province. Much of the Selawik Basin has good potential for oil and gas although no surface indications are present
Coal	No surface exposures known; may occur in areas favorable for oil and gas
Minerals	The northern border has high potential for gold, antimony and tungsten. The central area has good potential for tin, tungsten and fluorite. The southern quarter has good potential for gold, lead, silver, tungsten and mercury as well as sedimentary uranium and thorium

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	Unknown; little exploration to date
Minerals	Unknown; little exploration to date


ENERGY LEGEND
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SEEPS OR OTHER INDICATIONS OF HYDROCARBONS PRESENT
GEOLOGICALLY FAVORABLE BUT NO SURFACE INDICATIONS PRESENT
COAL
ANTHRACITE
BITUMINOUS
SUBBITUMINOUS
LIGNITE
UTILITY CORRIDOR
GEOLOGIC BASIN
GEOTHERMAL RESOURCE
KOBUK CRETACEOUS PROVINCE
SELAWIK LAKE BASIN
SELAWIK
SELAWIK LAKE
INLAND LAKE
ESCHSCHOLTZ BAY
KOTZEBUE SOUND
HOTHAM INLET
BALDWIN PENINSULA
Choris Peninsula
Elephant Point
Chamisso Island
SPAFARIEF BAY
(Latitude for 1957
SCALE 1:250 000
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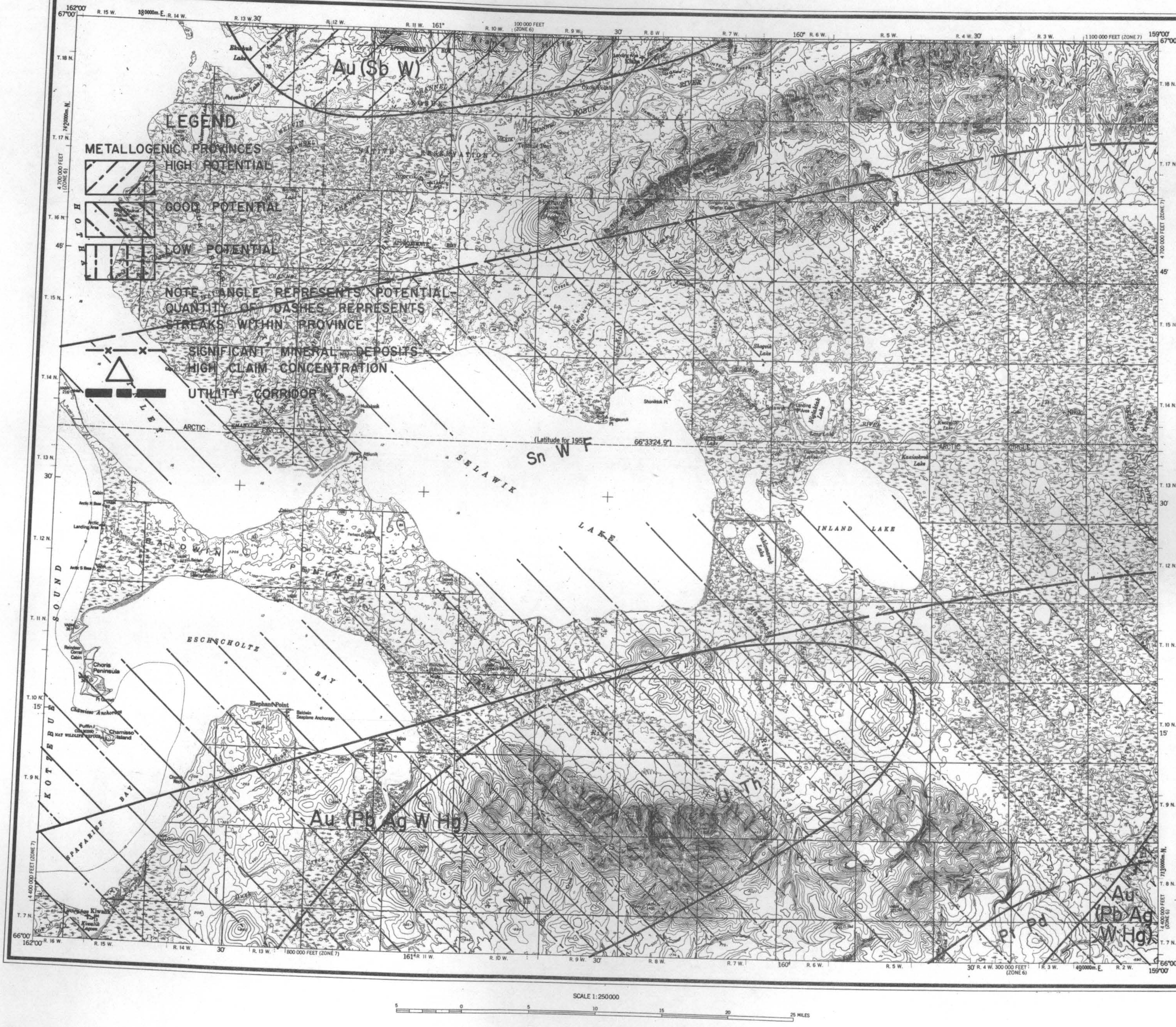
SELAWIK



LEGEND
METALLOGENIC PROVINCES
HIGH POTENTIAL
GOOD POTENTIAL
LOW POTENTIAL
NOTE: ANGLE REPRESENTS POTENTIAL-
QUANTITY OF DASHES REPRESENTS
STREAKS WITHIN PROVINCE
SIGNIFICANT MINERAL DEPOSITS
HIGH CLAIM CONCENTRATION
UTILITY CORRIDOR
Au (Sb W)
Sn W F
Au (Pb Ag W Hg)
U Th
Pt Pd
Au (Pb Ag W Hg)
SELAWIK LAKE
INLAND LAKE
ESCHSCHOLTZ BAY
BALDWIN PENINSULA
HOTHAM INLET
KOTZEBUE SOUND
SPAFARIEF BAY
ARCTIC CIRCLE
Elephant Point
Chamisso Island
Choris Peninsula
Kiwalik
SCALE 1:250000

QUADRANGLE: Seldovia

GEOLOGY: Most of the land consists of sandstones and shales with minor amounts of conglomerate and volcanic. The northcentral area is overlain by glacial and glaciofluvial deposits

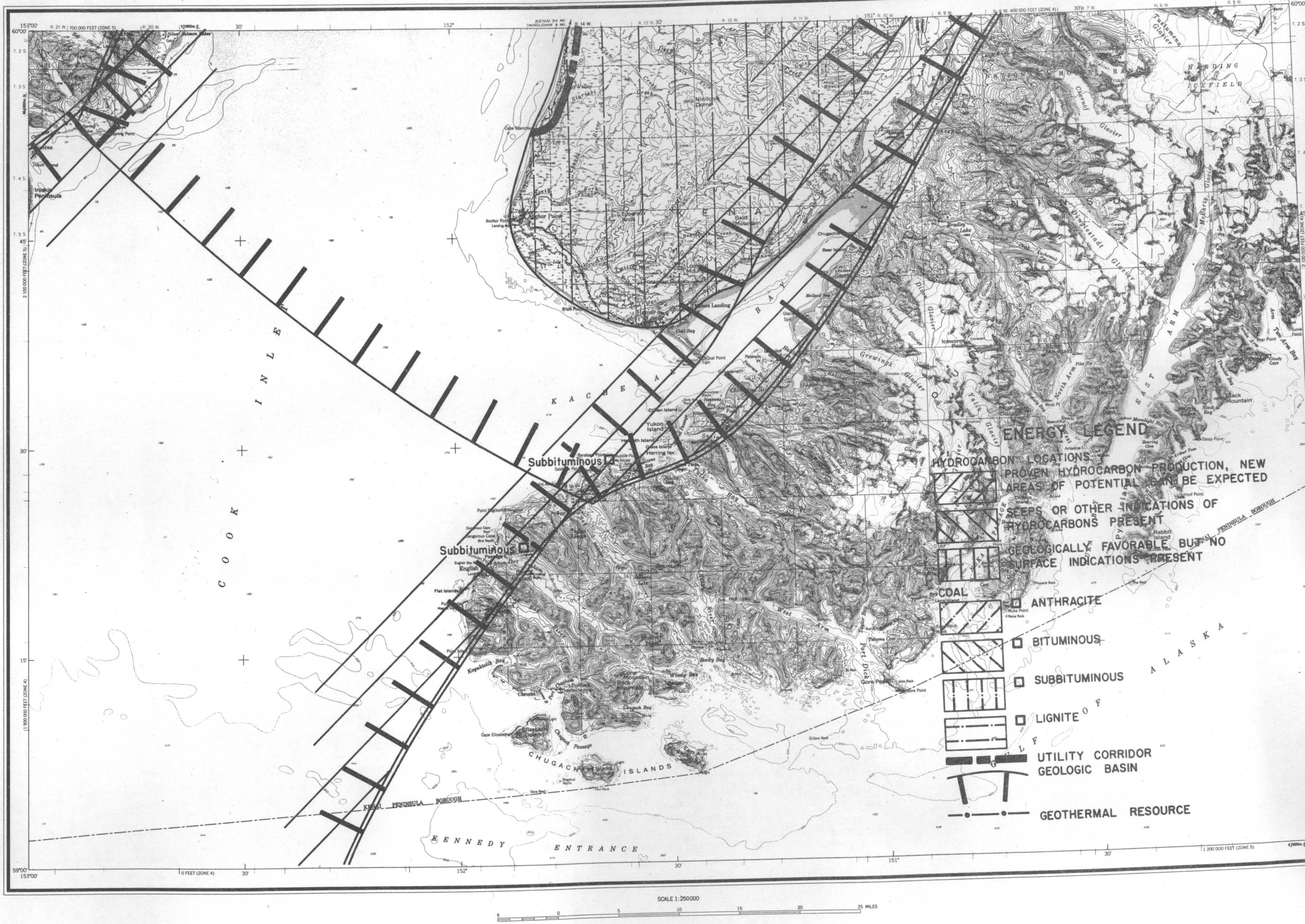
MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $2,312,600 - chromite, lode gold, coal, lode silver, lead, copper

MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The northwestern two-thirds are part of the Cook Inlet Mesozoic Province and Cook Inlet Tertiary Province. This area has proven production potential
Coal	The northcentral area is underlain by subbituminous coal
Minerals	The eastern third has good potential for copper, gold, lead, zinc, silver and tungsten. The central third has good potential for uranium

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	The potential for offshore development is high
Coal	Approximately 235 million tons of subbituminous coal occurs in the corridor. The potential for large underground mines is good
Minerals	The potential for mineral development north of Homer is low


ENERGY LEGEND
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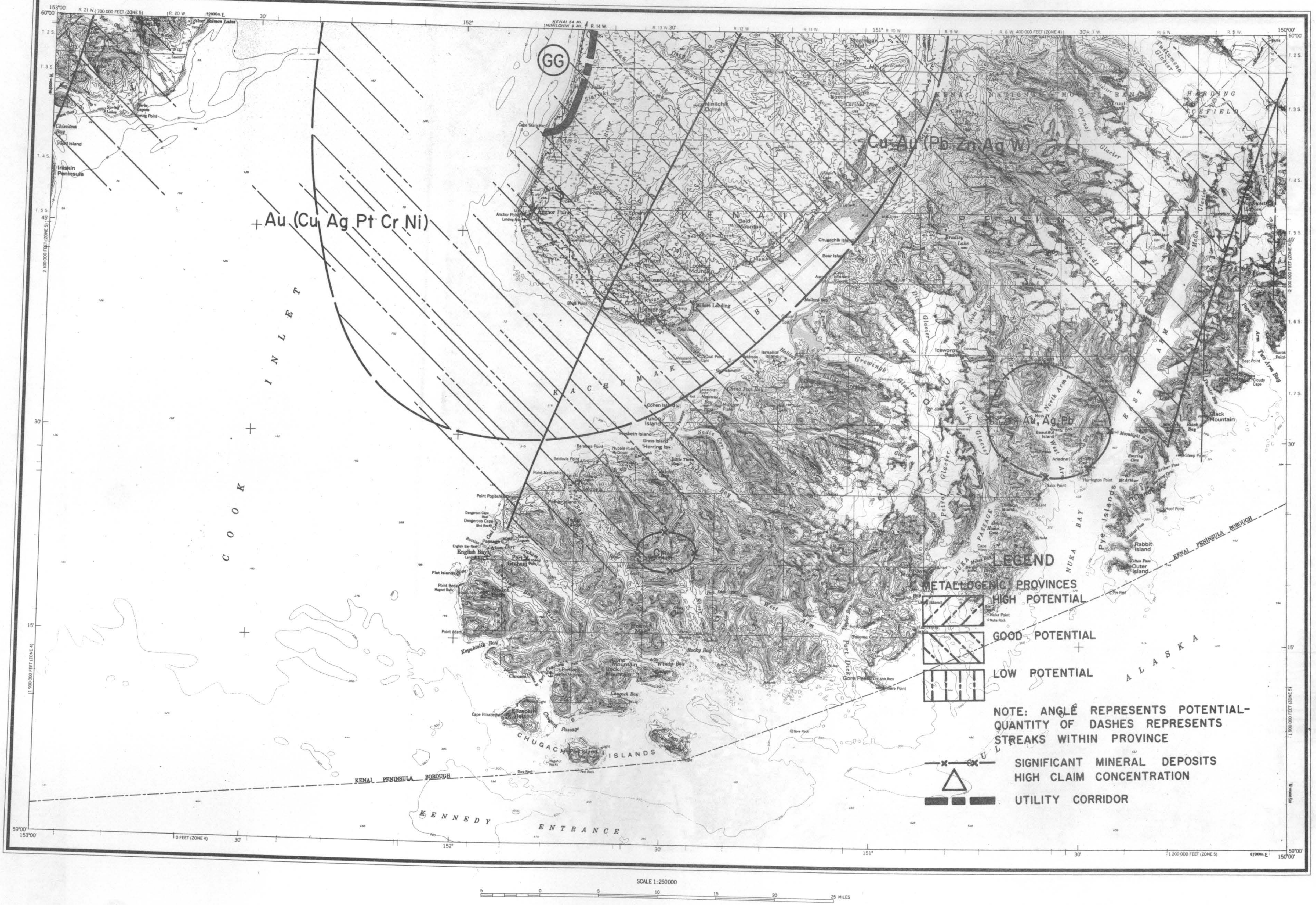
PROVEN HYDROCARBON PRODUCTION, NEW AREAS OF POTENTIAL CAN BE EXPECTED
SEEPS OR OTHER INDICATIONS OF HYDROCARBONS PRESENT
GEOLOGICALLY FAVORABLE BUT NO SURFACE INDICATIONS PRESENT
COAL
ANTHRACITE
BITUMINOUS
SUBBITUMINOUS
LIGNITE
UTILITY CORRIDOR
GEOLOGIC BASIN
GEOTHERMAL RESOURCE
Subbituminous
Subbituminous
COOK INLET
KACHEMAK BAY
KENAI PENINSULA
KENNEDY ENTRANCE
CHUGACH ISLANDS
GULF OF ALASKA
HARDING ICEFIELD
EAST ARM
SCALE 1:250 000
25 MILES

SELDOVIA


GG
Au (Cu Ag Pt Cr Ni)
Cu Au (Pb Zn Ag W)
Au, Ag, Pb
Cr
COOK INLET
KACHEMAK BAY
KENAI PENINSULA
KENNEDY ENTRANCE
CHUGACH ISLANDS
KENAI PENINSULA BOROUGH
GULF OF ALASKA
LEGEND
METALLOGENIC PROVINCES
HIGH POTENTIAL
GOOD POTENTIAL
LOW POTENTIAL
NOTE: ANGLE REPRESENTS POTENTIAL-
QUANTITY OF DASHES REPRESENTS
STREAKS WITHIN PROVINCE
SIGNIFICANT MINERAL DEPOSITS
HIGH CLAIM CONCENTRATION
UTILITY CORRIDOR
SCALE 1:250000
25 MILES

QUADRANGLE: Seward

GEOLOGY: Predominantly sandstone and shale with minor amounts of conglomerate, volcanic rocks and limestone. Some intrusive granitic rocks occur

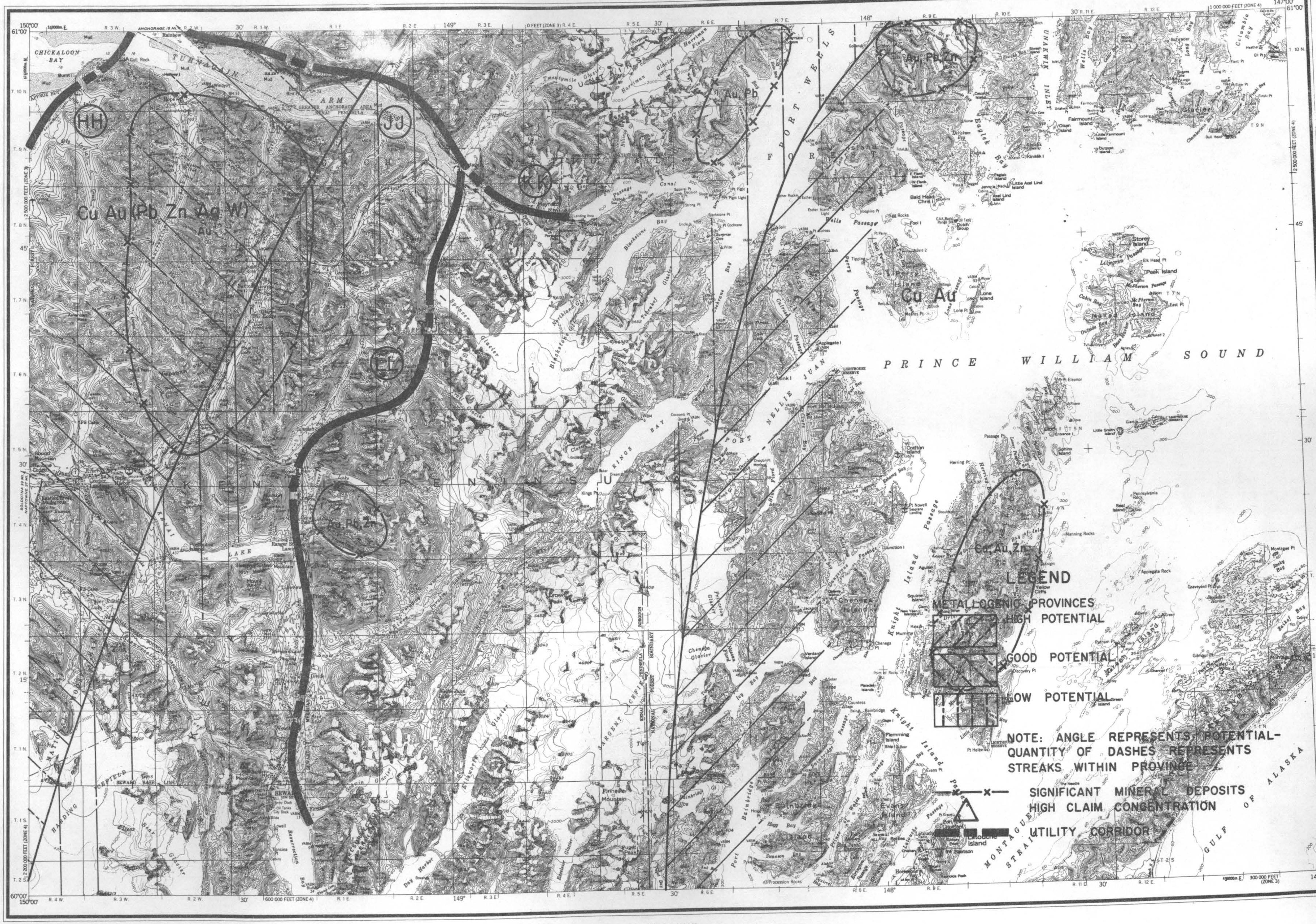
MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $36,418,900 - copper, placer gold, lode gold, lode silver, placer silver, lead

MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	None
Coal	None
Minerals	The northwestern quarter has good potential for copper, gold, lead, zinc, silver and tungsten. The eastern third has a high potential for copper and gold

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	None
Coal	None
Minerals	The potential for small copper, gold and silver deposits is fair



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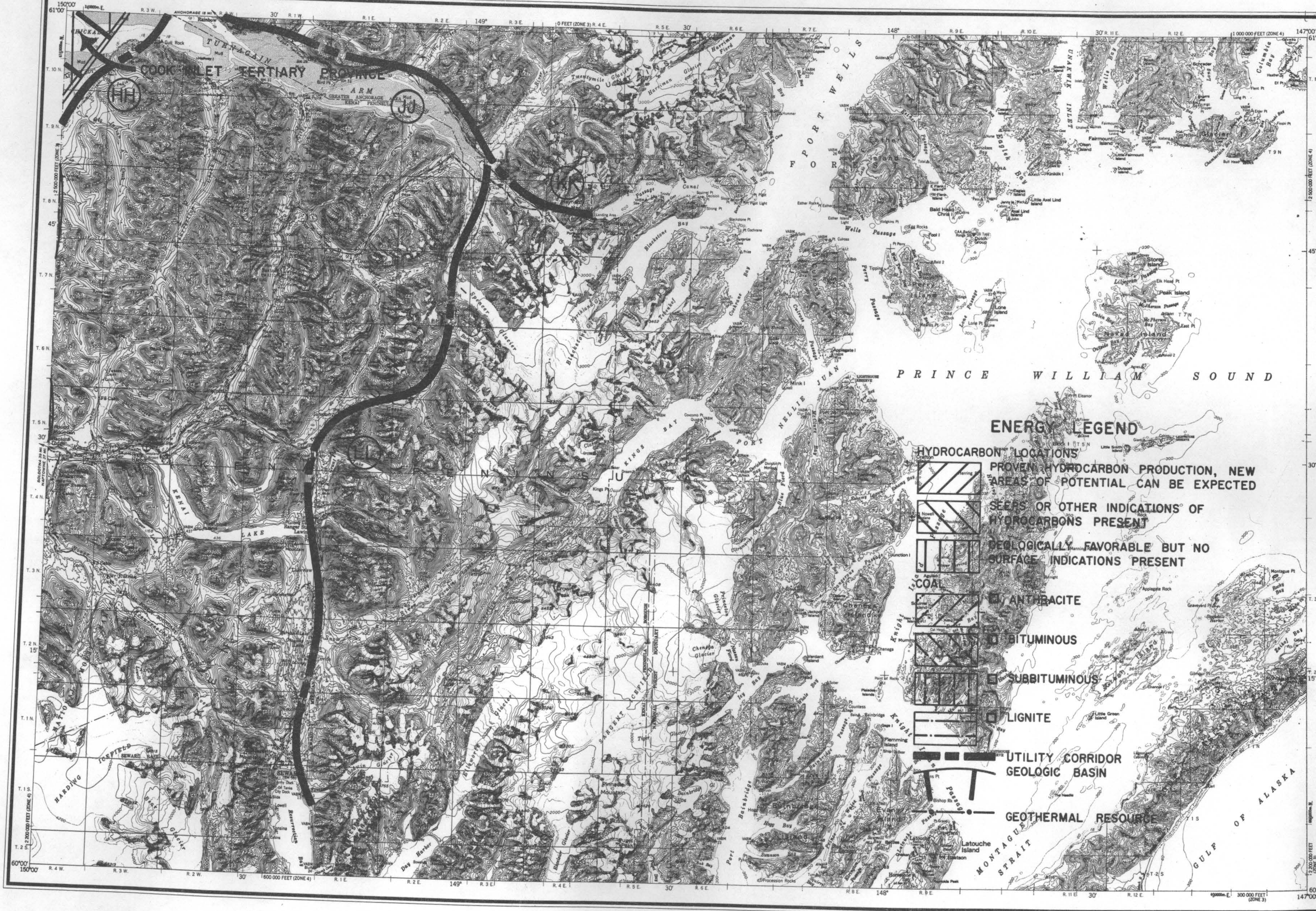

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QUADRANGLE: Shungnak

GEOLOGY: Predominantly sandstone and shale mostly covered by alluvium and glacial terrace deposits. Metamorphic and sedimentary rocks interfinger in the northeast

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $183,600 - placer gold, placer silver

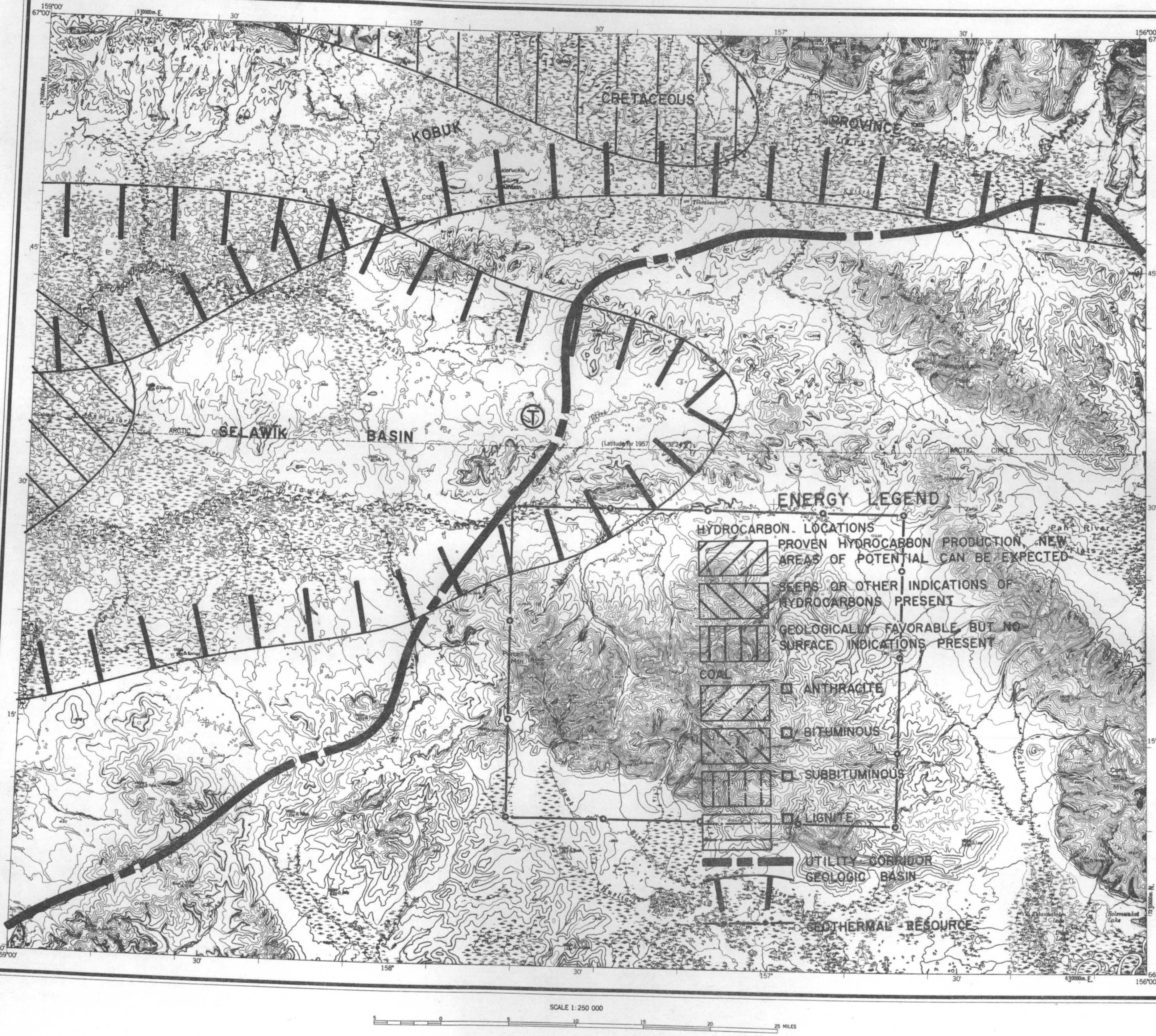
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The northern quarter and westcentral border are contained in sedimentary basins which may hold some potential
Coal	No surface exposures known; may occur in areas favorable for oil and gas
Minerals	The northern quarter has little potential, but most of the remaining area has good potential for gold, lead, silver, tungsten and mercury. The central half has good potential for tin, tungsten and fluorite, and for uranium and thorium

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

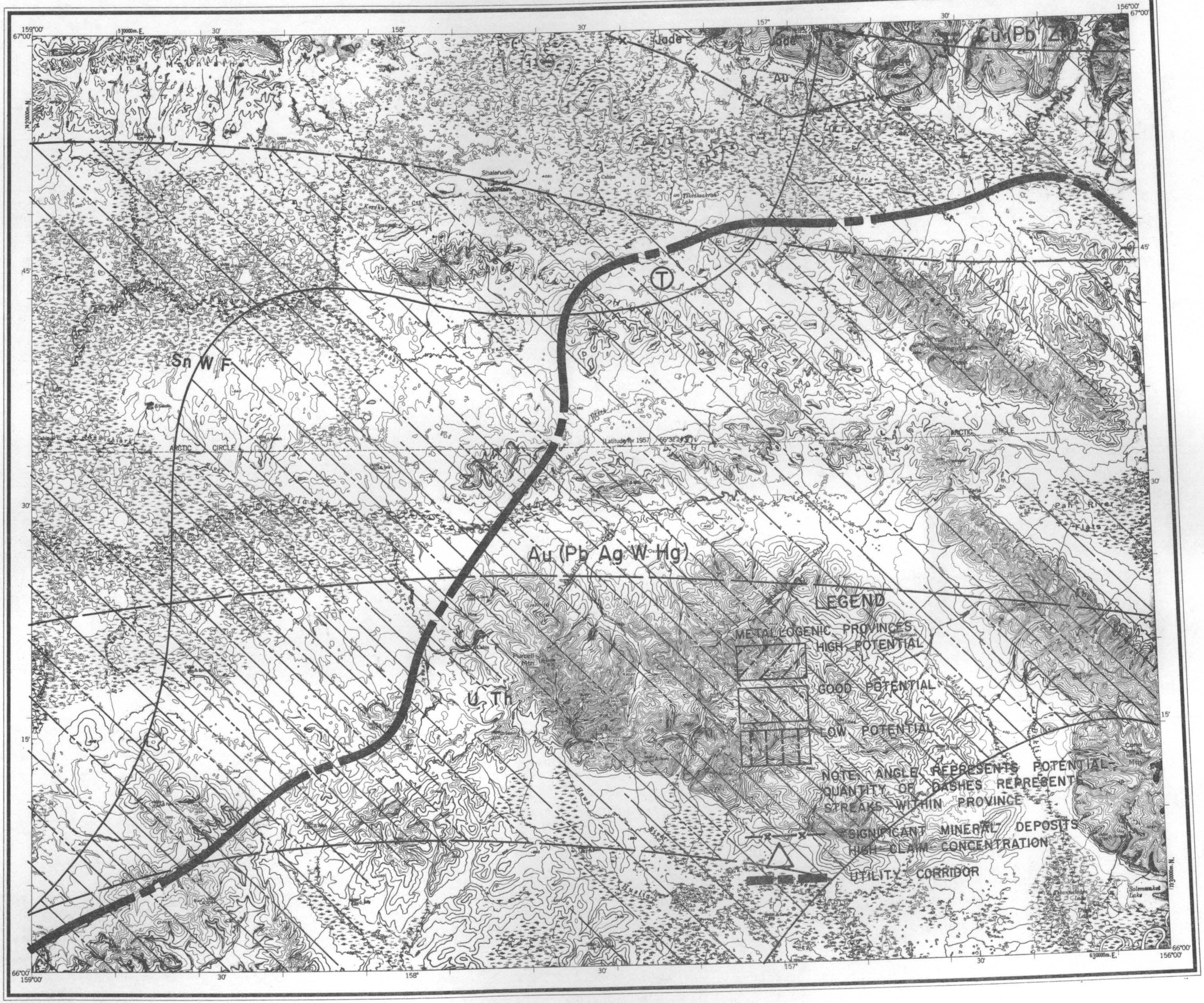
Oil and gas	Unknown; little exploration to date
Coal	Unknown; little exploration to date
Minerals	The development of large, low-grade gold deposits associated with intrusives is rated good. Large, low-grade uranium deposits of either intrusive or sedimentary origin is rated fair

SHUNGNAK



KOBUK
CRETACEOUS
PROVINCE
SELAWIK
BASIN
ARCTIC CIRCLE
ENERGY LEGEND
HYDROCARBON LOCATIONS
PROVEN HYDROCARBON PRODUCTION, NEW AREAS OF POTENTIAL CAN BE EXPECTED
SEEPS OR OTHER INDICATIONS OF HYDROCARBONS PRESENT
GEOLOGICALLY FAVORABLE, BUT NO SURFACE INDICATIONS PRESENT
COAL
ANTHRACITE
BITUMINOUS
SUBBITUMINOUS
LIGNITE
UTILITY CORRIDOR
GEOLOGIC BASIN
GEOTHERMAL RESOURCE
SCALE 1:250 000
25 MILES

SHUNGNAK



SCALE 1:250 000

5 0 5 10 15 20 25 MILES

QUADRANGLE: Solomon

GEOLOGY: Predominantly metamorphic rocks with scattered granitic intrusions

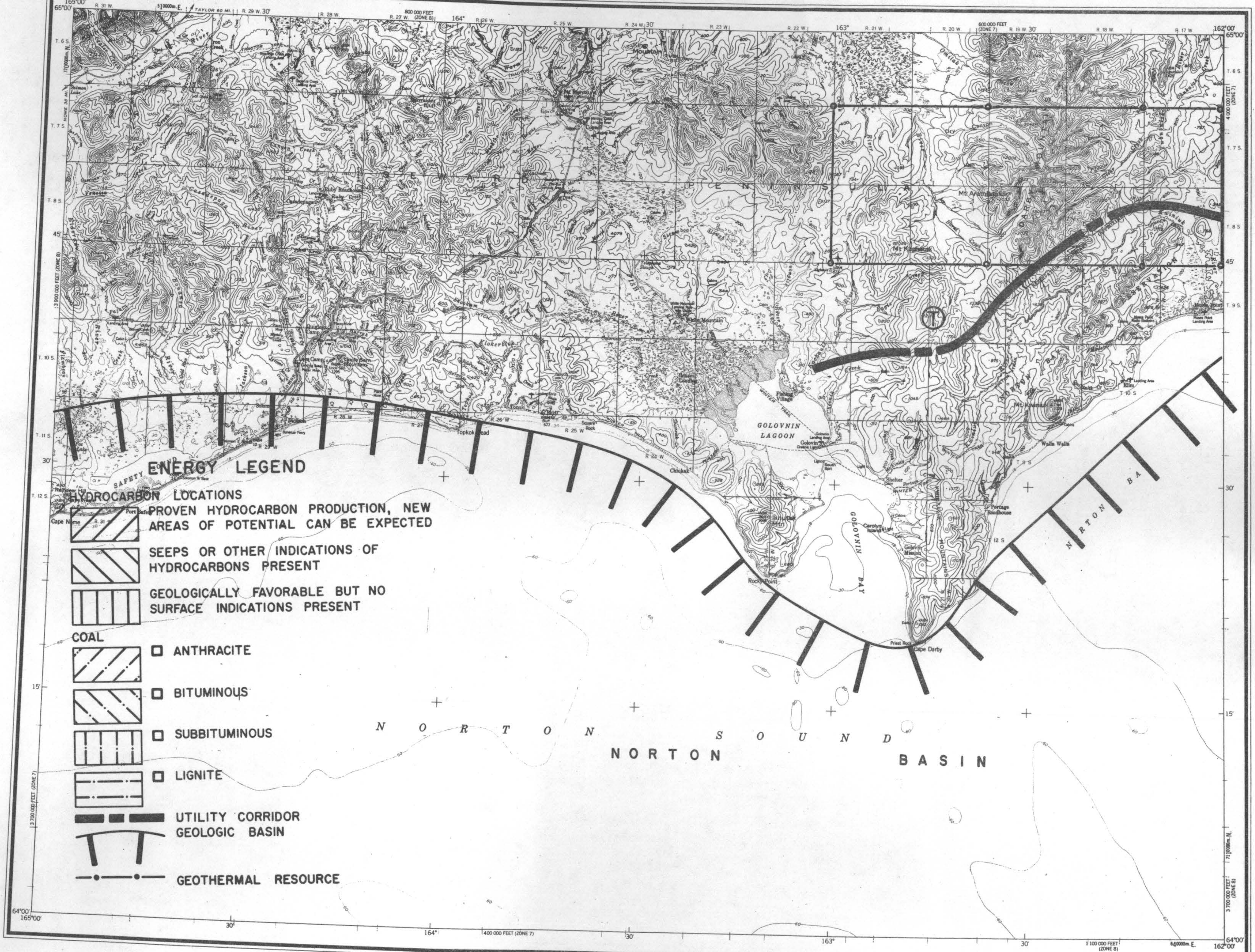
MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $26,134,700 - placer gold, placer silver, lode gold, lode silver, copper, lead

MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	None
Coal	None
Minerals	There is a good potential for gold, lead, silver, tungsten and mercury in the western two thirds, and good potential for uranium and thorium in the eastern third. The western two thirds have been an important past placer gold producing area

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	None
Coal	None
Minerals	The potential for continued placer gold development along the western boundary of the pipeline corridor is high



SCALE 1:250000

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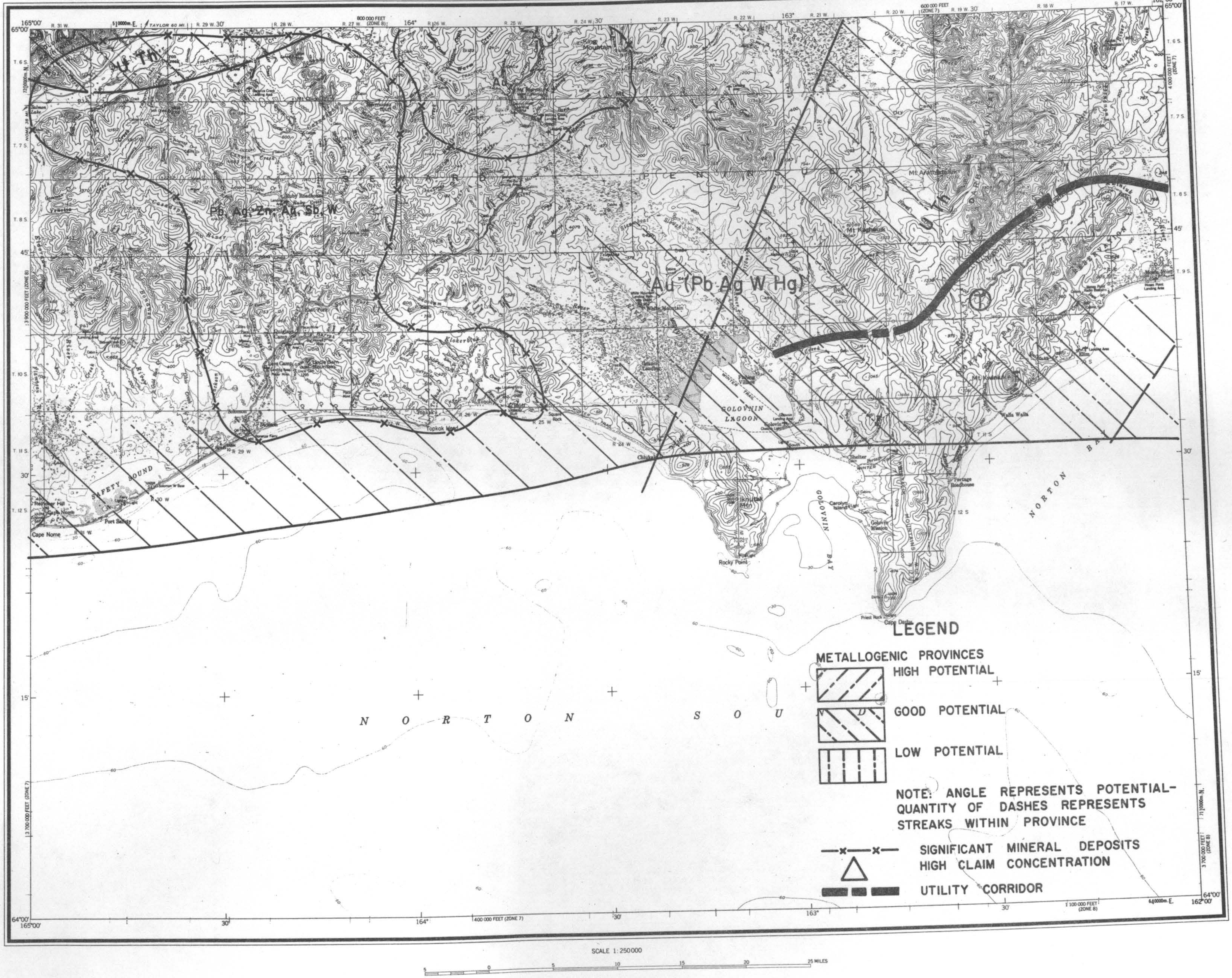
SOLOMON


U Th
Ag
Pb, Ag, Zn, Ag, Sb, W
Au (Pb Ag W Hg)
GOLOVNIN LAGOON
GOLOVNIN BAY
SAFETY SOUND
NORTON BAY
N O R T O N S O U
LEGEND
METALLOGENIC PROVINCES
HIGH POTENTIAL
GOOD POTENTIAL
LOW POTENTIAL
NOTE: ANGLE REPRESENTS POTENTIAL-QUANTITY OF DASHES REPRESENTS STREAKS WITHIN PROVINCE
SIGNIFICANT MINERAL DEPOSITS
HIGH CLAIM CONCENTRATION
UTILITY CORRIDOR
SCALE 1:250000
MILES

QUADRANGLE: Survey Pass

GEOLOGY: Predominantly limestone and marine clastic rocks. The southern quarter has a belt of metamorphic rocks trending east-west. Mafic and ultramafic rocks occur along the southern border

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $28,300 - lode gold, lode placer

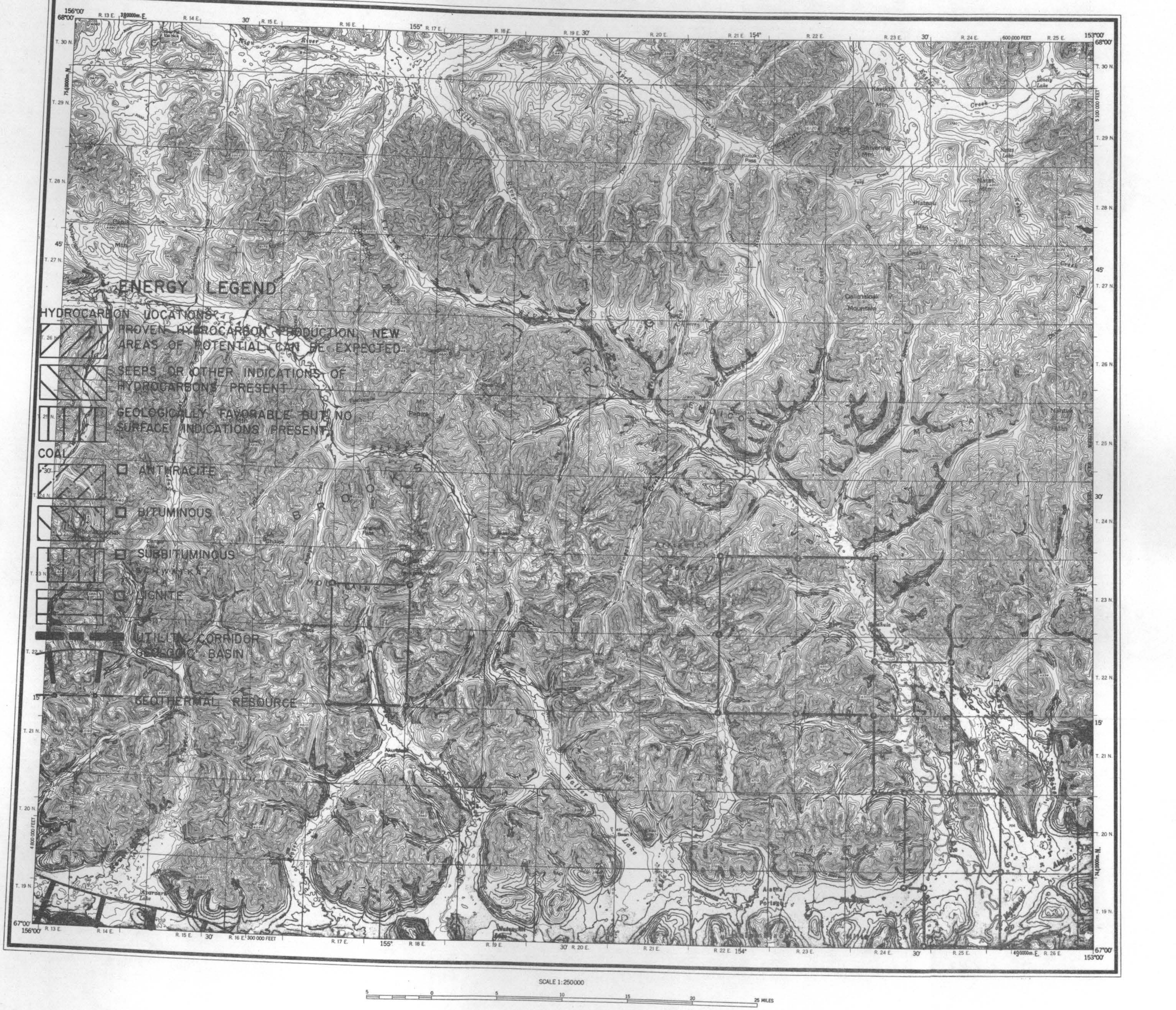
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	None
Coal	None
Minerals	The northern quarter has good potential for nickel, chromium, copper, platinum and zinc. The middle half has high potential for gold, antimony and tungsten. The southern quarter has high potential for copper, lead and zinc

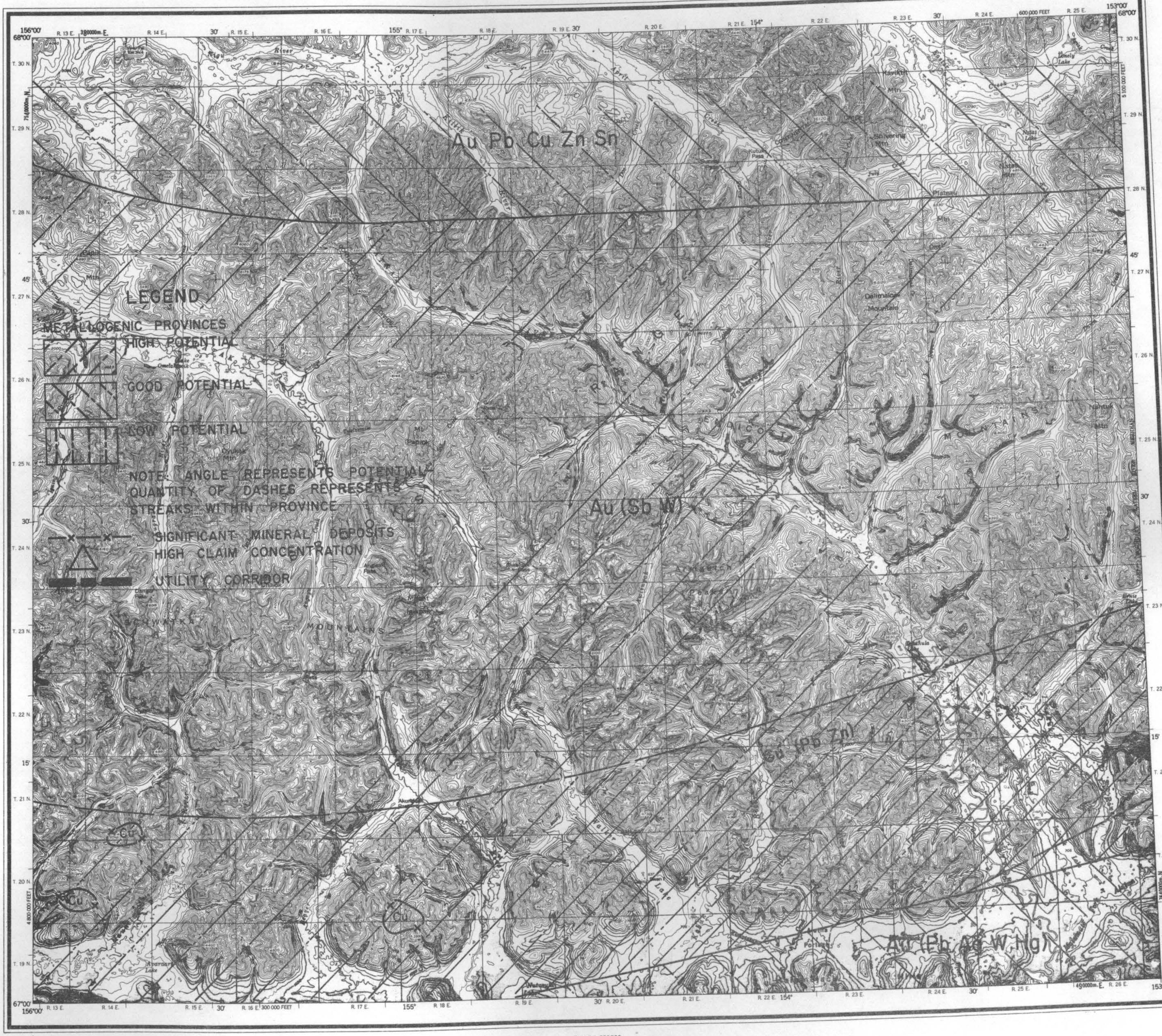
POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	None
Coal	None
Minerals	The potential for medium-size, high-grade copper-zinc-silver deposits associated with the metamorphic rocks is high. The potential for medium-size, high-grade copper-zinc deposits in limestones is considered fair

SURVEY PASS


ENERGY LEGEND
HYDROCARBON LOCATIONS
PROVEN HYDROCARBON PRODUCTION, NEW AREAS OF POTENTIAL CAN BE EXPECTED
SEEPS OR OTHER INDICATIONS OF HYDROCARBONS PRESENT
GEOLOGICALLY FAVORABLE BUT NO SURFACE INDICATIONS PRESENT
COAL
ANTHRACITE
BITUMINOUS
SUBBITUMINOUS
LIGNITE
UTILITY CORRIDOR
GEOLOGIC BASIN
GEOTHERMAL RESOURCE
BROOKS RANGE
SCALE 1:250000
25 MILES

SURVEY PASS



SCALE 1:250000

5 0 5 10 15 20 25 MILES

QUADRANGLE: Table Mt.

GEOLOGY: Predominantly sedimentary rocks of limestone, dolomite and shale. Granitic intrusives occur along the eastern border

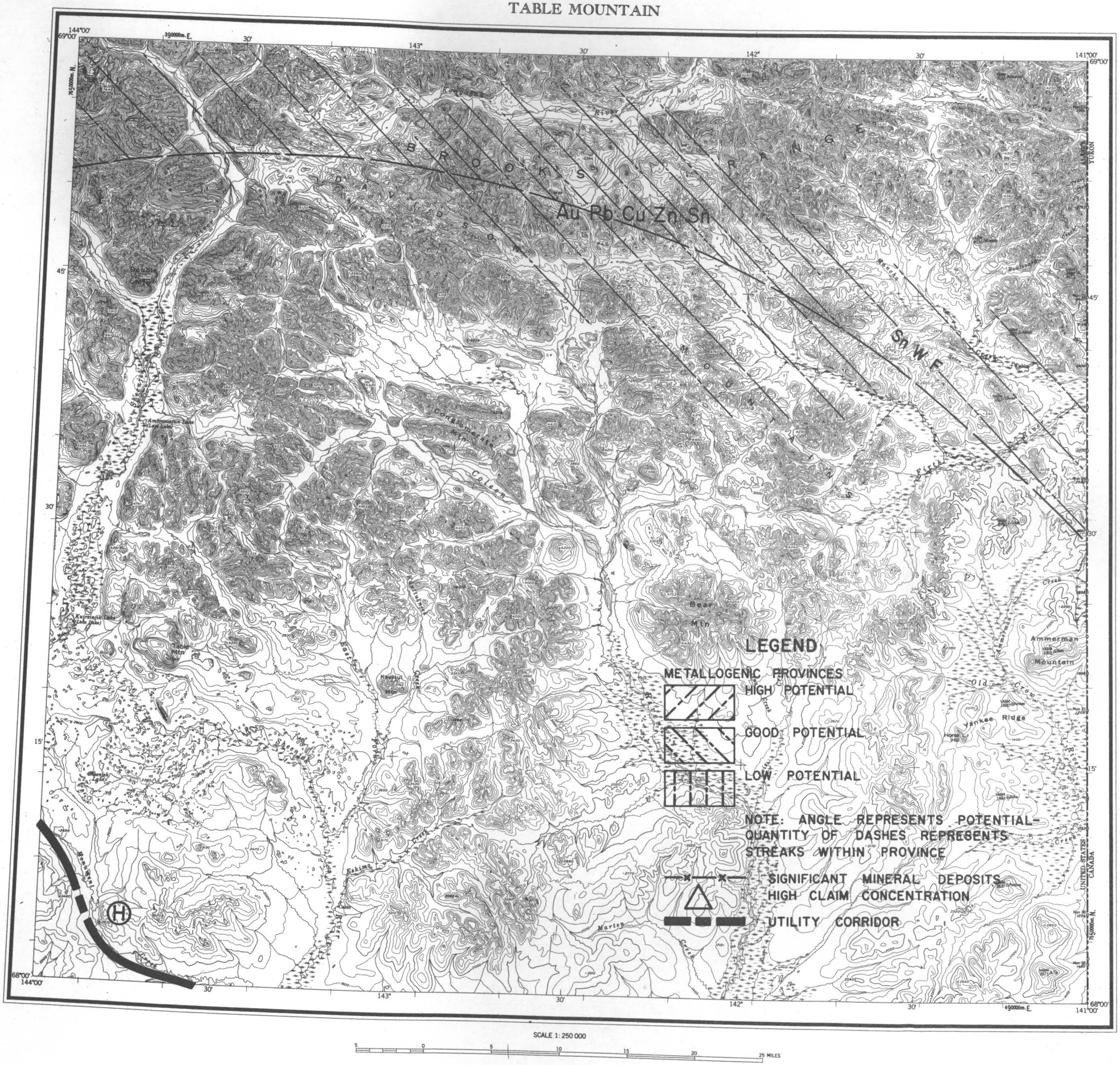
MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: None

MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	None
Coal	None
Minerals	The northern quarter has good potential for tin, tungsten and fluorite deposits; the southern three quarters have good potential for gold, lead, copper, zinc and tin

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	None
Coal	None
Minerals	Unknown; little exploration to date


BROOKS RANGE
DAVIDSON MOUNTAINS
Au Pb Cu Zn Sn
Sn W F
Table Mtn
Bear Mtn
Ammerman Mountain
Yankee Ridge
Old Crow River
LEGEND
METALLOGENIC PROVINCES
HIGH POTENTIAL
GOOD POTENTIAL
LOW POTENTIAL
NOTE: ANGLE REPRESENTS POTENTIAL-
QUANTITY OF DASHES REPRESENTS
STREAKS WITHIN PROVINCE
SIGNIFICANT MINERAL DEPOSITS
HIGH CLAIM CONCENTRATION
UTILITY CORRIDOR
UNITED STATES
CANADA
ALASKA
YUKON
SCALE 1:250 000
25 MILES

QUADRANGLE: Talkeetna

GEOLOGY: Predominantly sedimentary sandstone, limestones and shales, and minor volcanics associated with granitic intrusives. Large areas are overlain by glacial and glaciofluvial deposits in the southern half

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $7,901,700 - placer gold, placer silver

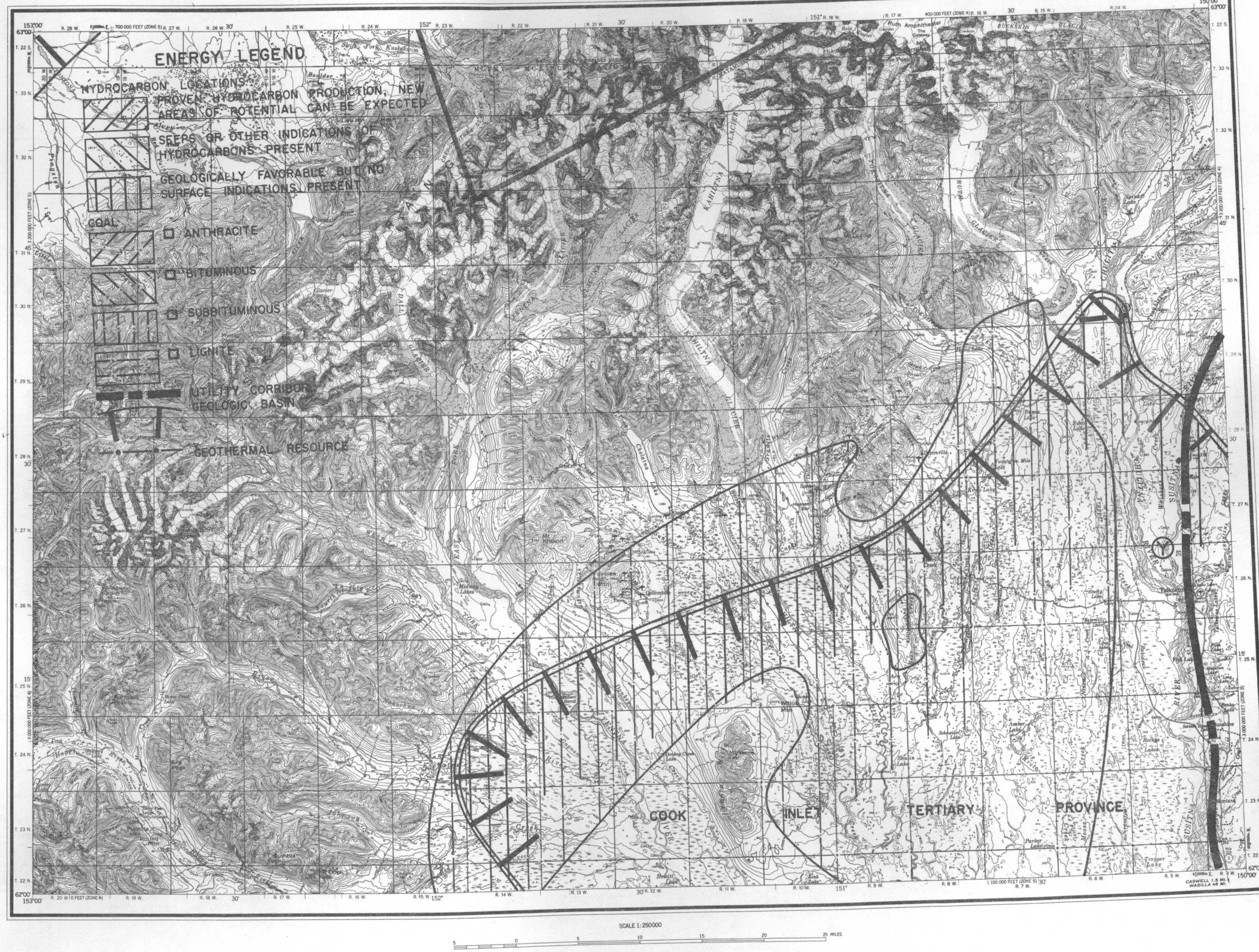
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The Cook Inlet Tertiary Province includes most of the southeastern half and this area is geologically favorable for oil and gas, although no surface indications exist
Coal	Subbituminous coal occurs throughout much of the southeastern half of the quadrangle
Minerals	The northwestern three quarters have a high potential for copper gold, lead, zinc, silver and molybdenum. The southeastern quarter has a good potential for uranium. The central area has been a major placer gold producer

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

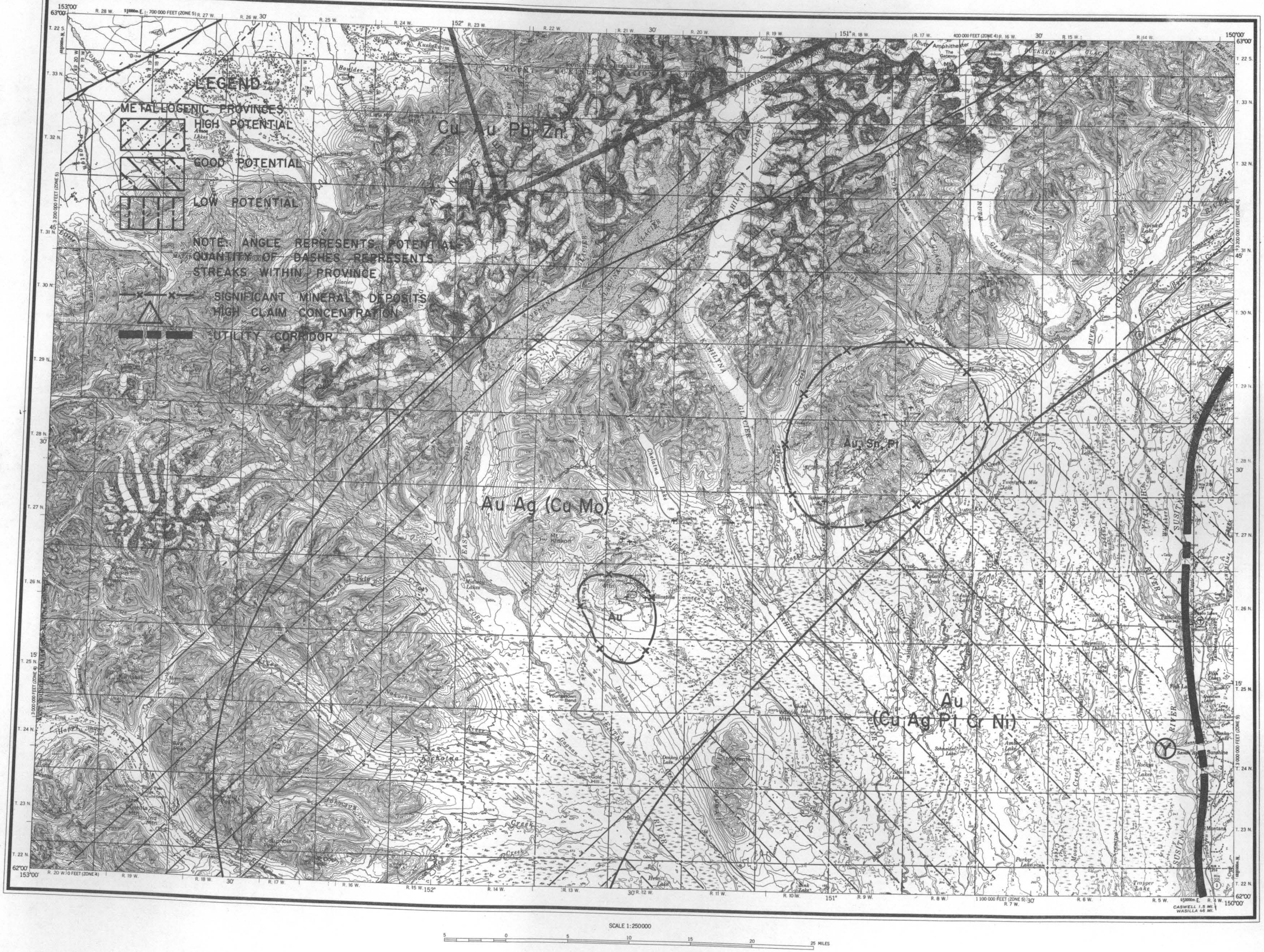
Oil and gas	Unknown; little exploration to date
Coal	Approximately 44 million tons of subbituminous coal occur within the pipeline corridor. The potential for large open pit mines is high
Minerals	The potential for a large, low-grade uranium deposit is considered low

TALKEETNA



ENERGY LEGEND
HYDROCARBON LOCATIONS
PROVEN HYDROCARBON PRODUCTION, NEW AREAS OF POTENTIAL CAN BE EXPECTED
SEEPS OR OTHER INDICATIONS OF HYDROCARBONS PRESENT
GEOLOGICALLY FAVORABLE BUT NO SURFACE INDICATIONS PRESENT
COAL
ANTHRACITE
BITUMINOUS
SUBBITUMINOUS
LIGNITE
UTILITY CORRIDOR
GEOLOGIC BASIN
GEOTHERMAL RESOURCE
COOK INLET TERTIARY PROVINCE
KAHILTNA GLACIER
RUTH GLACIER
SUSITNA RIVER
SCALE 1:250000
25 MILES

TALKEETNA



LEGEND
METALLOGENIC PROVINCES
HIGH POTENTIAL
GOOD POTENTIAL
LOW POTENTIAL
NOTE: ANGLE REPRESENTS POTENTIAL
QUANTITY OF DASHES REPRESENTS
STREAKS WITHIN PROVINCE
SIGNIFICANT MINERAL DEPOSITS
HIGH CLAIM CONCENTRATION
UTILITY CORRIDOR
Cu Au Pb Zn
Au Ag (Cu Mo)
Au, Sn, Pt
Au
Au
(Cu Ag Pt Cr Ni)
SCALE 1:250000
25 MILES

QUADRANGLE: Talkeetna Mts.

GEOLOGY: Predominantly volcanic and granitic intrusive rocks overlain by alluvium, glacial and glaciofluvial deposits

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $132,600 - placer gold, placer silver

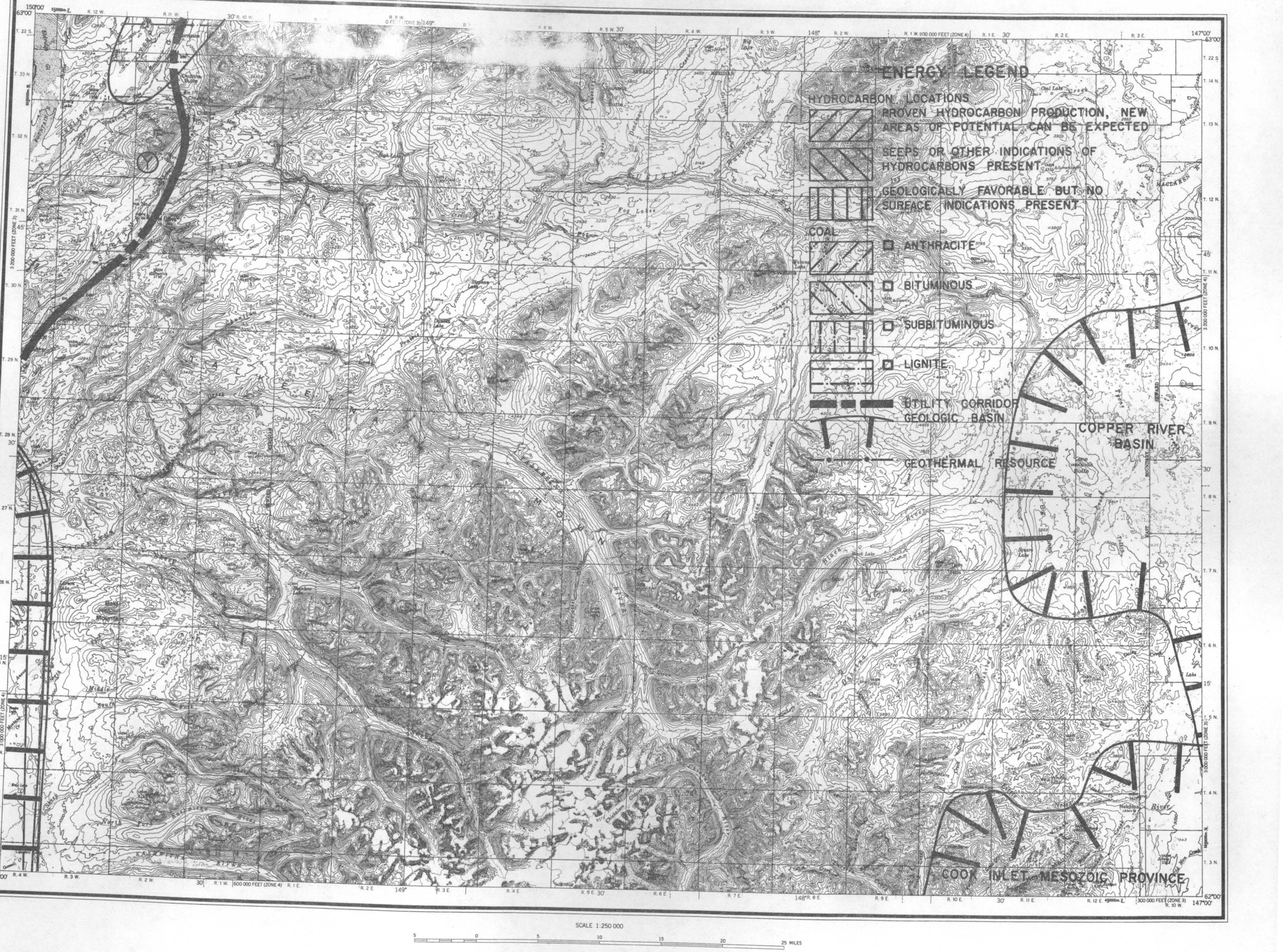
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The western and eastern borders are included in the Cook Inlet Tertiary Province and Copper River Basin, respectively. The western area is geologically favorable for oil and gas, although no surface indications exist
Coal	Lignite deposits occur in the northwestern corner
Minerals	The southeastern half has good potential for gold, copper, silver, lead and zinc while the northwestern half has good potential for gold, copper, silver, platinum, chromium and nickel

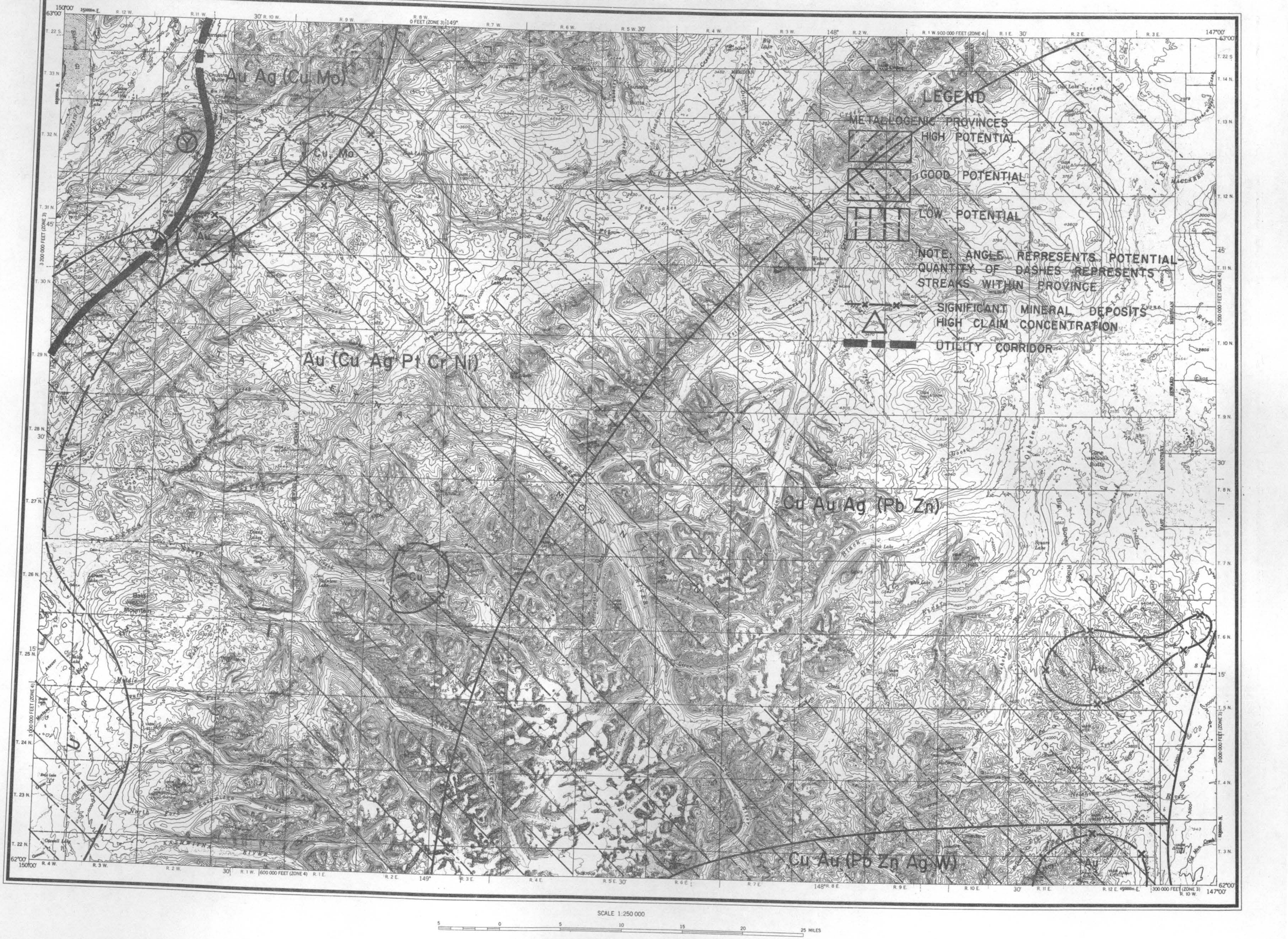
POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	Probably 14 million tons of lignite coals occur within the corridor. The potential for their development is considered low
Minerals	The potential for large, low-grade copper-molybdenum deposits is low

TALKEETNA MOUNTAINS



TALKEETNA MOUNTAINS



QUADRANGLE: Tanacross

GEOLOGY: The northeastern half and southwestern quarter are predominantly metamorphic and volcanic rocks with granitic and small ultramafic intrusives. The remaining area is overlain by alluvium and terrace deposits.

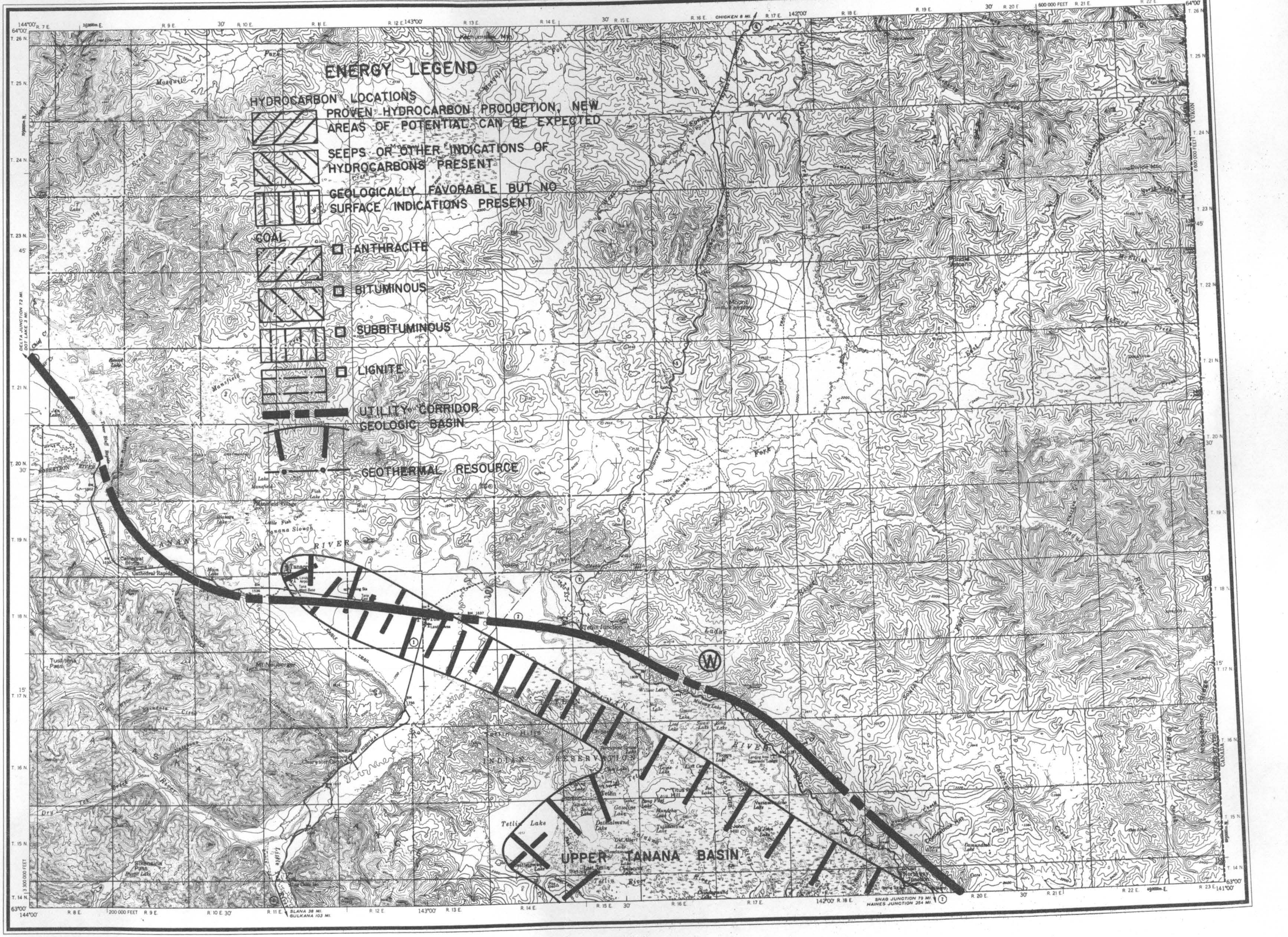
MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $900 - placer gold, placer silver

MINERAL POTENTIAL WITHIN THE QUADRANGLE:

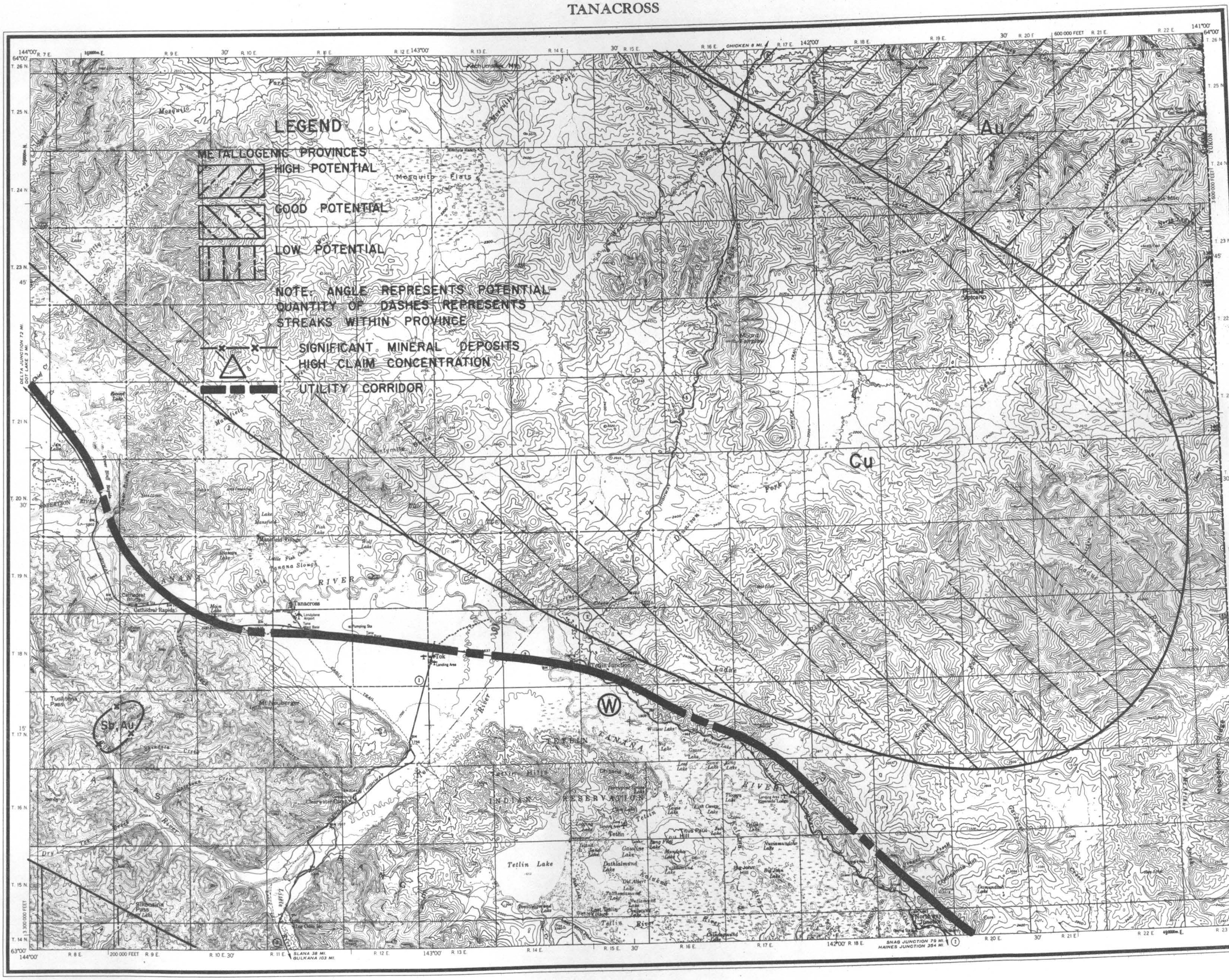
Oil and gas	The Upper Tanana Basin extends into the south-central part of the area, hence oil and gas may have some potential
Coal	No known surface occurrences; may occur in the Upper Tanana Basin
Minerals	The northeastern quarter has good potential for copper

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	Unknown; little exploration to date
Minerals	The potential for several large, low-grade copper-molybdenum deposits is high


ENERGY LEGEND
HYDROCARBON LOCATIONS
PROVEN HYDROCARBON PRODUCTION, NEW AREAS OF POTENTIAL CAN BE EXPECTED
SEEPS OR OTHER INDICATIONS OF HYDROCARBONS PRESENT
GEOLOGICALLY FAVORABLE BUT NO SURFACE INDICATIONS PRESENT
COAL
ANTHRACITE
BITUMINOUS
SUBBITUMINOUS
LIGNITE
UTILITY CORRIDOR
GEOLOGIC BASIN
GEOTHERMAL RESOURCE
UPPER TANANA BASIN
SCALE 1:250000
25 MILES

TANACROSS



SCALE 1:250000

5 0 5 10 15 20 25 MILES

QUADRANGLE: Tanana

GEOLOGY: Predominantly metamorphic rocks intruded by granitics and overlain by granitic volcanics. Large, ultramafic intrusives occur in the northern area. Alluvium covers much of the area along major drainages. Sedimentary rocks are scattered

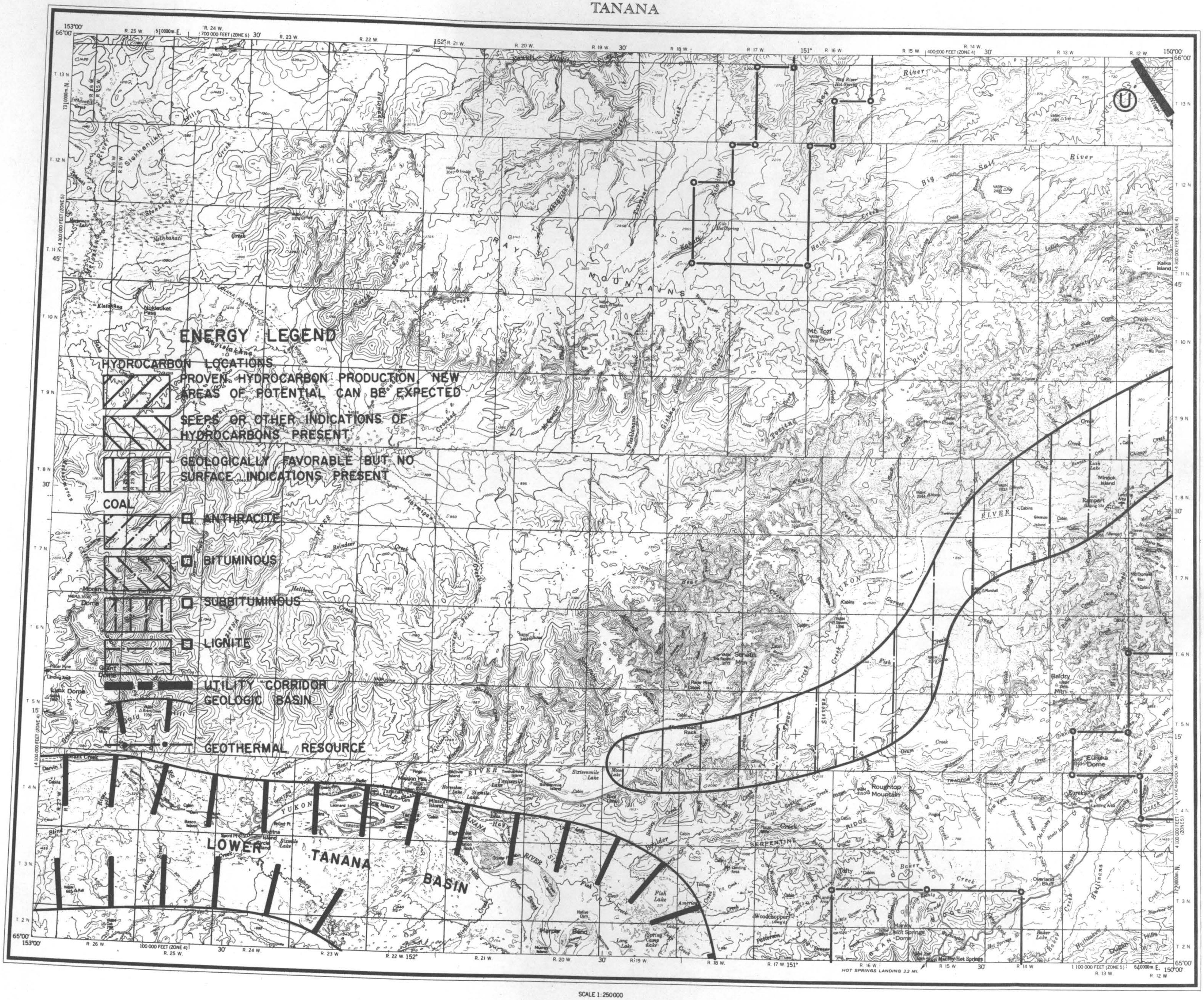
MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $10,092,900 - placer gold, tin, placer silver

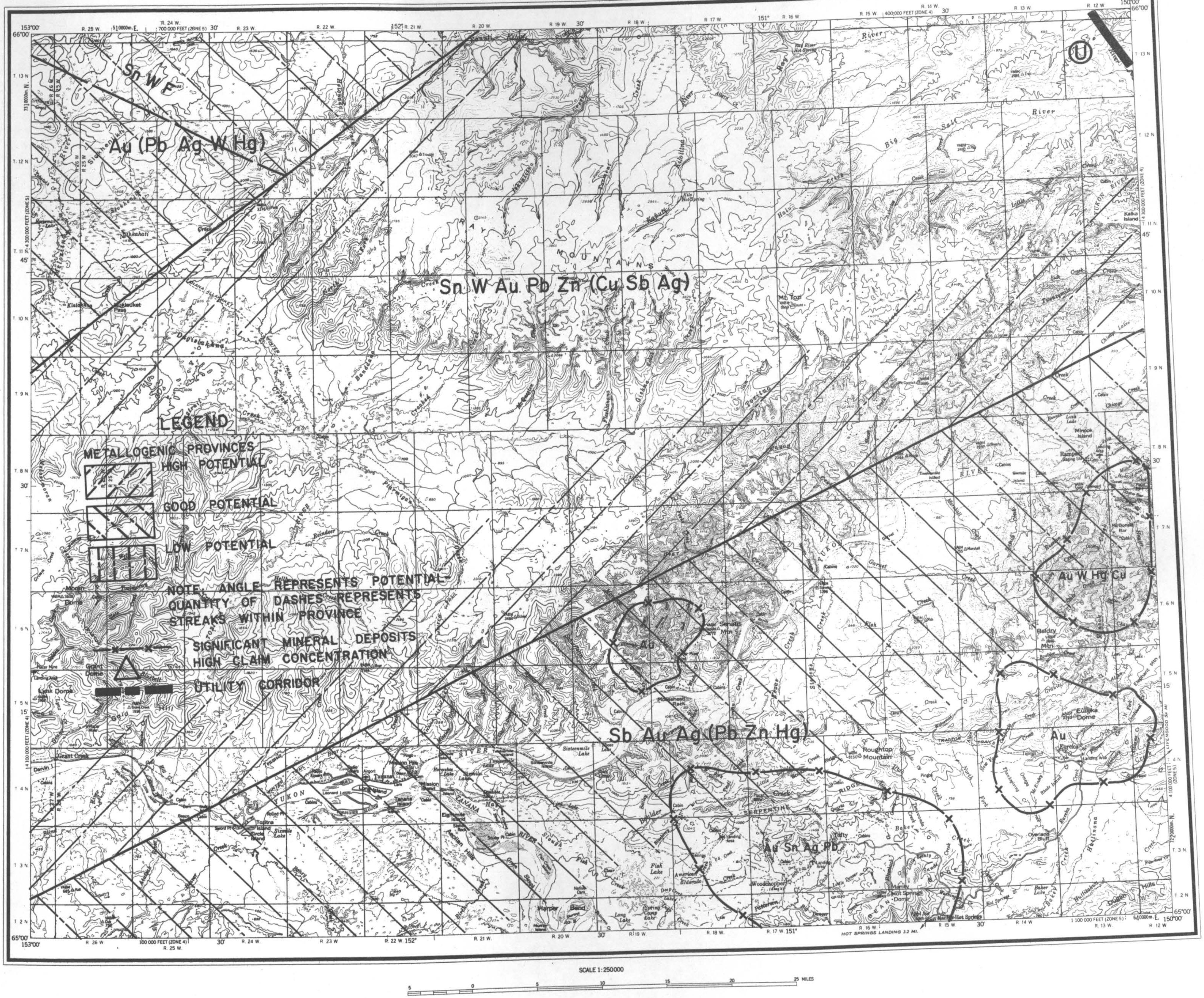
MINERAL POTENTIAL WITHIN THE QUADRANGLE

Oil and gas	The Lower Tanana Basin encompasses the southwestern quarter, hence oil and gas may have potential
Coal	A long trend of subbituminous coal occurs in the eastern half
Minerals	The northwestern half has high potential for tin, tungsten, gold, lead, zinc, copper, antimony and silver. The southeastern half has good potential for antimony, gold, silver, lead, zinc and mercury. The southeastern quarter has been a past placer gold producer

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	Unknown; little exploration to date
Minerals	The potential for small, medium, and large placer gold producers is high. The potential for medium-size massive sulfide lead, zinc and silver deposits in limestones is good. Large asbestos deposits have good potential in the ultramafic rocks. The potential for medium-size tin deposits associated with granitic intrusives is fair


ENERGY LEGEND
HYDROCARBON LOCATIONS
PROVEN HYDROCARBON PRODUCTION, NEW AREAS OF POTENTIAL CAN BE EXPECTED
SEEPS OR OTHER INDICATIONS OF HYDROCARBONS PRESENT
GEOLOGICALLY FAVORABLE BUT NO SURFACE INDICATIONS PRESENT
COAL
ANTHRACITE
BITUMINOUS
SUBBITUMINOUS
LIGNITE
UTILITY CORRIDOR
GEOLOGIC BASIN
GEOTHERMAL RESOURCE
LOWER TANANA BASIN
RAY MOUNTAINS
YUKON RIVER
TANANA RIVER
SCALE 1:250000
5 0 5 10 15 20 25 MILES
HOT SPRINGS LANDING 3.2 MI.


Sn W F
Au (Pb Ag W Hg)
RAY MOUNTAINS
Sn W Au Pb Zn (Cu Sb Ag)
LEGEND
METALLOGENIC PROVINCES
HIGH POTENTIAL
GOOD POTENTIAL
LOW POTENTIAL
NOTE, ANGLE REPRESENTS POTENTIAL
QUANTITY OF DASHES REPRESENTS
STREAKS WITHIN PROVINCE
SIGNIFICANT MINERAL DEPOSITS
HIGH CLAIM CONCENTRATION
UTILITY CORRIDOR
Au W Hg Cu
Au
Sb Au Ag (Pb Zn Hg)
Au
Au Sn Ag Pb
YUKON RIVER
TANANA RIVER
SCALE 1:250 000
25 MILES

QUADRANGLE: Tyonek

GEOLOGY: Predominantly volcanic and granitic intrusive rocks largely overlain in the eastern third by glacial and glaciofluvial deposits

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $5,996,600 - natural gas, placer gold, coal, placer silver

MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The eastern half lies within the Cook Inlet Tertiary Province and is geologically favorable for oil and gas, although no surface indications are present. Production has occurred in the southeastern eighth
Coal	Subbituminous coal occurs in the eastern half
Minerals	The western half has a high potential for copper, gold, lead, zinc, silver and molybdenum. The eastern half has good potential for uranium

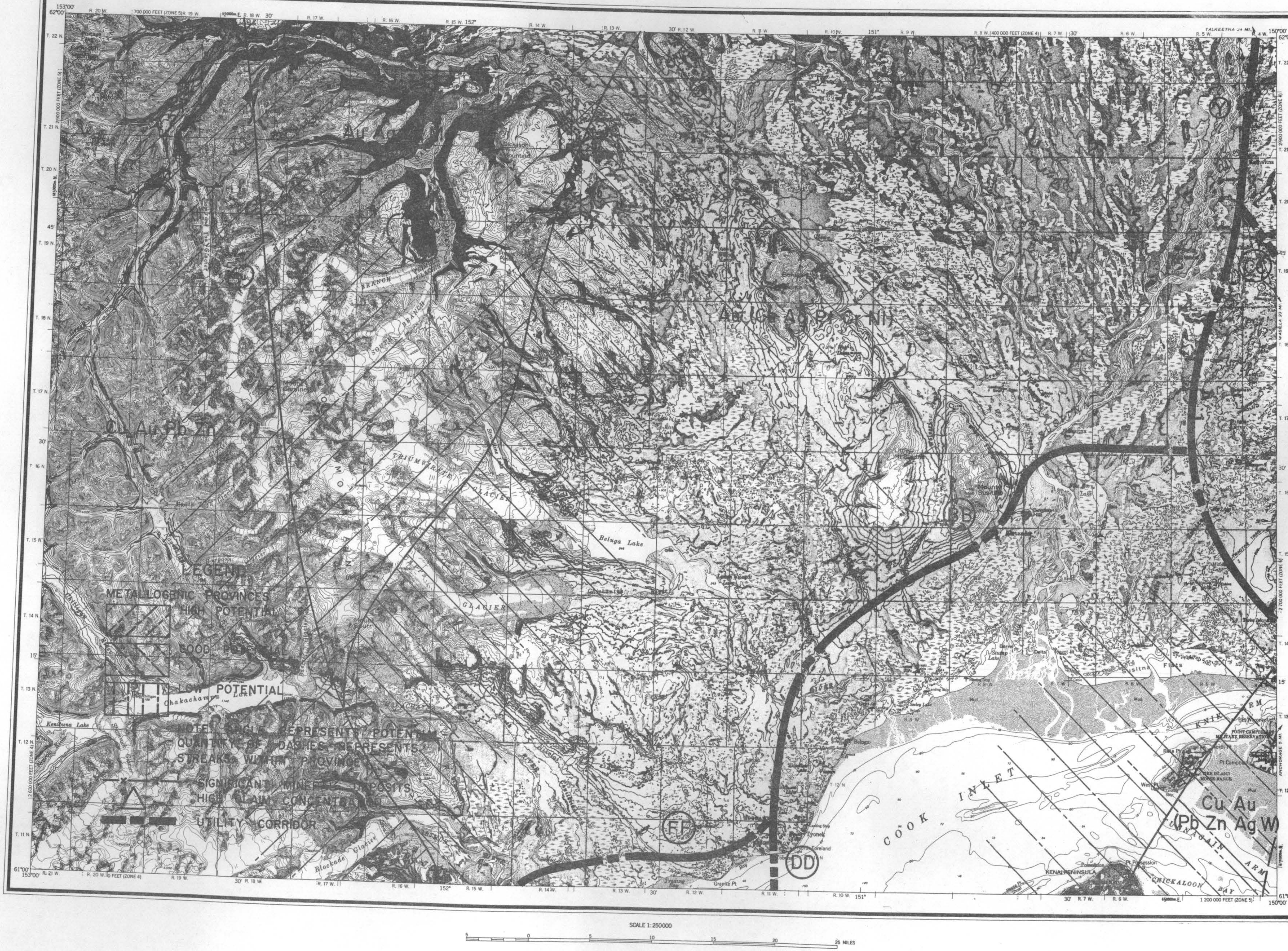
POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	The potential for continued natural gas production is high
Coal	Approximately 2,331 million tons of subbituminous coal occur in the corridor area. The potential for a large open pit development is high
Minerals	The potential for a large sedimentary-type uranium deposit being developed is low

SCALE 1:250000

5 0 5 10 15 20 25 MILES

TYONEK


LEGEND
METALLOGENIC PROVINCES
HIGH POTENTIAL
GOOD POTENTIAL
LOW POTENTIAL
NOTE: ANGLE REPRESENTS POTENTIAL
QUANTITY OF DASHES REPRESENTS STREAKS WITHIN PROVINCE
SIGNIFICANT MINERAL DEPOSITS
HIGH CLAIM CONCENTRATION
UTILITY CORRIDOR
Au Ag
Au (Cu Ag Pt Cr Ni)
Cu Au Pb Zn
Cu Au
(Pb Zn Ag W)
Y
BB
DD
FF
Beluga Lake
Chakachamna Lake
Kenibuna Lake
COOK INLET
KNIK ARM
TURNAGAIN ARM
CHICKALOON BAY
KENAI PENINSULA
TRIUMVIRATE GLACIER
Blockade Glacier
Mount Susitna
Tyonek
Susitna Flats
SCALE 1:250000
25 MILES

QUADRANGLE: Umiat

GEOLOGY: Predominantly marine and nonmarine sandstone and shales; overlain by alluvium, beach and terrace deposits in the northern portions

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: None

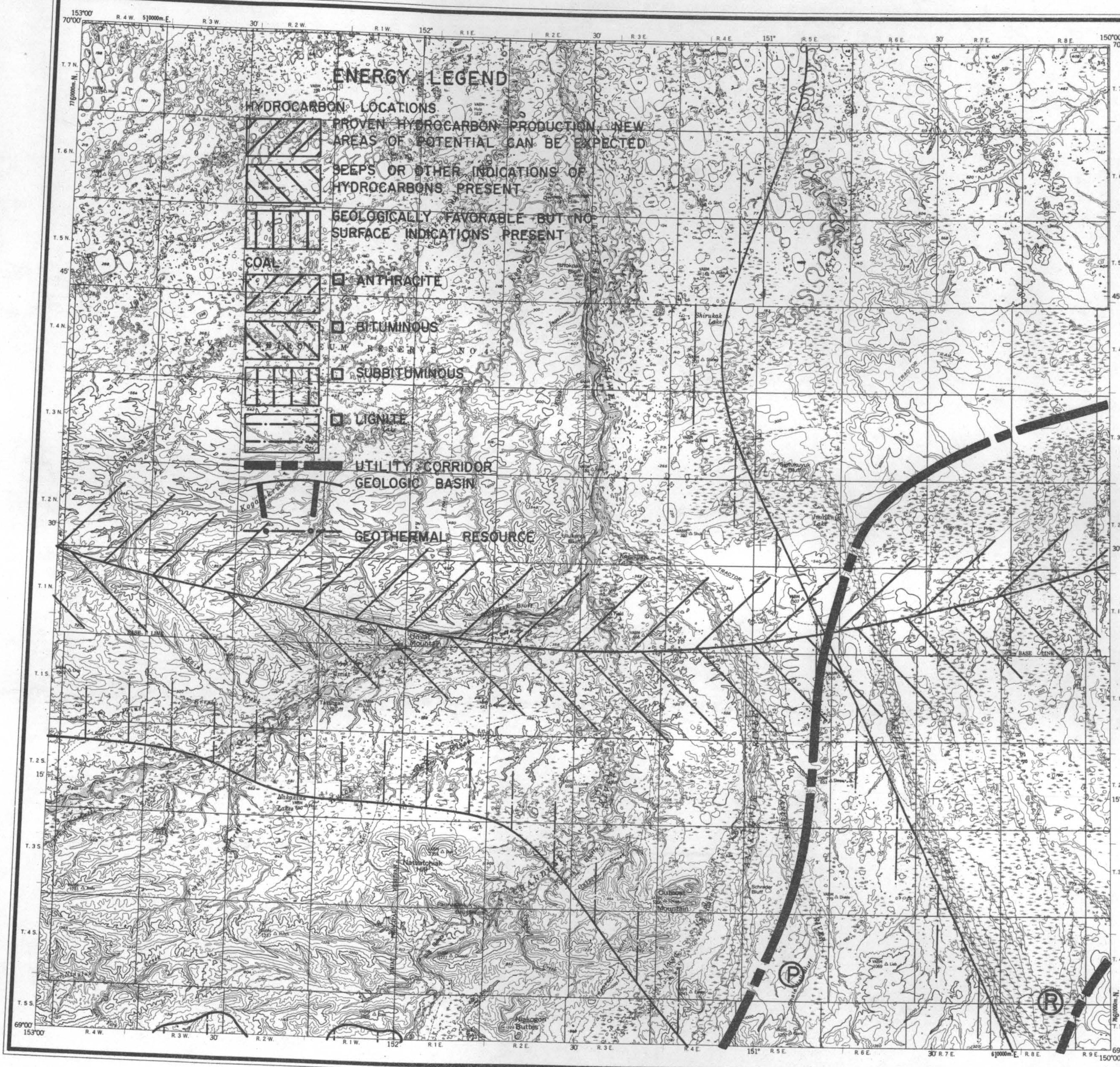
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	Northern half has proven production or has high potential; southern half has good potential based on oil seeps or other indications
Coal	Most of the western two-thirds are underlain by subbituminous coals
Minerals	None

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	The potential for developing additional oil and gas deposits is high
Coal	The potential for developing the approximately 11,000 million tons of subbituminous coal within the corridor is considered low
Minerals	None

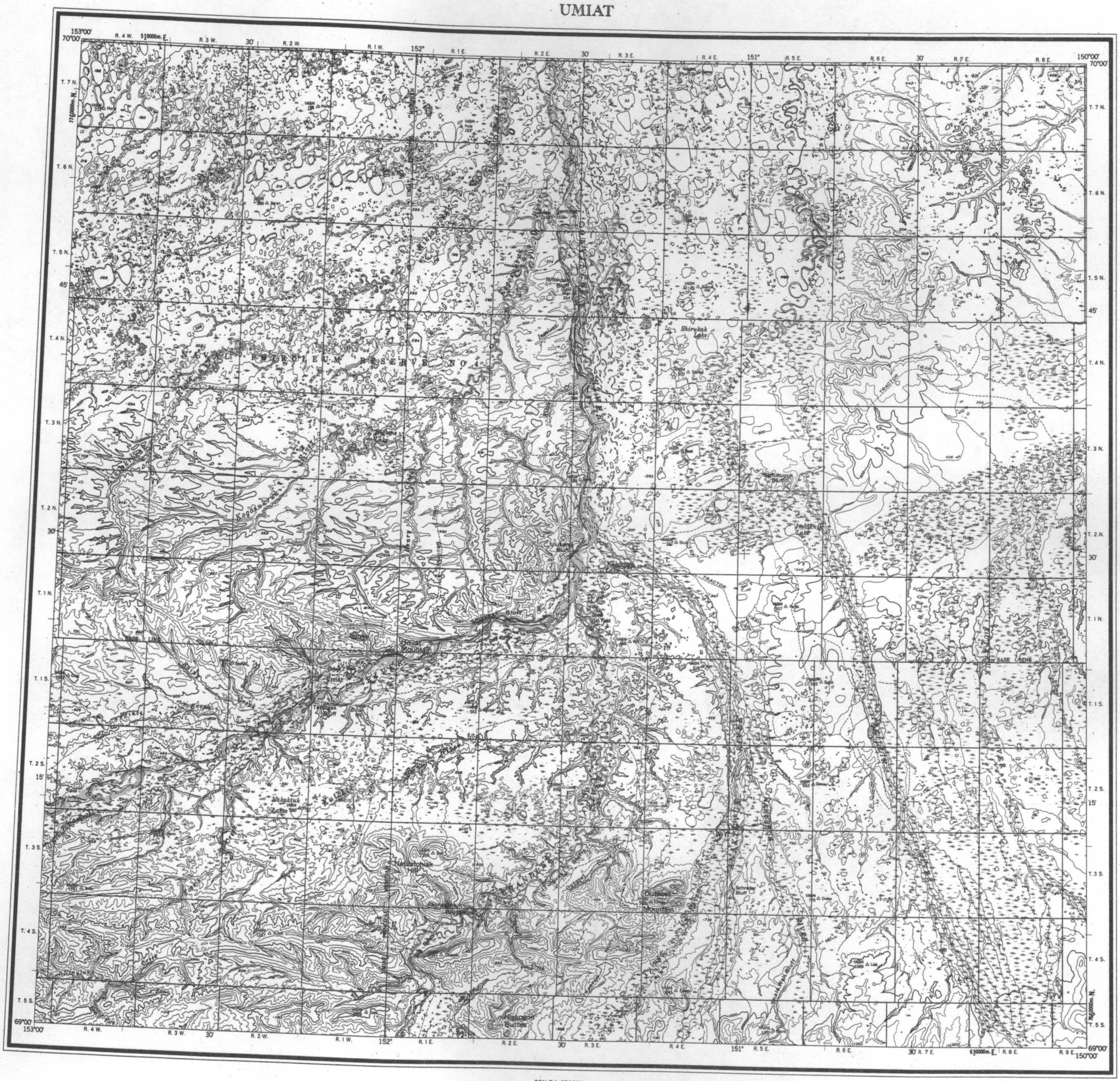
UMIAT



SCALE 1:250000

5 0 5 10 15 20 25 MILES

UMIAT



SCALE 1:250000

5 0 5 10 15 20 25 MILES

QUADRANGLE: Valdez

GEOLOGY: Predominantly sandstone and shale with minor amounts of conglomerate, volcanic rocks and limestone except in the northeast corner where volcanic rocks predominate. The northcentral area is overlain by alluvium and glacial and glaciofluvial deposits

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $4,300 - placer gold, copper, lode gold, lode silver, placer silver

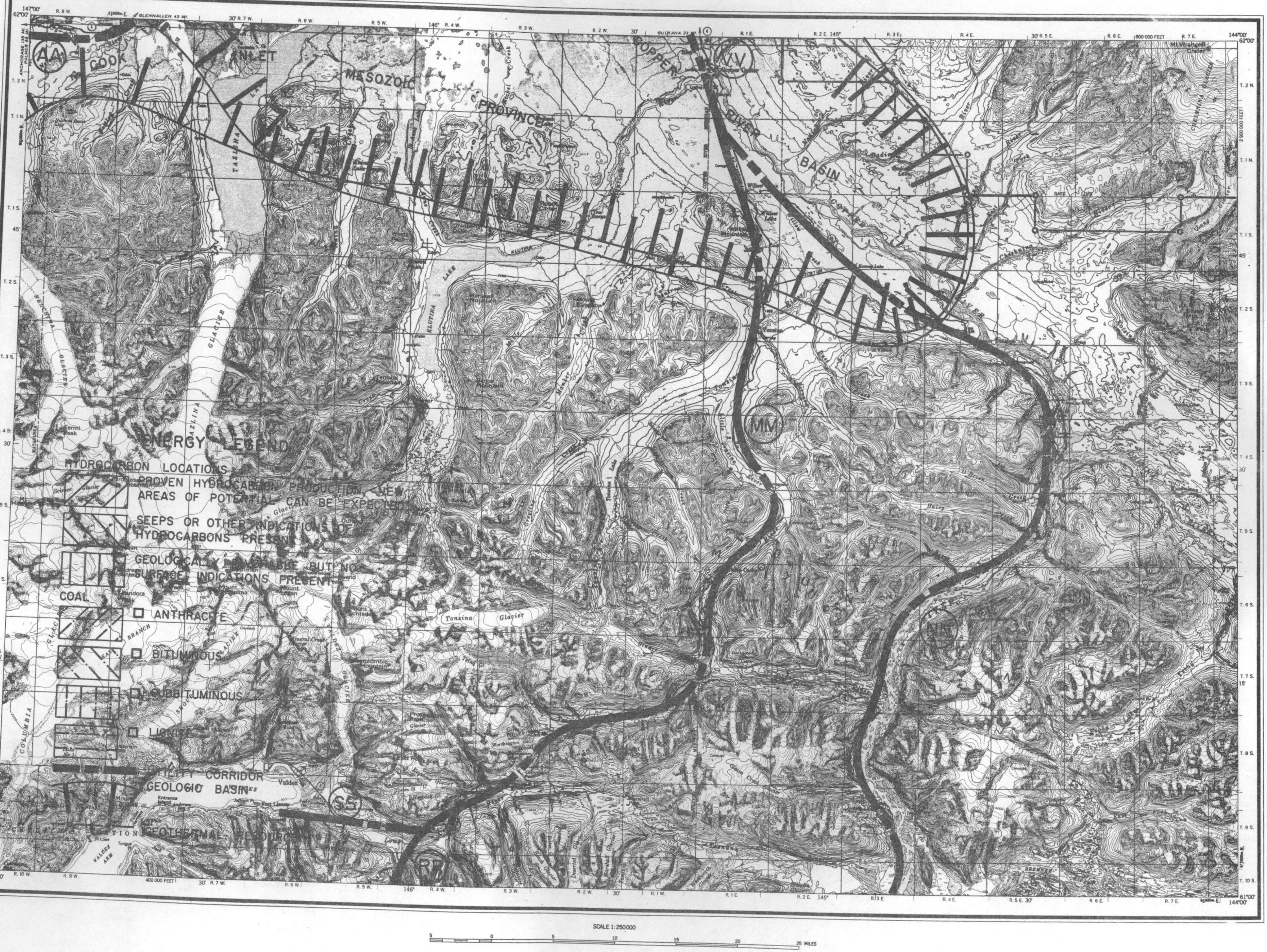
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The northcentral area is part of the Cook Inlet Mesozoic Province and Copper River Basin and, hence, may have oil and gas potential
Coal	No surface occurrences known; may occur in the Cook Inlet Mesozoic Province and the Copper River Basin
Minerals	Except for the northern border, the northwest quarter has good potential for copper, gold, lead, zinc, silver and tungsten. The northeast quarter has high potential for copper, silver, gold and molybdenum except for the northern border. The southeastern quarter has good potential for copper, chromium and nickel

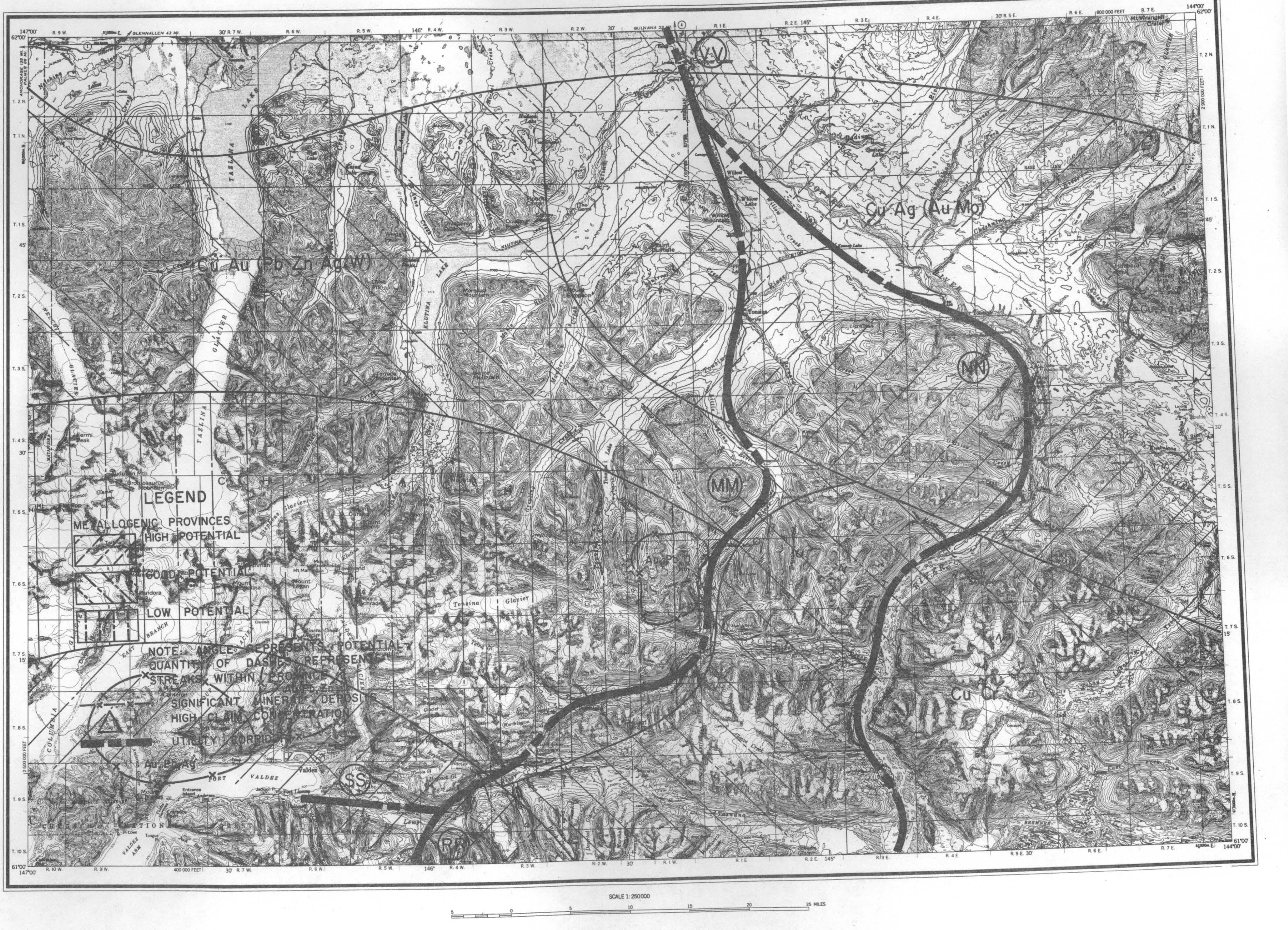
POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

Oil and gas	Unknown; little exploration to date
Coal	Unknown; little exploration to date
Minerals	The potential for small gold deposits is good

VALDEZ


COOK INLET
MESOZOIC
PROVINCE
COPPER
RIVER
BASIN
ENERGY LEGEND
HYDROCARBON LOCATIONS
PROVEN HYDROCARBON PRODUCTION. NEW AREAS OF POTENTIAL CAN BE EXPECTED
SEEPS OR OTHER INDICATIONS OF HYDROCARBONS PRESENT
GEOLOGICALLY FAVORABLE BUT NO SURFACE INDICATIONS PRESENT
COAL
ANTHRACITE
BITUMINOUS
SUBBITUMINOUS
LIGNITE
UTILITY CORRIDOR
GEOLOGIC BASIN
GEOTHERMAL RESOURCES
Tonsina Glacier
SCALE 1:250000

VALDEZ


LEGEND
METALLOGENIC PROVINCES
HIGH POTENTIAL
GOOD POTENTIAL
LOW POTENTIAL
NOTE: ANGLE REPRESENTS POTENTIAL
QUANTITY OF DASHES REPRESENTS
STREAKS WITHIN PROVINCE
SIGNIFICANT MINERAL DEPOSITS
HIGH CLAIM CONCENTRATION
UTILITY CORRIDOR
Cu Au (Pb Zn Ag (W))
Cu Ag (Au Mo)
Cu Ag Au
Cu Cr
Au Pb Ag
VV
NN
MM
SS
RR
Valdez
TAZLINA LAKE
KLUTINA LAKE
Tonsina Glacier
COLUMBIA
VALDEZ ARM
PORT VALDEZ
GLENNALLEN 43 MI.
GULKANA 23 MI.
Mt Wrangell
SCALE 1:250 000
25 MILES

QUADRANGLE: Wiseman

GEOLOGY: Predominantly limestones and marine clastic rocks in the northern half, metamorphic rocks in the next southern quarter, and sandstones and shales in the southern quarter

MINERALS PRODUCED IN ORDER OF THEIR VALUE, 1880-1971: $7,958,600 - placer gold, placer silver

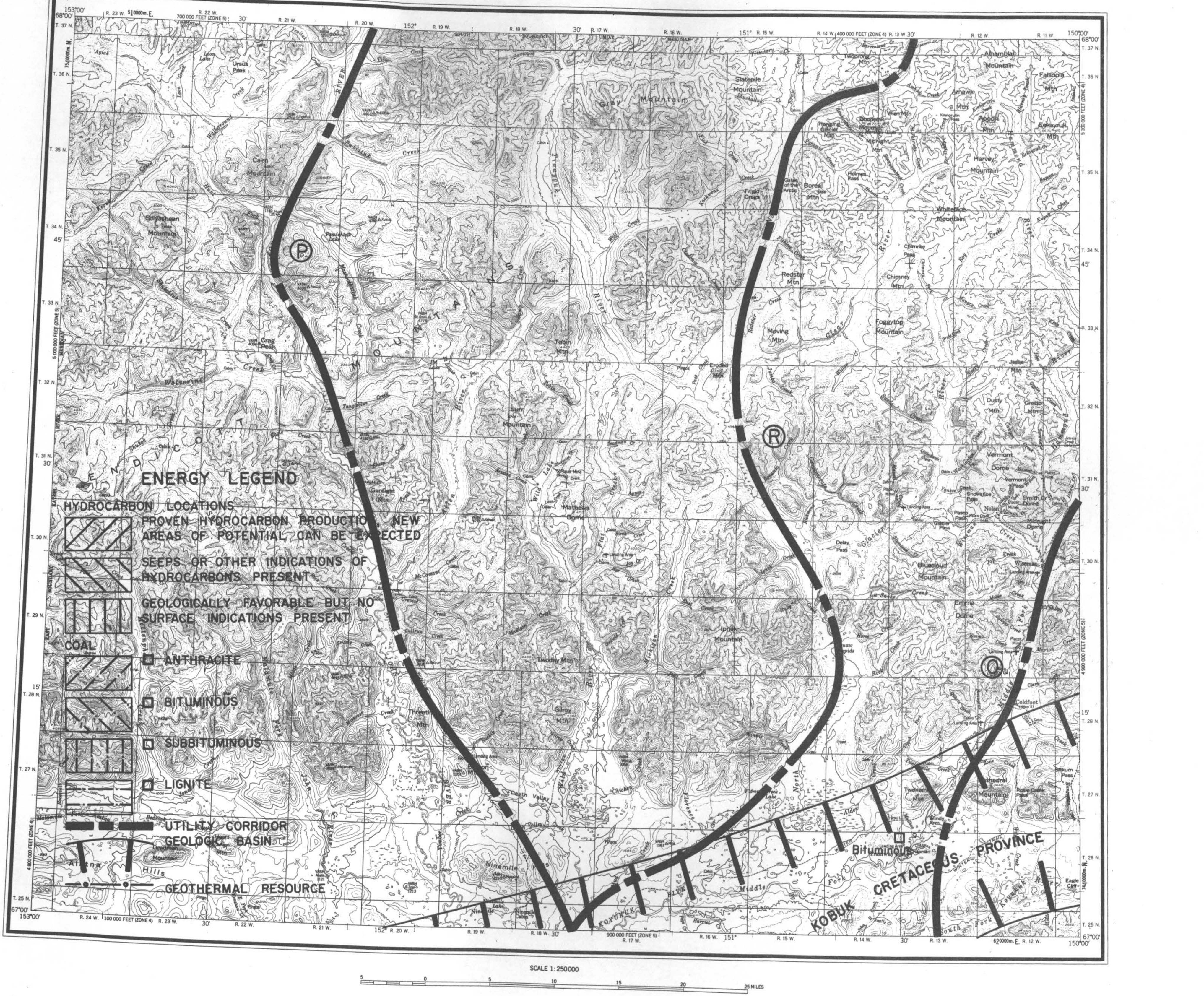
MINERAL POTENTIAL WITHIN THE QUADRANGLE:

Oil and gas	The Kobuk Cretaceous Province embraces the southern quarter, so oil and gas may possibly occur
Coal	An outcrop of bituminous coal occurs in the southeast
Minerals	The northern quarter has good potential for gold, lead, copper, zinc and tin. Most of the remaining areas have high potential for gold, antimony and tungsten. A belt favorable for copper, lead and zinc trends through the middle of the quadrangle from southwest to northeast. Much of the central area has been an important placer gold producing area

POTENTIAL FOR DEVELOPMENT WITHIN 50 MILES OF A CORRIDOR FROM 1975-2001:

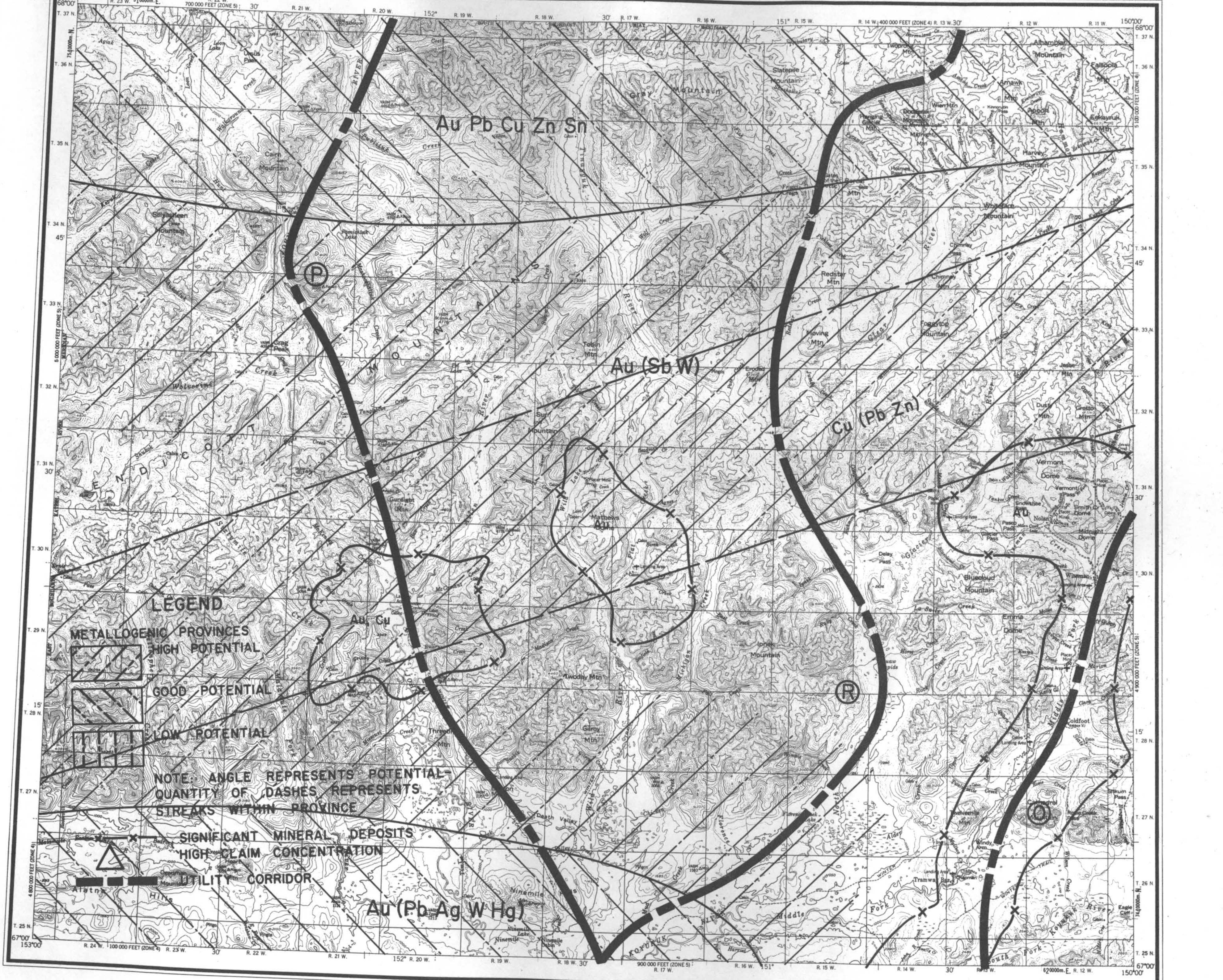
Oil and gas	Unknown; little exploration to date
Coal	Unknown; little exploration to date
Minerals	The continued development of small, medium and large placer gold deposits is high. The development of high-grade, low-tonnage copper, lead and zinc vein-type deposits is rated good where limestone is intruded by granites. The development of large-size, low-grade copper, lead, zinc and gold deposits associated with metamorphic rocks is rated fair

WISEMAN



ENERGY LEGEND
HYDROCARBON LOCATIONS
PROVEN HYDROCARBON PRODUCTION, NEW AREAS OF POTENTIAL CAN BE EXPECTED
SEEPS OR OTHER INDICATIONS OF HYDROCARBONS PRESENT
GEOLOGICALLY FAVORABLE BUT NO SURFACE INDICATIONS PRESENT
COAL
ANTHRACITE
BITUMINOUS
SUBBITUMINOUS
LIGNITE
UTILITY CORRIDOR
GEOLOGIC BASIN
GEOTHERMAL RESOURCE
KOBUK CRETACEOUS PROVINCE
Bituminous
P
R
Q
SCALE 1:250000
25 MILES

WISEMAN



SCALE 1:250000

5 0 5 10 15 20 25 MILES

DEVELOPMENT POTENTIAL BY PIPELINE CORRIDOR ROUTES

The potential for mineral and energy development is summarized in this section. The potentials are a judgment guess made by the author based on the information received to date. In general, the potential for development is made irrespective of land status except for the Arctic National Wildlife Range.

Routes A,B; A,C; and D

These three routes cross the North Slope of Alaska close to the Arctic Ocean, figure 1. The mineral and energy resources crossed by the routes consist primarily of oil and gas, both known or suspected. Several subbituminous coal outcrops occur as does one geothermal area. No past production of any resource is known. The potential for oil and gas development is high except where restricted by land status such as the Arctic National Wildlife Range. The number of people brought into the area along the routes could be large, up to 4,900 for a large, underground coal or phosphate mine and townsite, but the potential for such an event occurring is considered low.

Routes E,F,H and E,G,H

These two routes, which can be considered as one, proceed southeast away from the Arctic Coast around the south end of the Arctic National Wildlife Range. The mineral and energy resources along these two routes are largely unknown. Oil, gas, subbituminous coal and a geothermal area occur in the northern area north of the Brooks Range. The geology along most of the routes indicate a good to high potential for hard rock minerals, but the potential for development is unknown due to lack of exploration. The development of small to medium-size mines along the pipeline routes in the Sagavanirktok and Mt. Michelson quadrangles has a low potential at this time. These small to medium-size, perhaps high-grade, mines could attract several hundred to several thousand people to those areas.

Routes J,K,L,N and J,K,M,N

These two routes follow the Trans-Alaska Pipeline route away from the Arctic Coast into the Phillip Smith Mountain quadrangle, then turn southeastward and exit Alaska in the Charley River quadrangle, figure 1. The energy resources along these two routes consist of oil, gas and coal both north and south of the Brooks Range. Nearly all of these lands have unknown potential for these resources because little exploration has been done to date. Much the same situation exists for mineral development along the routes except in the Phillip Smith Mountain and Chandalar quadrangles. There, along the southern flank of the Brooks Range, a belt of metamorphic rocks has a high potential for small and medium size, high-grade copper, lead and zinc deposits. If these were underground open stope mines, they could employ 105 to 375 people and create townsites of 400 to 1,400 people. In the Charley River quadrangle, a high potential for a large, low-grade uranium deposit exists. If this type of deposit were developed by open pit mining, perhaps 380 to 680 employees could be attracted to the company creating a town of 1,400 to 2,500 people. Probably small and medium-size gold placer deposits will be worked in the summer months providing employment for groups of 10 to 20 employees.

Route J,O,U,V,W

This route follows the Trans-Alaska Pipeline from the Arctic Ocean to Fairbanks and the highway from Fairbanks to the border of Alaska, figure 1.

The known energy resources occur as oil and gas north of the Brooks Range and north of the Alaska Range. Geothermal sources occur within the pipeline corridor in the Bettles, Tanana, Livengood, Gulkana and Nabesna quadrangles. A large number of mineral claims exist along the pipeline route. Most basic types of minerals occur such as gold, copper, lead, zinc, nickel, chromium, asbestos and tungsten. The potential for development in the Brooks Range centers around small to medium-size copper, lead and zinc deposits which could be mined by underground methods creating townsites of 400 to 1,400 people. In the Tanacross and Nabesna quadrangles large, low-grade copper-molybdenum deposits have high potential for occurring. The development of these types of deposits by open pit mining methods could create companies of 380 to 680 employees and townsites of 1,400 to 2,500 people. A medium-size coal mining operation has good potential in the Mt. Hayes quadrangle and could bring 260 to 420 employees to the area creating a townsite of 900 to 1,500 people.

Routes J,O,U,Y,BB,FF
J,O,U,Y,CC,TT,JJ,KK
J,O,U,Y,CC,TT,JJ,LL
J,O,U,Y,CC,TT,HH,GG
J,O,U,Y,BB,FF

These routes follow the Trans-Alaska Pipeline from the Arctic Coast to Fairbanks and then the Railbelt through Anchorage to Whittier (J,O,U,Y,CC,-TT,JJ,KK), or Seward (J,O,U,Y,CC,TT,JJ,LL), or Starichkof Point (J,O,U,Y,-CC,TT,HH,GG). The remaining route (J,O,U,Y,BB,FF) stays to the west of Cook Inlet, terminating at Drift River, figure 1.

The known energy resources occur as oil and gas north of the Brooks Range and coal in scattered locations both north and south of the Brooks Range and north of the Alaska Range. Geothermal sources occur within the pipeline corridor in the Bettles, Tanana and Livengood quadrangles. A large number of mineral claims exist along the pipeline route. Most basic types of minerals occur such as gold, copper, lead, zinc, nickel, chromium, asbestos and tungsten. The potential for development in the Brooks Range centers around small to medium-size copper, lead and zinc deposits which could be mined by underground methods creating townsites of 400 to 1,400 people. South of the Fairbanks quadrangle, the primary potential for development centers around the large subbituminous coal deposits in the Railbelt, on the west side of Cook Inlet, and on the Kenai Peninsula. Medium and large open pit mines could require 260 to 680 employees and create townsites of 900 to 2,500 people in the Railbelt and to the west of Cook Inlet. Large underground room and pillar-type mines on the Kenai Peninsula could require 305 to 910 employees and create townsites of 1,100 to 3,300 people. The quadrangles having the greatest mineral potential are the Healy and Talkeetna Mountains. There, large-size, low-grade copper-molybdenum and uranium deposits could attract 380 to 680 employees to open pit-type mines creating townsites of 1,400 to 2,500 people.

Routes J,O,U,V,Z,VV,MM,RR
J,O,U,V,Z,VV,MM,SS
J,O,U,V,Z,VV,NN

These routes follow the Trans-Alaska Pipeline from the Arctic Ocean to the Valdez quadrangle, figure 1. There, route J,O,U,V,Z,VV,NN splits off and goes to the Gulf of Alaska via the Copper River. The remaining routes follow the TAPS lines to the Valdez area before route J,O,U,V,Z,VV,MM,RR bypasses Valdez to the east and terminates on the Gulf coast. The known energy resources occur as oil and gas north of the Brooks Range and coal in scattered locations both north and south of the Brooks Range and north of the Alaska Range. Geothermal sources occur within the pipeline corridor in the Bettles, Tanana, Livengood, Gulkana, and Valdez quadrangles.

A large number of mineral claims exist along the pipeline route. Most basic types of minerals occur such as gold, copper, lead, zinc, nickel, chromium, asbestos and tungsten. The potential for development in the Brooks Range centers around small to medium-size copper, lead and zinc deposits which could be mined by underground methods creating townsites of 400 to 1,400 people. In the remainder of the routes, the mineral potential centers around small gold placers and small copper and gold lode mines These types of mines, if mined by underground open stope methods, could result in companies of 105 to 145 employees and create townsites of 400 to 500 people.

Route J,O,S,T

This route begins on the Arctic Coast and follows the Trans-Alaska Pipeline south to the Bettles quadrangle then heads westward to Golovin on Norton Sound, figure 1. The known energy resources occur as oil and gas north of the Brooks Range and coal in scattered locations both north and south of the Brooks Range and north of the Alaska Range. Geothermal sources occur within the pipeline corridor in the Bettles quadrangle.

A large number of mineral claims exist along the pipeline route. Most basic types of minerals occur such as gold, copper, lead, zinc, nickel, chromium, asbestos and tungsten. The potential for development in the Brooks Range centers around small to medium-size copper, lead and zinc deposits which could be mined by underground methods creating townsites of

400 to 1,400 people. The most likely areas for development are north of the pipeline route in the Ambler River and Survey Pass quadrangles. Kennecott's Bornite and Arctic Camp properties could result in two medium-size underground mines within the next 5 to 10 years, requiring 145 to 375 employees and creating townsites of 500 to 1,400 people. Similar sizes of mines have a high potential for occurring at other locations locations in these two quadrangles. Large uranium deposits have good potential for occurring in the Candle and Bendeleben quadrangles.

CONCLUSION

The impact on mineral and energy development by the installation of a natural gas pipeline from Alaska's North Slope to the 48 contiguous States via Canada and from the North Slope to tidewater on Norton Sound, Cook Inlet, and Prince William Sound were examined. The general geology in each quadrangle touched or within a corridor extending 50 miles on either side of each proposed route was described. The potential for mineral and energy development in each quadrangle was analyzed by synthesizing the views of four consultants and various Bureau personnel. Finally, the potential for mineral and energy development along and 50 miles either side of each proposed pipeline was appraised and estimates made of the number of people which would likely accompany development.

In general, the impact from any natural gas pipeline or its permanent access road was thought to be little or none unless the State of Alaska wished to assist development by distributing its royalty gas from gas production to Alaskan consumers or by connecting any permanent pipeline access road to the present Alaska highway system. However, unless the State can make a firm request for natural gas when reserves are being committed, it is unlikely the State will have a supply to distribute.

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