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MAPS AND TABLES DESCRIBING METALLIFEROUS MINERAL RESOURCE POTENTIAL OF SOUTHERN ALASKA

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TO ACCOMPANY

Geological Survey Open-File Report 78-1E

This report is preliminary
and has not been edited or
reviewed for conformity with
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Explanatory text to accompany U.S. Geological Survey open-file report 78-1-E

INTRODUCTION

This report is the culmination of a regional mineral resource appraisal of southern Alaska by the U.S. Geological Survey. It consists of two maps, designated sheets 1 and 2 of open-file 78-1-E, descriptive and documentary tables that supplement the maps, and this explanatory text. Sheet 1 pertains to that part of southern Alaska east of the 153° meridian and north of the 59° parallel and sheet 2 to the western part of southern Alaska. South of the 59° parallel the eastern boundary of sheet 2 is the 152° meridian. Elsewhere the eastern boundary is the 153° meridian. As used in this study, southern Alaska includes a large area that extends northward from the Pacific Ocean to an irregular boundary that roughly parallels the northernmost forelands of the convex northward, arcuate Alaska Range (see supplementary index maps on the accompanying maps). From its apical region in the Fairbanks quadrangle, the northern boundary extends southwestward to Bristol Bay and southeastward to near latitude 63° 30' at the Canadian border. The easternmost and westernmost extremities of southern Alaska (in our usage) are, respectively, the 138° meridian and Unimak Pass. The purpose of this report is to provide a current and thorough appraisal of the known and potential metallic mineral resources of southern Alaska that utilizes the best geologic and mineral resource data available.

The maps (sheets 1 and 2) show outlines of favorable areas for

metalliferous mineral resources that are mainly based on known deposits and favorable geology for specific deposit types. Forty-three favorable areas are outlined on sheet 1 and thirteen on sheet 2. Supplementary tables that are keyed numerically to outlined areas on the maps describe the known and speculative deposit types in each outlined area, summarize available data on geology, production, reserves, and status of geologic knowledge, and provide the resource estimates, which are the basic objectives of this study. These tables are designated tables 1 (p.13-34) and 2 (p.32-44) and, respectively, refer to sheets 1 and 2. Another table (table 4 (p.45)) summarizes the probabilistic grade and tonnage models for specific deposit types.

Background data for this report have been published separately as a folio of open-file reports (table 3 (p. 2)). Those reports, which include pertinent references and other relevant information, are components of a folio of basic data that constitutes the foundations for this report.

Table 3. Component maps of the regional mineral resource appraisal of southern Alaska

Eastern southern Alaska

U.S. Geological Survey open-file map	Subject
OF-77-169-A (MacKevett and Holloway, 1977)	Metalliferous and selected nonmetalliferous mineral deposits
-B (Beikman, Holloway, and MacKevett, 1977)	Generalized geology
-C (Barnes, 1977)	Gravity data
-D (Holloway, 1977)	Coal
-E (Decker and Karl, 1977)	Aeromagnetic data

Western southern Alaska

U.S. Geological Survey open-file map

OF-77-169-F (MacKevett and Holloway, 1977)	Metalliferous mineral deposits
-G (Beikman, Holloway, and MacKevett, 1977)	Generalized geology
-H (Barnes, 1977)	Gravity data
-I (Holloway, 1977)	Coal
-J (Decker and Karl, 1977)	Aeromagnetic data

Fossil fuels, geothermal energy sources, and nonmetallic mineral commodities are not within the purview of this report. However, the folio of basic data includes descriptions of a few deposits of nonmetallic minerals in eastern southern Alaska, plus maps and tables that summarize coal deposits in southern Alaska.

RESPONSIBILITY AND ACKNOWLEDGMENTS

This report represents the combined and cooperative product of the authors. MacKevett and Holloway were largely responsible for geologic descriptions of deposit types and related data such as production, reserves, and status of geologic knowledge for a given area; MacKevett determined extents and configurations of the favorable areas; and Singer was mainly responsible for the resource estimates and appraisals.

The authors are indebted to many people, mainly U.S. Geological Survey colleagues, who facilitated the preparation of this report and the companion reports that provide the fundamental background materials. We are especially grateful to E. H. Cobb for his useful inventories of Alaskan mineral deposits; to B. L. Reed for sharing his extensive knowledge

of the geology and mineral deposits of the western Alaska Range; and to W. D. Menzie for his contributions in developing models for specific deposit types.

PHILOSOPHY AND LIMITATIONS

Our investigation represents a thorough attempt to use the best available and most current relevant information to derive objective mineral resource estimates for southern Alaska. Even so, some disparities exist in our basic data and, correspondingly, in the derivative resource estimates. For example, some areas are geologically poorly known and have been scantily prospected, whereas a few others are geologically well known and locally well prospected. Documentation for individual deposits ranges from a few sentences in old reports that cursorily allude to a deposit to a few modern scientific reports that provide thorough descriptions. Nevertheless, the basic geologic framework of southern Alaska and the types and geologic settings of the region's mineral deposits are reasonably well known.

In a broad sense, just about every area on earth has some resource potential, regardless of how remote or insignificant such a potential may be. In this study only the potentially significant resource areas are identified, delineated, and described; the other areas being excluded after carefully evaluating the basic data. Many of the excluded areas are mantled by thick covers of younger unfavorable rocks, glaciers, or unconsolidated surficial deposits, and even though they may contain concealed deposits at depth, the chances for discovering and exploiting such deposits are minimal.

Speculative or suspected deposit types, one of the criteria used in determining the favorable areas, are inferred from their occurrences

in similar geologic settings elsewhere. A more comprehensive use of this category might be desirable, but to be meaningful, it should be founded on more detailed geologic information than is generally available for southern Alaska. Such deposit types include some that have been known for many years in some other parts of the world and a few others, such as volcanic-type nickel deposits and various types of uranium deposits that have been recognized only recently.

Among the factors worth considering in estimating the mineral resource potential of southern Alaska are:

(1) Southern Alaska is well endowed with a variety of mineral deposits commensurate with its diverse geology

(2) With a few exceptions, notably for placer gold, southern Alaska is scantily prospected by modern standards, and the vast majority of known deposits are too poorly explored to permit precise evaluations

(3) Potentially significant new discoveries have been made in the region during the past decade, notably the extensive belt of submarine volcanogenic base metal-silver deposits along the north flank of the Alaska Range and the copper-molybdenum porphyry province of the Alaska Peninsula and nearby islands; such discoveries augur the continued success of thorough modern exploration

(4) Southern Alaska contains known deposits of several metals of current national interest, for example, chromium and tin, and it may contain significant resources of these commodities

(5) Some of the large covered tracts, both within and beyond areas designated as favorable, may contain concealed deposits at shallow depths that are amenable to discovery and exploitation

(6) Possibly some of the region's diverse known or undiscovered metals may be of future importance in supplying metals for new uses brought about by technologic advances

(7) Although no assuredly significant uranium deposits are known in southern Alaska, the region contains many geologic settings that are favorable for a variety of uranium deposits, and systematic prospecting for uranium is warranted in some areas.

(8) Extensive tracts of southern Alaska are geologically poorly known. Some contain geologic settings favorable for significant mineral deposits, and more thorough geologic knowledge of these areas would substantially increase the validity of future mineral resource estimates.

In order for this report to be useful, the purpose of the analysis had to be considered in the design of the resource appraisal (Singer, 1975). The purpose in this case is primarily to provide mineral resource information that can be used in the land classification decisions of Alaska. To achieve this, it is desirable to delineate individual tracts of land and to differentiate them on the basis of their potential for containing mineral resources. For each tract it is also desirable to indicate the quality and quantity of mineral resources with respect to the factors that affect possible economics and technologies of exploitation. Ideally, these factors include grade and tonnage estimates, the physical, chemical, and mineralogical features of the mineralized rock that could affect its treatment and recovery, and whether all of the mineralized rock has been found.

Information concerning many of these factors is probably best conveyed by using mineral deposit types as a basis for the estimates, as we have done. In many cases, deposit types have distinct physical, chemical, and mineralogical features, and some can be characterized as having restricted ranges of grades and tonnages. In addition, because deposit types tend to have certain geologic associations, the resource appraisal can be made relatively straightforward and readily explainable. Estimates of grades and tonnages of similar well explored deposits can be used as models of the incompletely explored and, in many cases, undiscovered deposits of Alaska (table 4).

METHODOLOGY

This report augments the fundamental mineral resource, geologic, and related information in the folio of basic data (table 3) by utilizing various mineral resource appraisal methods in order to fulfill its objectives. In essence, the favorable mineral resource areas are outlined on the basis of their known deposits, including principal occurrences, and their favorability for undiscovered or speculative deposits. No attempt is made to rank the outlined areas relative to their degrees of favorability, but the general potential and rank of a given area can be ascertained from descriptions in the tables. The potential for undiscovered deposits is regarded as a function of favorable geology and, in some cases, supplementary favorable geochemical or geophysical data. The outlined favorable areas and the metals for which they are noteworthy are shown on the accompanying maps. Symbols for the less significant metallic constituents that generally constitute byproducts or potential byproducts are

enclosed in parentheses. Succinct descriptions of the deposit types in the oulined areas are given in the accompanying tables (tables 1 and 2); these tables describe the contained metals, geologic settings, and other information relevant to the deposits. The tabulated descriptions are keyed numerically to the maps. Generally used nomenclature for deposit types, for example porphyry, vein, submarine volcanogenic, and contact metamorphic, are used in this report. Many of these have genetic connotations.

The mineral resource estimates, which are the crux of this report, are derived by integrating and objectively evaluating all available germane data. Mineral resource data for each favorable area outlined on the map are shown in tables 1 and 2. The mineral resource estimates supplement what is known by incorporating a variety of pertinent considerations, such as degrees of geologic, geochemical, and geophysical favorability, extent and adequacy of exploration and geologic knowledge, and, for some deposits, indications of sizes and grades extrapolated from models of better-known deposits of a specific type (table 4 (p.45)). In most cases the basic data are insufficient to justify more than qualitative resource estimates. However, in some instances the data are adequate to permit more quantitative estimates of the number of deposits of a specific type that may be present in a given area and their probable grades and sizes.

The general procedure followed in deriving the resource estimates consisted of: (1) using geology to delineate areas that either have known deposits of a particular type or areas that are favorable for containing them, (2) where possible, providing information on grades and tonnages of similar deposits based upon careful study of the geology and grades and tonnages of well explored deposits, and (3) where possible, subjectively

estimating the number of deposits of each type in each delineated area using the number of known deposits, the amount of favorable geology, the extent of exploration, and in some cases supplementary geochemical and geophysical data.

Estimates of grades and tonnages and of the number of deposits are presented in a range of probabilities. Probabilistic estimates of grades and tonnages (table 4) demonstrate the range of values observed for each deposit type; correlations amoung grades and tonnages are presented in order to show the degree of linear association between grades and tonnages. Significant correlations mean that probabilities of different grade and tonnage combinations must be calculated based on consideration of both variables, while non-significant correlations mean that the probability of a grade-tonnage combination can be calculated as the product of the two probabilities. Probabilistic estimates of the number of deposits show the degree of cetainty that we have concerning the number of deposits that might occur in an area. Typically, estimates of the number of deposits are made only for deposits with tonnages and grades comparable to those used in the grade-tonnage model listed in table 4. Also, estimates are made for a few deposits that lack associated grade-tonnage models.

CONCLUSIONS

Southern Alaska is well endowed with a large variety of mineral deposits. Favorable areas for these deposits are outlined on the accompanying maps and individually described in the accompanying tables. Tables 1 and 2 contain the basic resource estimates and some of the supporting data used in deriving the estimates. Additional documentary data are in map components of a folio of basic data (table 3) that should be used in conjunction with this report.

The outlined areas include potentially significant deposits of many types that contain an array of metal commodities. Discrete deposit types are described in the tables. In current economic context, probably the most significant deposits in southern Alaska are the porphyry-type deposits for copper and(or) molybdenum and the submarine volcanogenic deposits mainly for copper, silver, and zinc. However, the region contains numerous examples of many different deposit types that cumulatively contain a large variety of metals. Many of the known deposits, their undiscovered counterparts, and possibly some deposit types not presently known in the region, are of potentially important economic significance.

REFERENCES

Barnes, D. F., 1977a, Gravity map of the eastern part of southern Alaska: U.S. Geol. Survey open-file map OF 77-169-C, 1 sheet, scale 1:1,000,000.

-----1977b, Gravity map of the western part of southern Alaska: U.S. Geol. Survey open-file map OF 77-169-H, 1 sheet, scale 1:1,000,000.

Beikman, Helen M., Holloway, C. D., and MacKevett, E. M., Jr., compilers, 1977a, Generalized geologic map of the eastern part of southern Alaska: U.S. Geol. Survey open-file map OF 77-169-B, 1 sheet, scale 1:1,000,000.

-----1977b, Generalized geologic map of the western part of southern Alaska: U.S. Geol. Survey open-file map OF 77-169-G, 1 sheet, scale 1:1,000,000.

Decker, John, and Karl, Susan, compilers, 1977a, Preliminary aeromagnetic map of the eastern part of southern Alaska: U.S. Geol. Survey open-file map OF 77-169-E, 1 sheet, scale 1:1,000,000.

-----1977b, Preliminary aeromagnetic map of the western part of southern Alaska: U.S. Geol. Survey open-file map OF 77-169-J, 1 sheet, scale 1:1,000,000.

Holloway, C. D., 1977a, Map showing coal fields and distribution of coal-bearing rocks in the eastern part of southern Alaska: U.S. Geol. Survey open-file map OF 77-169-D, 1 sheet, scale 1:1,000,000.

-----1977b, Map showing coal fields and distribution of coal-bearing rocks in the western part of southern Alaska: U.S. Geol. Survey open-file map OF 77-169-I, 1 sheet, scale 1:1,000,000.

MacKevett, E. M., Jr., and Holloway, C. D., 1977a, Metalliferous and selected nonmetalliferous mineral deposits in the eastern part of southern Alaska: U.S. Geol. Survey open-file map OF 77-169-A, 1 sheet, scale 1:1,000,000.

-----1977b, Metalliferous mineral deposits in the western part of southern Alaska: U.S. Geol. Survey open-file map OF 77-169-F, 1 sheet scale 1:1,000,000.

Singer, D. A., 1975, Mineral resource models and the Alaskan mineral resource assessment program, in Vogely, W. A., ed., Mineral material modeling: Washington, D. C., Johns Hopkins Univ. Press, p. 370-382.

TABLE 1. METALLIFEROUS MINERAL RESOURCE DATA FOR EASTERN SOUTHERN ALASKA
(Refers to sheet 1)

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS	SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS) 1/	GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
1.	---	(a)(Cu,Zn,Au)-minor occurrences associated with disseminated pyrite in greenstone and amphibolite (b)Mo(Cu,Ag)--minor occurrences associated with altered zones in granitic rocks; may represent porphyry type deposits	(a)Interpreted as metamorphic deposits whose metals were redistributed and weakly concentrated during metamorphic processes (b)Probably late-stage differentiates of shallow plutons	No data	Broad reconnaissance mapping and widely spaced geochemical sampling by U.S. Geological Survey; essentially unprospected	Area 1 is in a remote and rugged part of the St. Elias Mountains that is largely covered by glaciers; no significant mineral deposits are known in the area	(a)The combination of several known minor occurrences in the few areas not covered by glaciers suggest many of these small deposits might be covered by glaciers. (b)Geochemical anomalies in altered granitic rocks suggest the possibility of porphyry molybdenum deposits.		(b) porphyry molybdenum model
2.	---	Au(Ag)--mainly quartz veins in Cretaceous metamorphosed flysch	Typically thin gold-bearing quartz veins that are localized in greenschist or lower grade metamorphosed flyschoid rocks; spatially and genetically related to Tertiary plutons	No data	Reconnaissance mapping and geochemical sampling by U. S. Geological Survey; scant prospecting	The area consists of a partly glacier-covered mountainous region between higher terrains of the St. Elias Mountains and the Yakutat Foreland; the less metamorphosed rocks southwest of the Boundary fault are regarded as more favorable for gold lodes than the dominantly amphibolite terrane between the Boundary and Fairweather faults	A number of gold veins probably occur in this area		
3.	Au,Fe,Ti--beach and older marine terrace placers	---	Modern beach and older marine terrace placers; the gold placers are best developed in the vicinity of Yakutat; the iron-titanium placers, which generally contain traces of gold, are best developed on beaches and forelands southeast of Yakutat	Minor gold production, probably about 6 kg (several hundred ounces), during early 1900's, from small deposits; large, low-grade iron and titanium resources having a general tenor of 29.8 kg of iron per cubic meter (35 lb/yd^3) and 12.2 kg of titanium dioxide per cubic meter (20.6 lbs/yd^3)	Reconnaissance mapping, some geochemical sampling, and local aeromagnetic coverage by U. S. Geological Survey; investigations involving auger-hole drilling and sampling by U. S. Bureau of Mines; scant recent interest by industry	The placers that are mainly for gold are small and in part ephemeral; the iron-titanium placers are large and extend intermittently for more than 20 km along beaches fronting the Gulf of Alaska; they consist of black sands that contain titaniferous magnetite and ilmenite; the deposits generally are between 1 and 3 m in thickness, and, although they contain local small higher-grade zones, their overall grade proximates that given in the "Production and resource information" column	Large tonnage, low grade iron and titanium placers are known, low tonnage gold placers that are in part emphemeral are also present.		
4.	(a)Au—beach placers (b)Au--stream and bench placers	---	(a)Gold-bearing black sands that are intermittently distributed for at least 25km along beaches fronting the Gulf of Alaska; largely ephemeral deposits concentrated during winter storms (b)Stream and bench placers localized by fluvial processes	(a) Worked intermittently since 1890's; total production between 470 kg and 500 kg (15 and 16 thousand ounces) of gold (b)Mined for a few years during early 1900's; production not accurately known; probably between 30 kg and 60 kg (1 and 2 thousand ounces) of gold	Old and modern, largely reconnaissance, mapping by U.S. Geological Survey; short study to determine potential of radioactive heavy minerals in the beach sands; sampling of beach sands by U.S. Bureau of Mines	The boundaries of area 4 are inaccurately known and the area may extend eastward to include recent unconfirmed placer operations on the perimeter of Icy Bay and westward to include some beaches near Cape Suckling	(a)Gold-bearing beach placers that vary in quality yearly due to winter storms are known (b)Stream and bench gold placers that have been mined; resources remaining are unknown		
5.	---	Cu(Ag,Au,Zn)--submarine volcanogenic deposits related to mafic lavas	Polymetallic copper-rich deposits genetically related to submarine basalts of the Orca Group (Tertiary) and less commonly Valdez Group (Cretaceous)	No data	Broad reconnaissance mapping and scant geochemical sampling by U.S. Geological Survey; essentially unprospected	Area 5 is delineated on the basis of favorable geology--mainly submarine basalts of the Orca Group --and one known occurrence	One known occurrence plus other possible glacially covered unfound mafic volcanogenic copper deposits.		mafic volcanogenic model

1/ Typically estimates of the number of deposits are made only for deposits with tonnages and grades comparable to those used in the grade-tonnage models. Also estimates are made for a few deposits that lack associated grade-tonnage models.

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS	SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS)			GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
6.	---	(a)Cu(Ag Au,Zn)--submarine volcanogenic deposits related to mafic lavas (b)Au--placer	(a)Same as 5 (above) (b)Beach placers and possibly stream or bench placers	No data	Reconnaissance mapping by U. S. Geological Survey; little prospecting	Area 6 contains rocks favorable for submarine volcanogenic deposits but no known deposits of this type; it contains one gold prospect on a beach placer and some permissive terrane for other placer gold deposits; the area may extend southward beneath the Gulf of Alaska to include Orca Group volcanic rocks on the northwest tip of Kayak Island	(a)Undiscovered mafic volcanogenic copper deposits may occur (b)One gold prospect on a beach placer and permissive terrane for other placer gold deposits				(a) mafic volcanogenic model
7.	Au--thin quartz veins in slate and graywacke	---	Gold-bearing quartz veins and veinlets in Orca Group (Tertiary) slate and graywacke; near Tertiary granitic plutons	Minor production, probably about 6 kg (several hundred ounces) of gold, from one property during early 1900's	Old Federal Government reports based on brief examination; reconnaissance mapping by U. S. Geological Survey; little recent interest by industry	Contains one inactive mine and one prospect; parts of the surrounding area may contain similar deposits, but they are largely covered by glaciers or unconsolidated surficial deposits	Two known gold veins; similar undiscovered covered deposits possible				
8.	(a)Cu(Ag,Au,Zn)--submarine volcanogenic (b)Au--mainly quartz veins in Valdez Group (c)Au--placer	Cu--magmatic deposits with weakly disseminated pyrrhotite and chalcopyrite in Tertiary diorite	The area is largely underlain by the Cretaceous Valdez Group, including abundant mafic submarine volcanic rocks (a)Typically localized in shear zones in or near the volcanic rocks (b)Quartz stringers and veins, generally less than 1 m thick, genetically related to Tertiary plutons (c)Stream placers	Only production was from the Midas mine, which produced more than 450 tons (a million pounds) of copper; the main ore zone at the Midas is about 1 m wide and 300 m long and contains some reserves	Reconnaissance geologic mapping by U.S. Geological Survey; brief studies of a few deposits; recent exploration interest by industry at the Midas mine and probably nearby areas	Area 8 is outlined mainly on the basis of its potential for submarine volcanogenic deposits; in addition to the Midas mine the area has 7 prospects on submarine volcanogenic copper deposits; its potential for gold and for magmatic copper deposits is much less than for submarine volcanogenic copper deposits; about half of the area is glacier covered	(a) At least eight mafic volcanogenic deposits are known and more probably remain to be found in the exposed bedrock and under ice. Estimated number of deposits is for deposits comparable in tonnage to those used in the grade-tonnage model. (b) A few low tonnage gold-quartz veins might occur in this area (c) Two small gold-bearing stream placers are known	90% 1	50% 2	10% chance that there are 4 deposits or more	(a) mafic volcanogenic model
9.	(a)Cu(Ag,Au,Zn)--submarine volcanogenic (b)Au--quartz lodes in Orca Group (c)Au--placer	---	A near-coastal area that is underlain by the Tertiary Orca Group and by Tertiary anatectic granitic plutons (a)The submarine volcanogenic deposits are localized in or near mafic lavas of the Orca Group (b)Veins and veinlets in Orca Group flysch (c)Stream placers	No production or resource data	Reconnaissance geologic mapping by U. S. Geological Survey; little recent interest by industry	The area appears to be sparsely mineralized; its known deposits include four for copper and two for gold; it is geologically favorable for additional similar deposits	(a) At least four known mafic volcanogenic deposits; others possible (b) One gold-quartz vein deposit; other small tonnage veins possible (c) Possibility of small stream gold placers; one deposit known				(a) mafic volcanogenic model.

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10.	(a)Cu(Ag,Au,Zn)--submarine volcanogenic (b)Au--Quartz lodes in Orca Group (c)Zn(Au,Ag,Cu)--breccia cemented by sulfides	Cu--magmatic; occurrence of Tertiary gabbro that contains disseminated pyrrhotite and chalcopyrite	Contains the most important submarine volcanogenic deposits of the Prince William Sound area; area underlain by Orca Group (Tertiary) flysch and mafic volcanic rocks and scattered Tertiary felsic plutons (a)Consist of massive and disseminated sulfides, mainly pyrite, pyrrhotite, chalcopyrite, and sphalerite, in Orca Group; generally localized in or near shear zones; related to submarine volcanic processes (b)Small gold-bearing quartz veins, stringers, and veinlets in Orca Group near Tertiary felsic plutons (c)One small known deposit; on brecciated Tertiary pluton; breccia partly cemented by zinc and copper sulfides	Between 1900 and 1930 14 mines on the volcanogenic deposits produced about 97,000 tons (214 million pounds) of copper and subordinate amounts of gold, silver, and zinc; two mines, the Latouche and Ellamar, accounted for more than 96 percent of the production; the few gold mines in the area probably produced a total of not more than 31 kg (1,000 ounces) of gold; resource data are sketchy but the submarine volcanogenic deposits probably represent substantial copper resources; one prospect (Rua Cove) has estimated reserves of at least 1,020,000 tons (1,125,000 st) containing 1.25 percent copper	Modern reconnaissance mapping accompanied by geochemical and geophysical studies by U. S. Geological Survey for that part of area within Seward quadrangle; U.S. Geological Survey sponsored mapping and some sampling for remainder of area; topical studies of some volcanogenic deposits by Government agencies and industry; recent exploration of some volcanogenic deposits by industry	The resource potential of the submarine volcanogenic deposits dwarfs that of other deposit types in the area; some of the volcanogenic deposits contain large amounts of pyrite, which have been investigated as a possible source of sulfuric acid; the main concentrations of known submarine volcanogenic deposits are in three areas; Knight and Latouche Islands and east of Valdez Arm; despite fairly thorough prospecting these largely vegetation-covered areas are favorable for new discoveries particularly of concealed deposits; the less prospected terrain west of Valdez Arm is also favorable	(a) Over 50 mafic volcanogenic deposits are known; many have been incompletely explored and others probably remain to be found. Estimated number of deposits is only for deposits with tonnages comparable to those used in the grade-tonnage model. (b) Several small tonnage gold-quartz veins are known; others possible. (c) One small breccia cemented by zinc and copper sulfides is known.	(a) 90% 50% 10% chance that there are 2 4 8 deposits or more	(a) mafic volcanogenic model
11.	(a)Au(Ag)--quartz lodes in Valdez Group (b) Au--placer	---	Valdez gold district (a)Typically gold-bearing quartz veins, less than 1 m in thickness and less than a few thousand meters in strike length; less commonly veinlets and small pods and lenses; localized in slate, argillite, and graywacke of Valdez Group (Cretaceous); one deposit in Tertiary granite; genetically related to Tertiary anatectic plutons, the deposits contain quartz, minor amounts of gold and less abundant silver, small economically insignificant amounts of base and ferrous metal sulfides, and rarely stibnite (b)Small concentrations of gold in stream placers	Production from the gold lodes commenced shortly after 1900, peaked prior to 1920, and continued on an intermittent small scale until early 1940's; it consisted of about 1400 kg (45,000 ounces) of gold and minor by-product silver; the gold is localized in high-grade shoots that may contain 340 g/ton(10 oz/st) or more gold; the overall grade of the lodes is probably less than 32 g/ton (1 oz/st); probably small reserves and resources in some lodes; production from the placers is negligible	Sketchy reconnaissance mapping and some old studies of the deposits by U. S Geological Survey; little recent interest by industry	The area contains 41 known lode deposits with recorded production from 20 of them, and two known small gold placers; the Valdez district is partly bounded by glacier-covered mountains	(a) Many small tonnage gold-quartz veins are known; others possible because part of the area is ice covered. (b) Several small concentrations of gold in stream placers are known.		

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS	SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS)	GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
12.	Au(Ag,Sb)--mainly thin quartz veins in Valdez Group	---	Port Wells gold district and nearby area; underlain by metaflysch of the Valdez Group (Cretaceous) and subordinately by Tertiary granitic plutons and felsic dikes; the deposits are mainly in the Valdez Group; they consist of quartz veins, rarely more than 1 m thick, and a few stringers, small lenses, pods, and breccia fillings; the lodes generally are less than a few hundred meters in strike length; besides gold and quartz they generally contain calcite, pyrite, arsenopyrite, minor uneconomic amounts of base metal sulfides, and a little silver; a few deposits contain stibnite, which might constitute a minor potential by-or coproduct	Production was mainly prior to 1920 and consisted of 657 kg (21,125 ounces) of gold, including 648 kg (20,600 ounces) from the Granite mine, and a little byproduct silver; most ore was in sporadically distributed high-grade shoots; probably many of the deposits have small reserves and resources	Excellent modern reconnaissance mapping and accompanying geochemical and geophysical data for that part of area in Seward quadrangle; older U. S. Geological Survey mapping for other parts of area; topical studies and some mapping of the mineral deposits; scant recent interest by industry	45 deposits, including 15 mines that, at least, have had minor production, are known in area 15; the potentially favorable areas are partly delimited by glaciers and fiords	Numerous small tonnage gold-quartz veins are known; others possible, particularly under ice		
13.	(a)Cu(Ag,Zn,Au)--submarine volcanogenic (b)Ni,Cr--Magmatic	Cu--occurrence of weakly disseminated copper and iron sulfides in gabbro	Resurrection Peninsula; underlain by Valdez Group (Cretaceous), mainly mafic metavolcanic rocks; minor gabbro and serpentinized dunite (a)Mainly as disseminations and breccia cement in sheared Valdez Group mafic volcanic rocks; local massive sulfides and thin veins; mainly pyrite with subordinate chalcopyrite, sphalerite, pyrrhotite, and secondary copper minerals (b)Minor anomalous amounts of nickel and chromium in serpentinized dunite	No production or known reserves	Modern reconnaissance geologic, geochemical, and geophysical coverage by U. S. Geological Survey; little industry interest	Area 13 contains 11 scantily explored, essentially inactive prospects, and 2 known occurrences	(a) At least 11 incompletely explored mafic volcanogenic copper prospects are known; a few more are possible. The grade-tonnage model may apply to some of these. (b) One small body of serpentinized dunite containing anomalous values of nickel and chromium is known. A few small tonnage nickel or chromium deposits are possible.		(a) mafic volcanogenic model
14.	(a)Au(Ag,Sb)--lodes, typically thin quartz veins in Valdez Group (b)Au(Ag)--placer	Cu--occurrence, vein in shear zone in Valdez Group	Girdwood, Hope-Gilpatrick, and Moose Pass mining districts; area underlain by Valdez Group (Cretaceous) metaflysch that locally is cut by Tertiary felsic dikes and granitic plutons (a)Gold lodes genetically and spatially related to Tertiary anatectic plutons; occur generally as quartz veins that are discontinuous, generally less than 1.5 m thick, and less than 2,000 m long; mainly in the flysch; typically gold-bearing quartz veins with minor amounts of silver and uneconomic scattered base and ferrous metal sulfides; a few deposits have potentials for minor by-or coproduct antimony (b)Stream and beach placers and one beach placer	Total estimated production from the lodes about 435 kg (14,000 ounces) of gold, a small amount of silver, and about 90 kg (a few hundred pounds) of antimony; grade data unknown but probably the gold was erratically distributed and mainly concentrated in shoots; small reserves at a few properties; mostly mined during early 1900's; most placer mines were operated during the early 1900's; their production isn't accurately known, but it probably is slightly greater than the lode production	Reconnaissance geologic mapping and some reconnaissance geophysical surveys and geochemical sampling by U.S. Geological Survey; local detailed or semidetailed mapping of some mines and prospects; small-scale recent activity at a few placer and lode properties	The area includes moderately accessible parts of the Kenai Mountains, and it has been fairly well explored for gold as attested by numerous mines and prospects	(a) Numerous small tonnage gold-quartz veins are known; area fairly well explored and only a few more deposits might be expected to be found. (b) Many small stream and beach gold placers and one beach placer are known; chances for more are slight.		

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS	SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS)	GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
15.	(a)Au(Ag)--mainly thin quartz veins in Valdez Group (b)Au(Ag)--placer	---	Nuka Bay area; underlain by Valdez Group (Cretaceous) and by local felsic dikes and plutons (Tertiary); (a) Mainly thin gold-bearing quartz veins that cut Valdez Group metaflysch; local rich shoots (b)Stream and beach placers	Lode production between 1924 and 1942 about 171 kg (5,600 ounces) of gold and a little byproduct silver; average grade a little more than 103 g/t (3 oz/st) some reserves; no known placer production	Local geologic mapping and some sampling near known deposits, but regional geologic, geochemical, or geophysical coverage is skimpy or lacking; scant recent interest by industry	Area 15 contains 6 mines and 8 prospects on gold lodes and 2 placer gold prospects; its deposits are generally small but locally rich	(a) Five mines and eight prospects on gold-quartz veins are known; deposits tend to be small but locally rich. A few deposits might remain undiscovered (b) Two placer gold deposits that apparently are mined are known; additional deposits not likely	90% 50% 10% chance that there are 2 2 3 deposits or more	
16. a,b	(a)Au(Ag)--lodes, mainly thin quartz veins in Valdez Group or, less commonly in Orca Group or Tertiary felsic plutons (b)Au(Ag,Pt)--placer	(c)(Cu,Ag)--Vein occurrence (d)(U)--lode claims	Area includes most of Chugach and Kenai Mountains and contains extensive glacier cover; largely underlain by Valdez Group (Cretaceous) metaflysch; subordinately by Orca Group (Tertiary) flysch and Tertiary felsic plutons and dikes; (a)Thin gold-bearing quartz veins and a few small lenses mainly localized in Valdez Group; genetically affiliated with Tertiary anatectic plutons. (b)Stream placers and a few small bench placers; one stream placer contains traces of platinum (c)Weakly mineralized vein occurrence in Valdez Group (d)Minor anomalous radioactivity detected at a few sites in the Valdez Group	Estimated total gold production from lodes about 46 kg (1,500 ounces); that from the placers about 120 kg (4,000 ounces); minor byproduct silver recovered; the known gold lodes and placers are small but locally rich; they have scant reserves.	Large disparity in geologic data base; most of area mapped by reconnaissance methods, but extensive tracts of the mountainous hinterland are virtually unmapped; scant local geophysical and geochemical coverage; small-scale recent activity at a few placer and lode gold deposits	Area delineated mainly on basis of its favorable geologic setting for small gold-bearing lodes; it contains scattered isolated known deposits and local clusters of small deposits; large parts of the area are remote and scantily prospected	(a) Widely scattered gold-quartz veins that have small tonnage but locally rich grades; remoteness and large amount of glacial cover suggest that most of the probably large number of undiscovered deposits will remain undiscovered; most of those that are found will probably be uneconomic to mine due to their low tonnage (b)Stream gold placers, one of which contains traces of platinum and a few bench placers are known; relatively small production and few probably remain to be found (c) One small tonnage copper-silver vein with low grades is known; others possible (d) Minor anomalous radioactivity detected at a few localities; slight chance of large tonnage deposits		
17.	Cr--magmatic deposits in layered ultramafic rocks	---	Disseminated and locally massive chromite in layered dunite and, to a small extent, in pyroxenite and serpentinite; known deposits in two ultramafic masses: Red Mountain, about 6.4 by 3.2 km in outcrop plan, and a smaller near tidewater mass at Claim Point; on basis of recent studies both ultramafic bodies are interpreted as klippen that have been thrust over the McHugh complex (Cretaceous?)	Production: 1917-18, about 2,000 tons containing 45 percent Cr_2O_3; 1942-44, 6,619 tons averaging 42 percent Cr_2O_3; 1954-57 about 21,000 tons, grade not known but probably about 40 percent Cr_2O_3; Cr:Fe ratio between 2.7 and 3:1; 1942 estimated reserves of about 150,000 tons of chromite including 77,000 tons that would be derived from concentrating lower-grade material	The deposits have been studied in some detail and the surrounding areas mapped in reconnaissance; scant geophysical and geochemical investigations; continuing interest by industry	Possibly undiscovered deposits of this type exist along the northwest flank of the Kenai and Chugach Mountains, in tectonic settings that are similar to the environs of Red Mountain and Claim Point; however large parts of the inferred favorable areas are covered	One of two ultramafic masses in this area, Red Mountain reportedly contains a total of about 50,000 tons of shipping ore at 41 percent Cr_2O_3. The other mass, Claim Point has about 260,000 tons at 17.8 percent Cr_2O_3 that could be concentrated to about 75,000 tons at 45 percent; additional deposits under younger rocks and water are likely at Claim Point. Additional deposits possibly exist under covered areas along the northwest flank of the Kenai and Chugach Mountains; nickel anomalies are known in both areas; grades and tonnages of podiform deposits are appropriate for unfound deposits in alpine masses		podiform chromite model
18.	(a)Au(Ag)--placer	(b) U--in Tertiary sedimentary rocks	Placer gold deposits on beaches fronting lower Cook Inlet and possibly in nearby alluviated valleys; typically small, in part ephemeral deposits; only a few deposits known	Worked intermittently during early 1900's; production not known, probably about 30 kg (1,000 ounces) of gold and a little silver	The geology of the area has been studied in some detail during U.S. Geological Survey coal-and petroleum-oriented investigations; some interest in the general region for uranium; geophysical investigations related to petroleum exploration; scant recent interest in the gold placers	Tertiary nonmarine sedimentary rocks that underlie the region and large parts of the nearby Kenai Lowland are regarded as favorable hosts for uranium; however, despite some exploration, no uranium deposits are known in the region	(a) A few small, in part ephemeral, gold placer deposits are known; a few others possible (b) Tertiary rocks that underlie this area and large parts of the nearby Kenai lowland are favorable for uranium; however none has been found despite some exploration		

AREA OUTLINED ON MAP	KNOWN TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	CUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS	SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS)	GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
19.	(a)Au(Ag)--mainly thin quartz veins in Valdez Group or McHugh Complex	(c)Cu(Ag,Zn)--submarine volcanogenic (d)Cr--magmatic deposits in ultramafic rocks	The area is contiguous to the Border Ranges fault, a major fault that constitutes a plate boundary; the terrain northwest of the fault is largely covered, but it contains small exposures, mainly of diverse older Mesozoic rocks; the area southeast of the fault contains the McHugh complex (Cretaceous?) and, in some of its sketchily mapped parts, probably Valdez Group (Cretaceous) (a)Mainly thin gold-bearing quartz veins (b)Small placer gold concentrations in beaches, streams, and benches (c)Represented by one poorly known deposit that probably is in mafic volcanic rocks of the Valdez Group and by a few minor occurrences in Jurassic andesitic lavas (d)No known deposits but area is favorable for chromite in layered ultramafic masses similar to deposits in area 17 or in small alpine-type ultramafic rocks	About 6 kg (a few hundred ounces) of gold produced from one placer deposit; no known reserves in any of the deposits	Local semi-detailed and modern reconnaissance mapping in southern part of area; elsewhere sketchy mapping; reconnaissance gravity survey for part of the area; other geophysical or geochemical studies lacking; scant recent exploration interest	---	(a) Some small tonnage gold-quartz deposits exist; a few others possible (b) Small tonnage placer gold in beaches, streams, and benches are known; no known reserves (c) One possible mafic volcanogenic deposit and a few minor occurrences in andesitic lavas are known; others possible (d) No known deposits but area is favorable for chromite similar to deposits in area 17 or in small alpine-type ultramafic rocks		(d) podiform chromite model
20.	(a)Cr--magmatic deposits in ultramafic rocks (b)Cu,Zn,(Ag)--submarine volcanogenic deposits associated with mafic lavas (c)Au(Ag)--lodes, typically thin quartz veins (d)Au(Ag)--placer	(e)Ni--local minor anomalous amounts of nickel in ophiolite (f)U--one prospect allegedly for uranium, in McHugh Complex	The area comprises a terrane south of the Border Ranges fault underlain by the McHugh complex (Cretaceous?) and small tracts north of the fault that are underlain by upper Paleozoic metasedimentary and metavolcanic rocks, ultramafic rocks, gabbro, and granite (a)Chromite in disseminations, thin bands and lenses in dunite in layered ultramafic complexes with outcrop areas as much as 16 km^2; also contain trace amounts of platinum group elements; represented by two prospects and four known occurrences (b)Apparently small low-grade zones in metamorphosed upper Paleozoic mafic volcanic rocks; contain sulfides, including chalcopyrite and sphalerite, in disseminations and veins (c)Two prospects on thin gold-bearing quartz veins in the McHugh Complex (d)Stream placers	Except for small amounts of placer gold there is no known production from the area; the chromite is localized in zones as much as 4 m thick with average Cr_2O_3 contents as much as 11.6 percent; Cr:Fe ratios are between 2 and 3 to 1	Most of the western part of the area is well mapped and covered by reconnaissance geochemical surveys; the eastern part of the area is, at best, sketchily mapped and lacks geochemical coverage; the only known geophysical coverage is a reconnaissance gravity survey; some of the chromite deposits have been studied and sampled; the eastern part of the area has been only cursorily prospected, and it probably contains undiscovered deposits; slight recent interest in the area by industry	Known deposits in area 20 are either too small or too lean to be of current economic importance; however, the area contains commodities that are currently in demand, and more thorough and systematic exploration could discover mineable deposits	(a) Two chromite prospects and four occurrences are known in this area; the large area that is favorable for chromite deposits combined with the scanty exploration suggests that a large number of deposits might exist here (b) Small low-grade mafic volcanogenic deposits containing copper, zinc, and some silver are known; favorable terrain and lack of systematic exploration, especially in the eastern part of the area, suggest that some possibly larger deposits could exist (c) Two thin gold-bearing quartz veins are known; others possible (d) Gold-bearing stream placers are known in the western part of area 20; a few similar placers might exist in the eastern part		(a) podiform chromite model (b) mafic volcanogenic model

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS	SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS)	GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
21.	(a)Cr(Ni,Cu,Pt)--magmatic deposits (b)Cu(Ag,Zn)--submarine volcanogenic deposits (c)Cu(Mo,Ag,Au)--porphyry (d)Zn(Pb,Ag)--replacement deposits (e)Au(Ag)--lode deposits, typically thin quartz veins (f)Ni,Cu(Pt)--magmatic (g)Au(Ag)--placer (h)Cu(Ag)--lode deposits, generally thin veins	(i)(Mn)--hydrothermal lodes	Area includes northern flank of Chugach Mountains and contaminous Chitina Valley; largely underlain by upper Paleozoic metamorphosed sedimentary and volcanic rocks and less extensively by ultramafic-mafic complexes and Jurassic granitic rocks (a)Thin layers, lenses, and disseminations of chromite in partly serpentinized dunite that forms large parts of ultramafic-mafic complexes that are as much as 16 km long and several kms wide but commonly much smaller; local minor anomalous amounts of nickel, copper, and platinum-group elements from parts of the complexes (b)Mainly disseminated sulfides including chalcopyrite and sphalerite in or near metamorphosed upper Paleozoic mafic volcanic rocks (c)Altered zones in Jurassic granitic rocks that contain local sulfide-bearing disseminations and veinlets (d)Massive and disseminated sulfides, mainly sphalerite and galena, in Permian marble (e)Thin gold-bearing quartz veins in upper Paleozoic metamorphic rocks; generally near granitic plutons (f) Small deposits of massive and disseminated sulfides, including pentlandite, bravoite, and chalcopyrite in peridotite dikes or gabbro (g)Stream placers (h)Small copper-bearing veins in upper Paleozoic metamorphic rocks; some may be of submarine volcanogenic derivation (i)Concentrations of manganite-bearing quartz veinlets in lenticular zones within upper Paleozoic metamorphic rocks	Recent gold production, probably on the order of 6 kg (a few hundred ounces) from one of the gold lodes; probably similar older production from the gold placers; the other known deposit types probably contain fairly large, but low-grade resources of several commodities	Some disparity in coverage; that part of the McCarthy quadrangle within the area is covered by modern reconnaissance geologic, geochemical, and geophysical surveys; the remainder of the area by sketchy geologic mapping with scant geochemical and geophysical support; exceptions to this are local studies by graduate students and fairly detailed studies of the Bernard Mountain ultramafic - mafic complex and the Spirit Mountain nickel -copper deposit; moderate recent industry interest in several of the deposits	Area 21 contains a variety of potentially important deposits and much favorable terrain that has been scantily prospected; almost all of the known deposits are unexplored or scantily explored, and reliable assessments of their significance requires additional exploration and study; the little prospected parts of the area are favorable for new discoveries, particularly for deposits associated with mafic-ultramafic complexes, porphyry copper, and submarine volcanogenic deposits.	(a) Scantily explored chromite deposits are known; lack of detailed exploration and favorable geology suggest that many more deposits exist.	90% 50% 10% chance that there are 4 deposits or more	(a) podiform chromite model
							(b) Some disseminated mafic volcanogenic deposits containing copper, silver, and zinc are known; large amount of unexplored favorable terrain; probably undiscovered deposits in area 21	90% 50% 10% chance that there are 1 3 deposits or more	(b) mafic volcanogenic model
							(c) A few undrilled sulfide bearing altered zones in granitic rocks are known; other deposits probably exist	90% 50% 10% chance that there are 1 2 5 deposits or more	(c) porphyry copper model
							(d) Massive and disseminated sulfides containing lead, zinc, and silver are known in Permian marble; other deposits possible		
							(e) Small tonnage gold-bearing quartz veins with some production; others possible		
							(f) Low tonnage massive and disseminated deposits containing nickel and copper with minor concentrations of platinum-group elements are known; other deposits in the ultramafic complexes possible	90% 50% 10% chance that there are 1 2 4 deposits or more	(f) nickel sulfide model
							(g) Gold placers are known; some production; other small placers possible		
							(h) Small tonnage copper veins are known; others possible		

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS	SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS)			GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
								90%	50%	10% chance that there are	
22.	(a)Cu,Mo(Ag)--porphyry type deposits (b)Mo--veins and stockworks (c)Pb,Zn(Ag,Cu)--replacement deposits	(d)Au--disseminated deposits (e)Fe--skarn (f)Cu(Ag)--vein deposits (g)(U,Th)--some favorable hostrock for U-Th deposits	Extreme southeastern parts of Wrangell Mountains; underlain by metamorphosed mid-Paleozoic, mainly carbonate rocks; weakly metamorphosed upper Paleozoic sedimentary and volcanic rocks, andupper Paleozoic syenite-monzonite plutonic complex, gabbro, and Tertiary granitic plutons (a)Associated with altered zones in Tertiary granodiorite; two known deposits; one mainly for copper and the other mainly for molybdenum (b)Molybdenite-bearing quartz veins and small stockworks in Tertiary granitic plutons (c)Small sulfide-bearing pods and disseminations in Permian marble (d)Sparsely disseminated gold in upper Paleozoic volcaniclastic rocks; mineralized zone low in grade and probably local in extent (e)Small magnetite-and hematite-bearing contact metamorphic(skarn) deposit in marble adjacent to upper Paleozoic monzonite; contains minor amounts of copper (f)Small copper-bearing veins in fault zones (g)Some phases of the syenite-monzonite complex are geologically favorable for uranium-thorium deposits	No production; the main inferred resources of the area are in the copper and molybdenum deposits that are associated with Tertiary plutons	Reconnaissance geologic mapping and supplemental reconnaissance geochemical and geophysical investigations; very little exploration	The area is remote and rugged and, at best, has been cursorily prospected; its potentially most significant deposits are copper and molybdenum porphyries associated with Tertiary plutons; these deposits, like others in the area, have had minimal exploration; the Tertiary plutons and their environs are regarded as highly favorable for exploration;other parts of the area, including extensive tracts underlain by mid-Paleozoic rocks that lack known deposits, have diverse degrees of geologic favorability	(a) One porphyry copper and one porphyry molybdenum deposit are known but undrilled; other deposits likely (b) Molybdenite-bearing quartz veins and small stockworks exist; these deposits may be indicators of larger deposits such as the porphyries (c) Small tonnage lead-zinc replacement deposits have been found in area 22; other small deposits of this type probably occur here (d) A low grade disseminated gold deposit in volcaniclastic rocks has been found; probably local in extent	2	3	4 or more deposits	(a) porphyry copper model and porphyry molybdenum model

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS
23.	(a)Cu(Ag)--Kennecott type (b)Cu(Ag)--vein (c)Au(Ag,Sb,Mo)--vein (d)Au(Ag,Cu)--placer (e)Cu(Mo)--porphyry (f)Cu(Fe)--skarn (g)Cu(Ag)--subaerial volcanogenic (h)Ag(Cu,Zn,Pb)--vein (i)Sb(Au,W)--vein	(j)Zn(Ag,Pb)--replacement or vein (k)Mo--vein	South-central flank of Wrangell Mountains, a well mineralized area that contains diverse deposits; underlain by upper Paleozoic and abundant Mesozoic sedimentary and volcanic rocks, local Jurassic and Tertiary plutons--the latter mainly represent subvolcanic hypabyssal rocks-- and local Cenozoic lavas with minor sedimentary facies (a)Mainly massive copper sulfide-rich lodes localized in lower, chiefly dolomitic, parts of Upper Triassic Chitistone Limestone (b)Typically quartz-calcite veins less than 1 m thick that are almost entirely confined to the Triassic Nikolai Greenstone; chief ore minerals, chalcopyrite, bornite, and chalcocite (c)Thin gold-bearing quartz veins genetically related to Tertiary plutons or, rarely, to Jurassic plutons (d)Stream and bench placers (e)Apparently weakly mineralized porphyry-type deposits associated with Jurassic granitic plutons (f)Small magnetite-rich contact-metamorphic (skarn) deposits in Triassic carbonate rocks adjacent to Jurassic granitic plutons (g)Native copper-bearing mainly amygdaloidal deposits in Triassic basalt (h)Small veins that contain silver-bearing tetrahedrite; associated with Jurassic granitic plutons (i)Thin stibnite-rich veins in Triassic carbonate rocks (j)Untested occurrence of sulfide-rich pods in Triassic carbonate rocks (k)Occurrences of thin molybdenite-bearing veins	Production dominated by Kennecott mines, Alaska's premier producer of copper and silver; during their major operations, between 1913 and 1938, these mines produced 540,000 tons (1.2 billion pounds) of copper and 280 tons (9 million ounces) of silver; minor post-1938 production from small-scale, largely surficial, operations; production data for other Kennecott-type deposits less accurately known; probably about 2,300 tons (5 million pounds) of copper and 6,220 kg (200,000 ounces) of silver; Kennecott-type deposits contain some reserves and possibly significant resources; the copper-bearing veins (b)and the gold-bearing veins (c) have accounted for minor production; their resources are believed to be small; prior to 1959 the gold placers (d) produced 4,463 kg (143,500 ounces) of gold and some byproduct silver; since 1959 they produced about 60 kg (a few thousand ounces) of gold and small amounts of native copper nuggets that are utilized in Alaskan jewelry and curios; some placer mines are active, but their reserves and resources are probably small; except for the subaerial volcanogenic deposits (g), which have yielded a little copper and silver, none of the other deposits have been mined; most of these deposits, as well as some of the others, have not been adequately explored, and they all can be regarded as having some resource potential	Geologic mapping, ranging from detailed to reconnaissance, and reconnaissance geochemical and geophysical coverage for entire area; local topical studies, mainly related to the mineral deposits; moderate localized current exploration interest	The area has been well prospected by old, traditional prospecting methods, but only scantily explored by modern, sophisticated techniques; because of its diverse deposits, favorable geology, and impressive mining record, the area is regarded as having a strong potential for significant mineral resources; an approximate summary of the number of known deposits in the area follows: Kennecott type, 11 mines and 3 prospects; copper-bearing veins, mainly in Nikolai Greenstone, 3 mines, 33 prospects, 9 occurrences; gold placers, 4 mines and 4 prospects; mainly native copper in basalt, 1 mine, 7 prospects, 3 occurrences; all other deposit types, 1 mine, 22 prospects, 9 occurrences; a small percentage of the mines and prospects have been active during recent years; the occurrences were discovered during recent U. S. Geological Survey investigations, and some of them are worthy of exploration

SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS)			GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
(a) Massive copper sulfide deposits containing silver were the largest producers of copper and silver in Alaska; average grades were about 13 percent copper and 66 g/t silver; all known deposits are exposed, at least in part on surface, and about 130 km² of favorable geologic terrain is covered; approximately 7 of the large tonnage-high grade and numerous smaller deposits are estimated to be unfound				
(b) Generally small tonnage quartz-calcite veins containing copper and silver; other deposits possible				
(c) Small tonnage gold-bearing quartz veins are known; others possible				
(d) Gold-bearing stream and bench placers that contain some silver and copper have been mined; a few are still active; reserves and resources are probably small				
(e) Three undrilled but apparently weakly mineralized porphyry copper deposits are known; others possible	90% 2	50% 3	10% chance that there are 5 or more deposits	(e) porphyry copper model
(f) Small tonnage skarn deposits containing iron and copper have been found; unfound deposits probably remain				
(g) Low grade native copper-bearing deposits are known; mainly amygdaloidal deposits in Triassic basalt; other deposits likely				
(h) Silver-bearing veins that have small tonnages are known				
(i) Small high-grade antimony (stibnite)-bearing veins				

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS	SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS)	GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
24.	---	(a)Cu(Mo)--porphyry (b)Au--vein	Western Wrangell Mountains; small windows that expose upper Paleozoic metamorphic rocks, Mesozoic granitic plutons, and Cretaceous sedimentary rocks; surrounded by Cenozoic Wrangell Lava; (a)The granitic rocks and their environs are favorable for porphyry-type deposits (b)One gold prospect on a quartz vein that cuts the metamorphic rocks	No data	Sketchily mapped; no known geochemical or geophysical investigations; no known recent prospecting	Area outlined on basis of favorable geology	(a) Favorable terrain for porphyry copper deposits; has not been prospected recently; possibility of one or two deposits in this area (b) One small gold-bearing quartz vein is known; others possible	90% 50% 10% chance that there are 0 1 2 deposits or more	(a) porphyry copper model
25.	(a)Cu(Ag)--submarine volcanogenic (b)Cu(Ag)--vein (c)Cu--magmatic	(d)Cu(Mo)--porphyry (e)Cu--placer	Northeastern flank of Wrangell Mountains; underlain by upper Paleozoic and Mesozoic volcanic and sedimentary rocks, Cretaceous(?) and Tertiary plutons, and Cenozoic Wrangell Lava (a)Native copper in Triassic basalt (b)Chalcopyrite and bornite or chalcocite and their oxidation products in veins less than 1 m thick or in swarms of veinlets or surface coatings; generally in Triassic basalt (c)Occurrence of disseminated sulfides, including chalcopyrite, in a thick mafic dike (d)Altered zones suggestive of porphyry-type mineralization in granitic rocks (e)Native copper nuggets in stream and bench placers	No production or reserve data but possibly significant copper resources	Reconnaissance geologic, geochemical, and geophysical coverage; scant exploration interest	Area 25 has been only scantily prospected; 7 of its 14 known deposits are occurrences that were discovered during recent U.S. Geological Survey investigations; the potential resource significance of the area's diverse copper deposits cannot be accurately determined without adequate exploration; apparently large but very low grade copper resources in Triassic basalts (Nikolai Greenstone) in this and other areas, notably (23), may constitute a resource of the future	(a) Very low grade native copper deposits are known in large volumes of basalt (b) Small tonnage veins or swarms of veinlets generally in basalt (c) One occurrence of copper-bearing disseminated sulfides in a thick mafic dike is known (d) Two altered zones suggestive of porphyry copper-type mineralization in granitic rock have been observed	90% 50% 10% chance that there are 0 1 2 deposits or more	(d) porphyry copper model
26.	(a)Cu--porphyry (b)Au(Ag,Pt)--placer (c)Cu(Au)--lode deposits, mainly veins (d)Au(Ag)--vein	---	Upper Matanuska Valley and nearby terrain; in part bounded by major faults; underlain by Mesozoic sedimentary and volcanic rocks, Tertiary sedimentary rocks, and Mesozoic and Tertiary intrusive rocks (a)The few known porphyry type deposits are associated with strongly altered zones in Tertiary felsic plutons and nearby rocks (b)Numerous small placer gold deposits along streams and alluvial benches (c)Poorly known; probably mostly veins related to intrusive rocks but may include submarine volcanogenic deposits (d)Thin veins probably genetically related to Mesozoic and Tertiary plutonism	Small, but inaccurately known production, probably about 30 kg (1,000 ounces) of gold, from the placers; no lode production; inadequate exploration for valid resource estimate, but resources probably are small to moderate	Reconnaissance and local semidetailed geologic mapping; scant geophysical and geochemical coverage; recent industry interest at several placer and lode deposits	The area contains about 39 known placer deposits and 15 lode deposits; extensive areas northeast of Area 26 that are underlain by Cretaceous sedimentary rocks or surficial deposits of the Copper River Basin contain scattered gold placers; parts of the Copper River Basin are geologically permissive for sedimentary uranium deposits, but this area is not outlined as favorable because prospecting results have been negative; area 26 contains zeolite deposits, which although a nonmetallic commodity, are of possible economic importance	Zeolite deposits that are of possible economic significance are known (a) A few porphyry copper-type deposits are known; few, if any, remain to to be found (b) Many small stream and bench placer deposits containing gold with some silver and platinum (c) Small tonnage copper-bearing veins and possibly submarine volcanogenic deposits (d) Low tonnage gold veins are known; others possible	90% 50% 10% chance that there are 0 1 3 deposits or more	(a) porphyry copper model

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS	SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS)			GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
								90%	50%	10% chance that there are	
27.	(a)Cu(Ag)--lodes, mainly veins	(b)Cu(Mo)--porphyry (c)Au--placer	Southern Talkeetna Mountains; underlain by a large Mesozoic granitic mass and by small areas of upper Paleozoic metamorphic rocks (a)Poorly known copper deposits generally represented by thin veins, fracture coatings and local disseminations; typically in or near apophyses of granitic rocks; may include some porphyry type and magmatic deposits (b)Geologically favorable for porphyry type deposits, but none definitely known (c)One known stream placer	No data	Reconnaissance geologic mapping and local geochemical and geophysical coverage; little recent interest by industry	Area delineated mainly on basis of its geologic favorability for porphyry copper deposits and its lack of systematic modern prospecting	(a) Generally thin copper-bearing veins; some known occurrences may be related to porphyry type and magmatic deposits; lack of systematic prospecting (b) Area favorable for porphyry copper deposits; none known	0	0	2 deposits or more	(b) porphyry copper model

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS	SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS)	GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
28.	(a)Au(Ag,Te)--veins (b)Au(Ag)--placer	(c)Cu(Mo,Ag)--porphyry	Willow Creek district and southwest part of Talkeetna Mountains; largely underlain by an Upper Cretaceous-Tertiary tonalitic batholith; small tracts of upper Paleozoic rocks peripheral to the batholith included in area (a)Mainly quartz veins less than 2 m thick that may extend for a few kilometers along strike; contain gold, minor amounts of sulfides, and, rarely, tellurides and scheelite (b)Chiefly stream placers (c)One poorly known deposit that may be a porphyry type reported in the tonalite; others probable	Total production from the Willow Creek gold lodes about 17,800 kg (574,000 ounces) of gold, small amounts of silver and probably a little tellurium; main mining between 1932 and 1942; placer gold production probably 60 kg (several thousand ounces), but not accurately known; lode gold was produced from 15 mines, a few of which contain small reserves; grade probably about 70 g/t (a few ounces per ton)with local higher-grade shoots	The Willow Creek district has been mapped and studied in some detail; the rest of the area in reconnaissance; reconnaissance geochemical and geophysical surveys cover parts of the area; small-scale recent activity at a few of the placer and lode deposits.	For some unknown reason the productive known gold lodes are concentrated in or near southern parts of the tonalite batholith; although no gold lodes are known in them, similar gold lodes may occur in other parts of the batholith; the Willow Creek district has been well prospected, and its inferred lode gold resources are largely in deeper parts of known deposits or in concealed, undiscovered deposits; the northern and central parts of the batholith have some potential for porphyry copper deposits as well as gold lodes; one small soapstone deposit in the area is mined intermittently	(a) Numerous gold-bearing quartz veins in southern part of this area have had significant production; a few contain small reserves; majority of resource probably in deeper parts of known deposits or in concealed, undiscovered deposits that may be near the known deposits or in other parts of area 28 that appear geologically similar (b) Small gold-bearing stream placers are known; some others possible (c) One deposit may be a porphyry copper-type; geology is favorable for more	90% 50% 10% chance that there are 0 1 3 deposits or more	(c) porphyry copper model
29.	(a)Fe--contact metamorphic	(b)Au--placer	Area includes marginal facies of Jurassic granitic batholith and nearby Lower Jurassic sedimentary and volcanic rocks (a)Apparently small contact-metamorphic(skarn) type deposits that are rich in magnetite (b)Stream placers	No data	Local brief study of known contact-metamorphic deposits and reconnaissance geologic mapping; scant known geochemical and geophysical investigations; little recent interest	The known deposits appear to be too small to constitute a significant iron resource, but the area has been only cursorily prospected and may contain larger deposits	(a) Several iron-rich (magnetite) skarn deposits; tonnages appear small but other larger deposits may exist in this largely unprospected area		

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS
30.	(a)Mo--veins and veinlets (b)U--veinlets and coatings (c)Au(Ag)--vein	(d)Cu(Mo,Ag)--porphyry; one known occurrence (e)Ag,Au(Pb,Zn,Sb,Bi)--vein; one known occurrence (f)Cu(Au)--contact metamorphic; one reported occurrence (g)Sn--vein or disseminated; float samples (h)Au(Ag)--placer	Part of southwestern Alaska Range; underlain largely by a Tertiary granitic batholith that forms the core of the range throughout the area; less extensive Mesozoic granitic rocks, and locally metamorphosed Mesozoic and Tertiary volcanic and sedimentary rocks; area continues westward into sheet 2 (a)Molybdenite in thin quartz veins and veinlets that cut Tertiary granitic rocks; possibly local stockworks (b)Sparsely distributed secondary uranium minerals mainly localized along joints in Mesozoic tuff and tuff breccia (c)Thin gold-bearing quartz veins in Tertiary granite or Mesozoic volcanic and sedimentary rocks (d)Mineralized altered zones in Tertiary granite (e) Apparently small polymetallic precious metal-bearing veins that cut Tertiary granite (f)One reported occurrence of a contact-metamorphic (skarn)-type deposit; probably contiguous to a Tertiary pluton (g)Float samples that contain small anomalous concentrations of tin (h)Occurrence of placer gold in panned concentrates	No production or known reserves but possibly potentially significant resources	Most of area sketchily mapped, but parts are unmapped; local reconnaissance geochemical coverage; scant geophysical investigations; recent activity at a few of the prospects, notably those for molybdenum or uranium	The area is in rugged, partly glacier-covered terrain and has not been thoroughly prospected; most of its known deposits represent recent discoveries; the extensive, largely alluviated lowland east of the area contains several placer gold deposits, including a few that have had minor production; isolated outcrops throughout the lowland have some potential for mineral resources, particularly for porphyry type copper-molybdenum deposits; area 30 contains a variety of known mineral deposits and extensive scantily explored or unexplored tracts that are geologically favorable; additional exploration of the known deposits or in scantily prospected areas may identify significant mineral resources

SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS)			GRADES AND TONNAGES FOR THIS DEPOSITS TYPE (IN TABLE 4)
	90%	50%	10% chance that there are	
(a) Thin quartz veins and possible local stockworks containing molybdenite exist; others possible but tonnages low				
(b) Uranium in veinlets and coatings associated with volcanic rocks is known				
(c) *Thin gold-bearing* quartz veins; tonnages small				
(d) One porphyry type occurrence; area is largely unexplored and favorable for porphyry copper and molybdenum deposits	1	2	5 deposits or more	(d) porphyry copper model porphyry molybdenum model
(e) One small tonnage polymetallic vein containing gold and silver; others possible				
(f) *Reported occurrence* of a copper-bearing skarn; others probable				(f) copper skarn model
(g) Anomalous concentrations of tin; significance not known				
(h) Placer gold occurrence that has not been examined closely				

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS	SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS			GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
31.	(a)Cu(Mo,Ag,Au)--porphyry (b)Au(Ag)--placer (c)Cu(Ag)--vein (d)Cu(Ag)--subaerial volcanogenic (e)Au(Ag,Cu)--vein	(f)Au(Cu)--contact metamorphic? (g)Cu--magmatic, one occurrence (h)Ag(Au,Cu,Zn,Pb)--vein	Extreme northeastern part of McCarthy quadrangle and southeastern part of Nabesna quadrangle; contains local upper Paleozoic and Triassic sedimentary and volcanic rocks, abundant upper Mesozoic flysch with subordinate volcanic facies, Cretaceous granitic plutons, Tertiary felsic hypabyssal plutons, and Cenozoic andesitic lavas (a)Porphyry-type deposits associated with Cretaceous granitic rocks of the Klein Creek pluton (b)Stream and bench placers (c)Thin sulfide-bearing quartz or quartz-calcite veins in diverse host rocks (d)Mainly native copper sparsely distributed in amygdules or lean disseminations in Triassic basalt (e)Thin gold-bearing quartz veins in a variety of host rocks (f)Massive sulfides, chiefly pyrrhotite, associated with minor amounts of gold at one old prospect (g)Sparsely disseminated sulfides, including chalcopyrite, in gabbro (h)Thin polymetallic carbonate or barite veins	Placer gold production estimated between 1,400 kg and 1,560 kg (45,000 and 50,000 ounces) of gold and minor byproduct silver constitutes the only production from the area; the area's six porphyry copper prospects have resources estimated at 260 million tons of 0.2 percent copper and very low molybdenum and gold contents; the area may contain some placer gold resources of interest, but resources in other deposit types, except porphyries, are inferred to be minor	Covered by modern reconnaissance geologic, geochemical, and geophysical investigations; recent exploration interest in the porphyry deposits, a few gold placers, and one gold lode	The resource potential of the porphyry copper deposits overshadows that of the other deposit types; a strong aeromagnetic anomaly near the southeastern extremity of the area is strongly suggestive of a concealed pluton of the Klein Creek type, which may be an attractive exploration target for porphyry-type deposits	(a) Mine porphyry copper type deposits have been found but are incompletely explored; six deposits have been partially drilled; several undiscovered deposits are possible in this area; between areas 31 and 32 lies a covered region favorable for porphyry copper deposits (b) A number of placer gold deposits are known; past production about 1500 kg gold; some gold probably remains in known placers; a few placers might be left to be found (c) Small tonnage sulfide-bearing veins occur; others possible (d) High tonnage of very low grade copper in basalt; smaller tonnages with locally high grades possible (e) Small tonnage gold-bearing quartz veins	90%	50%	10% chance that there are 6 or more deposits	(a) porphyry copper model

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS
32.	(a)Cu(Mo,Ag,Au)--porphyry (b)Mo--porphyry (c)Au,Cu(Ag,Fe)--contact metamorphic (d)Cu(Ag,Au)--stockwork (e)Cu(Ag,Pb,Zn)--breccia pipe (f)Cu(Ag)--subaerial volcanogenic (g)Cu(Ag)--vein (h)Au(Ag)--placer (i)Au(Ag)--vein	(j)Cu--magmatic? (k)Mo--pegmatite (l)(Ag,Pb,Zn)--vein	South-central and west-central parts of Habesha quadrangle; underlain by upper Paleozoic and Mesozoic volcanic and sedimentary rocks, Mesozoic and Tertiary plutons, and local Cenozoic volcanic rocks (a)Porphyry-type deposits associated with Mesozoic granitic plutons (b)Porphyry-type deposits generally associated with Tertiary plutons (c)Contact-metamorphic deposits adjacent to Mesozoic granitic plutons; chiefly for gold or copper (d)Stockworks of quartz veins in or near Tertiary or Mesozoic plutons (e)Breccia pipes associated with dynamic intrusive activity (f)Amygdaloidal and weakly disseminated copper deposits in Triassic basalt (g)Thin copper-bearing veins in various host-rocks, mainly Triassic basalt (h)Small placer gold deposits in streams (i)Thin gold-bearing veins in diverse geologic settings (j,k,l)Minor occurrences with little economic potential	The only production from the area consists of a little less than 1,800 kg (57,000 ounces) of gold almost entirely from one contact-metamorphic deposit, the Habesha mine; large low-grade copper, molybdenum, and gold resources are inferred in the porphyry-type deposits; the two largest- known and best-explored porphyry copper deposits have indicated and inferred resources of about 820 million (metric) tons that average between 0.30 and 0.35 percent copper, 0.02 percent molybdenum, and about .017 g/t (0.006 oz/st) gold, and very low amounts of silver; the other porphyry copper and porphyry molybdenum deposits are much smaller; one contact-metamorphic deposit contains 4,000 tons that averages 34 g/t (1 oz s/t) gold, and similar resources are inferred in nearby deposits; the other deposit types are inferred to have small resources, but, in general, they haven't been adequately explored	Covered by modern reconnaissance geologic, geochemical and geophysical studies by U.S. Geological Survey; local topical studies, mainly of porphyry type deposits, by government and other geologists; fairly active recent exploration of a few porphyry type deposits	The area is highly and diversely mineralized; it is believed to contain significant resources, particularly in porphyry-type deposits; despite a moderate amount of prospecting, the area probably contains some undiscovered, concealed deposits that may be important

SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS)			GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
(a) Two porphyry copper deposits have been well explored; four other deposits have been partially explored and are probably porphyry coppers; other concealed deposits probably remain to be found	90%	50%	10% chance that there are	(a) porphyry copper model
	4	6	9 or more deposits	
(b) Two deposits that are probably the porphyry molybdenum type have been discovered; one or two more are possible in this area	90%	50%	10% chance that there are	(b) porphyry molybdenum model
	2	3	4 or more deposits	
(c) Contact metamorphic copper deposits that contain gold are known; geology favorable for more	90%	50%	10% chance that there are	(c) skarn copper model
	8	10	14 deposits or more	
(d) Copper-bearing stockworks of quartz veins containing silver and gold; possibly related to porphyry copper type deposits				
(e) Breccia pipes containing copper and some silver, lead and zinc; tonnages not known but probably small				
(f) Large tonnage of very low grade copper in basalt; low values of silver; possibly local concentrations of higher grade				
(g) Low tonnage vein deposits containing copper with minor silver				
(h) Small placer gold deposits in streams				
(i) Low tonnage gold-bearing veins				

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS	SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS)	GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
33.	(a)Au(Ag,Pt)--placer (b)Ag,Au(Cu,Pb)--vein (c)Cu(Ag)--submarine volcanogenic (d)Cu--contact metamorphic (e)Mo,Cu(Ag)--porphyry and stockwork	(f)Fe--submarine volcanogenic? (g)Cu(Ag)--subaerial volcanogenic (h)Au--disseminated (i)U--vein? (j)Cr--magmatic	Southern flank of eastern Alaska Range and vicinity; area locally transected by Denali fault but mainly south of the fault; underlain by Paleozoic metamorphic rocks north of Denali fault; elsewhere by upper Paleozoic volcanic, sedimentary, and plutonic rocks and by Mesozoic volcanic and plutonic rocks (a)Stream, bench, and channel placers (b)Quartz or barite-carbonate veins less than 2.5 m thick generally in the Ahtell pluton (upper Paleozoic) or nearby rocks; mainly prospected for silver, less commonly for gold or copper (c)Mainly copper-bearing disseminated sulfides in Paleozoic metamorphic rocks; includes a few deposits that may represent metamorphic replacements (d)Localized adjacent to granitic plutons; typically contain sparsely disseminated copper minerals (e)One weakly mineralized molybdenum porphyry and one small stockwork that contains copper minerals; both in upper Paleozoic granitic rocks (f)One occurrence, a banded zone about 5 m thick that is rich in magnetite and hematite; in Pennsylvanian volcanic rocks (g)Occurrence of weakly mineralized copper-bearing amygdules and disseminations in Triassic basalt (h)Occurrence of sparsely disseminated gold in diorite (i)Lode claim for uranium; no geologic data (j)Sparsely disseminated chromite in small, partly serpentinized, dunite masses along the Denali fault	The gold placers account for the only production from the area; their production is not accurately known but probably on the order of 1,900 kg (60,000 ounces) of gold with a little by-product silver and platinum; the placers are believed to contain sufficient resources for continued small-scale mining; the silver-rich veins associated with the Ahtell pluton appear to be too small to constitute more than a modest resource; the largely untested submarine volcanogenic, porphyry, and stockwork deposits may contain significant resources; other deposit types known in the area are regarded as having minor resource potentials	The geology of the area is mainly known from local investigations by state geologists; some geochemical sampling, but no geophysical studies, accompanied these investigations; parts of the area are well prospected and others scantily prospected; recent activity has centered on several placer operations, exploring a few silver-bearing veins, and searching for submarine volcanogenic or porphyry-type deposits	The area is well mineralized; it contains several deposit types and, possibly, significant resources	(a) Gold-bearing stream, bench, and channel placers have had past production on the order of 1900 kg gold with some silver and platinum; continued small production possible (b) Small tonnage quartz or barite-carbonate veins containing silver, gold, and some copper and lead (c) Copper-bearing disseminated sulfides that may represent volcanogenic deposits (d) Three contact metamorphic deposits containing copper known; others possible (e) One weakly mineralized porphyry molybdenum deposit and one small stockwork that may be a porphyry copper are known; area is favorable for porphyry copper or molybdenum deposits and is only partially explored (h) Occurrence of sparsely disseminated gold in diorite; may be related to porphyry copper mineralization	90% 50% 10% chance that there are 3 5 9 deposits or more 90% 50% 10% chance that there are 0 1 3 deposits or more	(e) porphyry copper model porphyry molybdenum model

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS
34.	(a)Au(Ag)--placer (b)Cu(Mo,Au,Ag)--porphyry (c)Cu(Ag)--submarine volcanogenic (d)Cu(Fe,Au)--contact metamorphic (e)Ni,Cu(Ag)--magmatic (f)Cu(Ag)--subaerial volcanogenic (g)Au(Ag)--vein (h)Cu(Ag)--vein (i)Mo(Cu)--porphyry (j)Cu(Ag)--sedimentary?	(k)Au(Cu)--fossil placer? (l)Zn(Cu)--metamorphic replacement (m)Cr--magmatic (n)U--type unknown	Southern flank of east central Alaska Range south of McKinley strand of Denali fault and proximal area to south; underlain by upper Paleozoic and Mesozoic volcanic and sedimentary rocks; Mesozoic and Tertiary granitic plutons, and local ultramafic and mafic masses (a)Stream, beach, and channel placers (b)Porphyry-type deposits in or near granitic plutons (c)Disseminated and locally massive sulfides, including chalcopyrite; typically associated with upper Paleozoic volcanic rocks (d)Skarn-type deposits generally with lean disseminations of chalcopyrite and local concentrations of magnetite (e)Disseminated and locally massive sulfides in ultramafic dikes or gabbro; contain some chalcopyrite and pentlandite (f)Low-grade mineralized zones in Triassic mafic lavas (g)Thin gold-bearing quartz veins in diverse host rocks (h)Thin veins commonly localized in shear zones; most abundant in Triassic volcanic rocks (i)Local, apparently low-grade concentrations of molybdenite-bearing quartz veins in Cretaceous? granite (j)Finely laminated pyrite and chalcopyrite in Triassic sedimentary rocks that interfinger with Triassic basalt (k)Weakly mineralized gold-bearing upper Paleozoic conglomerate (l)Occurrence of disseminated zinc and copper minerals in metasedimentary rocks (m)Sparsely disseminated chromite in small masses of serpentinized dunite (n)Reported claim; geologic setting not known	The Valdez Creek district has produced about 1,700 kg (54,000 ounces) of placer gold and some byproduct silver; its placer gold resources have been estimated at more than 15,000 kg (485,000 ounces) in buried channels and bench gravels; the other gold placers in the area have yielded minor production; they probably have small resources; no known lode production; potentially significant resources in several types of lode deposits, particularly the porphyry and submarine volcanogenic deposits	Geologic mapping in area mainly by State and University geologists; local geochemical studies; seismic survey of a small part of the Valdez Creek district; parts of the area have been only cursorily examined; fairly active recent prospecting but minor physical exploration	The area is regarded as being well mineralized and as having a good resource potential; besides its placer gold resources, the area contains scantily explored deposits of several types that represent potentially significant resources, and it is favorable for additional discoveries

SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS)			GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
(a) Placer gold deposits with some silver; past production of about 1,700 kg gold; placer gold deposits in buried channels and bench gravels have resources estimated at more than 15,000 kg gold				
(b) Five porphyry copper deposits have been found; favorable geology and uneven exploration suggest that additional unfound deposits remain	90% 4	50% 6	10% chance that there are 10 deposits or more	(b) porphyry copper model
(c) Volcanogenic deposits containing copper, silver and some lead; five deposits have been discovered; more likely	90% 2	50% 4	10% chance that there are 9 deposits or more	(c) felsic and intermediate volcanogenic massive sulfide model
(d) Copper skarn deposits that contain iron and gold are known; additional deposits possible				(d) copper skarn model
(e) Six nickel and copper-bearing massive sulfide deposits have been found; others possible				(e) nickel sulfide model
(f) Very low grades of copper and silver in large tonnages of mafic volcanic lavas; local concentrations of higher grades possible				
(g) Numerous low tonnage quartz veins containing gold and some silver				
(h) Small tonnage copper veins; usually in mafic volcanic rocks				
(i) One apparently low grade porphyry molybdenum deposit is known; others possible				(i) porphyry molybdenum model
(j) Copper and minor silver in sedimentary rocks associated with basalt; deposit type not clear				
(k) Low grade gold-bearing conglomerate				
(m) Apparently low grades of chromite in small masses of dunite; other deposits possible				(m) podiform chromite model

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS
35.	(a)Cu(Au,Ag)--vein (b)Cu(Au,Ag)--submarine volcanogenic (c)Cu(Mo)--porphyry (d)Au(Ag)--placer	(a)Au--vein, occurrences (f)Mo--porphyry	Parts of the Talkeetna Mountains and nearby low-relief uplands; underlain by upper Paleozoic volcanic and sedimentary rocks; Lower Jurassic volcanic and sedimentary rocks, and Mesozoic and Tertiary granitic rocks (a)About 10 prospects and several occurrences on typically thin copper-bearing veins that are localized in shear zones, mainly in upper Paleozoic rocks (b)Disseminations and local small masses that contain copper sulfides; in upper Paleozoic volcanic rocks (c)Lean disseminations and veinlets that contain chalcopyrite and molybdenite; in or near granitic rocks (d)Stream and bench placers (e)Thin, lean gold-bearing veins (f)The granitic plutons, chiefly the Tertiary ones, are favorable for porphyry molybdenum deposits	Except for small production of gold from the placers the area has not been productive; known resources are meager, but possibly significant potential resources, mainly in the submarine volcanogenic or porphyry type deposits	The Talkeetna Mountains quadrangle part of the area is covered by modern reconnaissance geologic, geochemical, and geophysical studies; the eastern part of the area, in the Gulkana quadrangle, is only sketchily mapped and lacks geochemical and geophysical studies; moderate recent exploration interest in parts of area, particularly in the submarine volcanogenic and porphyry deposits and a few gold placers	The area contains large tracts that have not been thoroughly prospected and are geologically favorable for porphyry and submarine volcanogenic deposits; although the known submarine volcanogenic deposits are associated with upper Paleozoic volcanic rocks, the Lower Jurassic volcanic sequences may also contain similar deposits; isolated outcrops and concealed area mainly south of the eastern tongue-like extremity of the area also have some favorability for resources
36.	(a)Mo(Cu,Au)--porphyry and vein (b)Ag,Au,Sb--vein (c)Cu(Au)--porphyry and vein (d)Au(Ag)--placer	(e)Cu(Ag)--subaerial volcanogenic (f)U--one occurrence reported; adjacent to a small granitic pluton	Includes broad, mainly mountainous regions in the upper Susitna and Chulitna River drainage systems; largely underlain by upper Mesozoic flysch and by Tertiary and Cretaceous granitic plutons; local Triassic and Cenozoic subaerial volcanic rocks (a)A few known porphyry-type deposits and thin veins associated with Tertiary granitic rocks (b)Small precious metal and locally stibnite-rich veins in diverse host rocks; typically associated with Tertiary intrusive rocks (c)Poorly known deposits mainly related to granitic rocks; includes at least one copper-bearing porphyry (d)Stream and bench placers (e)The Triassic volcanic rocks are favorable hosts for subaerial volcanogenic deposits	Minor placer gold production; a little silver recovered from the placers and one lode; known deposits apparently have small resources	Parts of the Talkeetna and Talkeetna Mountains quadrangles that are within Area 36 are covered by modern U.S. Geological Survey studies including reconnaissance geology, geochemistry, and geophysics; the remainder of the area has scant geologic coverage and no known geochemistry or geophysics; a little recent interest by industry	On the basis of its known deposits, the mineral resource potential of the area is low; however, the area has been scantily prospected, and it is geologically favorable, particularly for porphyry type deposits

SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS)			GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
(a) copper-bearing veins that contain some gold and silver; generally small tonnages; about 10 prospects known; more possible				
(b) Copper-bearing submarine volcanogenic deposits that contain gold and silver; known deposits are apparently disseminations and local small masses; other, possibly larger, deposits likely	90%	50%	10% chance that there are 9 deposits or more	(b) felsic and intermediate volcanogenic massive sulfide model
	1	3		
(c) several low grade porphyry copper deposits that contain molybdenum have been found; other, possibly higher grade deposits, are possible in area 35 and south of the eastern tongue-like extremity of the area	90%	50%	10% chance that there are 5 deposits or more	(c) porphyry copper model
	1	2		
(d) numerous gold-bearing stream and bench placers are known; production has been small; small quantities probably remain				
(f) Part of the area is favorable for porphyry molybdenum deposits; none have been discovered yet	90%	50%	10% chance that there are 3 deposits or more	(f) porphyry molybdenum model
	0	1		
(a) Several porphyry molybdenum deposits have been found; favorable geology and scanty exploration suggest that more deposits may occur	90%	50%	10% chance that there are 4 deposits or more	(a) porphyry molybdenum model
	1	2		
(b) A few small tonnage veins containing gold, silver, and some antimony are known; others likely				
(c) Several poorly known deposits that may be the porphyry copper type; others may be present	90%	50%	10% chance that there are 4 deposits or more	(c) porphyry copper model
	0	1		
(d) Gold-bearing stream and bench placers; minor gold and a little silver produced; apparently small amounts remain				
(e) Mafic volcanic rocks may contain local concentrations of copper				
(f) One uranium-bearing occurrence adjacent to a small granitic pluton				

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS	SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PRESENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS)			CODES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
37.	(a)Au(Ag,Pt,Sn,U,Th) --placer (b)Au(Ag)--vein	(c)Sn--vein or greisen	Kahiltna River drainage basin; underlain by upper Mesozoic sedimentary and volcanic rocks, Cretaceous and Tertiary sedimentary rocks, Tertiary granite, and Quaternary surficial deposits (a)Stream, bench, and flood-plain placers and fossil placers in Tertiary conglomerate (b)Thin precious metal-bearing veins in sedimentary rocks or Tertiary plutons; probably genetically related to Tertiary igneous activity (c)Suspected tin deposits associated with Tertiary granite	The area includes a productive and active placer district with at least 20 active placer mines; one of Alaska's major placer gold areas, but production data are not reliably known; some byproduct silver and platinum; no known lode production; the placers represent a viable resource capable of, at least, short-term important gold production; some tin, uranium, thorium, and platinum minerals in the placer concentrates; these may indicate some resource potential; the known lode deposits are too small to suggest significant resources	Covered by modern U.S. Geological Survey reconnaissance geologic, geochemical, and geophysical studies and by older topical and reconnaissance studies; recent activity concentrated on the placer deposits	Tertiary plutons in the poorly explored mountainous northern part of the area are favorable for tin deposits	(a) Placer gold deposits containing silver, platinum, tin, uranium, and thorium; significant production of gold with some byproduct silver and platinum; deposits occur as stream, beach, floodplain and fossil placers in conglomerate; potential for further production from known deposits and undiscovered deposits (b) Small tonnage veins containing gold are known (c) Vein or greisen tin deposits; poorly explored northern part of area favorable for tin deposits				
38.	(a)Au,Ag(Cu,Pb)--breccia pipe (b)Au,Ag(Sb,Pb,Zn) --vein (c)Sn--lode (d)Ni,Cr(Cu,Pt)--magmatic (e)Cu(Au,Ag)--porphyry (f)Cu(Au,Ag,Mo)--contact metamorphic (g)Cu(Au,Ag,Sb,Pb,Zn) --vein and replacement (h)Au(Ag)--placer	(i)Mo--vein; one prospect on thin rhodochrosite-bearing veins	Upper Chulitna district and nearby regions; a highly mineralized, structurally complicated area underlain by locally metamorphosed Paleozoic and Mesozoic sedimentary and volcanic rocks, Tertiary sedimentary rocks, Tertiary and Cretaceous granitic plutons, and a few small ultramafic bodies (a)Precious-and base-metal-bearing Tertiary breccia pipes (b)Thin, polymetallic precious metal-bearing veins in diverse host rocks (c)Tertiary granites that contain cassiterite, mainly in greisen (d)Magmatic deposits typically in small serpentinized ultramafic masses; contain disseminated and locally massive chromite, local anomalous amounts of nickel and copper, and trace amounts of platinum (e)Apparently weakly mineralized porphyry-type deposits (f)A few, probably small, contact-metamorphic deposits (g)Polymetallic sulfide-bearing veins and dissemination, mainly in Triassic carbonate and volcanic rocks (h)Stream and beach placers	The Golden Zone mine, which exploited a breccia pipe, produced about 49 kg(1,580 ounces)of gold, 268 kg (8,620 ounces) of silver, 19 t(21 st) of copper, and a little lead; minor placer gold production with some byproduct silver; some identified resources in the Golden Zone; more speculative resources in many of the other deposits, which are largely poorly explored	The Talkeetna quadrangle part of the area and the Upper Chulitna district are well covered by reconnaissance mapping supplemented by some geochemical and geophysical support; the more remote parts of the area in the Healy quadrangle have been sketchily mapped; some recent exploration interest	The area contains many types of mineral deposits including some that have been only scantily explored; among these, the tin, magmatic, and porphyry-type deposits, in particular, may have good resource potentials and are worthy of exploration	(a) Four breccia pipes containing gold, silver, copper and lead are known; one deposit has produced about 50 kg of gold and 60 kg silver with some copper and a little lead; some resources remain in known deposits; a few other deposits possible (b) Numerous small tonnage veins that contain gold and silver with minor antimony, lead, and zinc (c) Several tin deposits that are mainly in greisen have been found; others possible (d) At least 10 deposits that contain chromite and/or nickel, copper and trace amounts of platinum; typically in small serpentinized ultramafic masses; not thoroughly explored (e) Porphyry-type deposits that apparently are weakly mineralized; three deposits known; a slight possibility of other deposits (f) A few, probably small tonnage, contact metamorphic deposits that contain copper and some gold, silver and molybdenum (g) Copper-bearing vein and replacement deposits that have some gold, silver, antimony, molybdenum, and zinc (h) Generally small gold-bearing stream and beach placers	90% 1 50% 2 10% chance that there are 4 deposits or more		(d) podiform chromite model, nickel sulfide model (e) porphyry copper model	

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS	SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESCRIBED OR MORE DEPOSITS	GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
39.	(a) Cr(Ni)--magmatic (b) Mo--vein (c) Cu,Au--mainly vein	(d) Cu(Ag,Au)--porphyry (e) Mo(Cu)--porphyry (f) Au--placer (g) Sn--lodes (h) W--veins?	Extensively glacier-covered part of Alaska Range in Talkeetna quadrangle; largely underlain by upper Mesozoic flysch and Tertiary granite; local ultramafic rocks and Paleozoic sedimentary rocks (a) Disseminated and massive chromite in ultramafic rocks that generally are poorly exposed and, in places, layered; local anomalous amounts of nickel in some of the ultramafic rocks (b) Thin molybdenite-bearing quartz veins, genetically related to Tertiary plutons (c) Thin veins, local disseminations, and one massive body that may represent a replacement; commonly contain copper-iron sulfides and some gold (d) One known, apparently lean, porphyry-type deposit in Tertiary granitic rocks (e) Float samples indicative of molybdenum porphyry deposits (f) Placer gold in panned concentrates (g) Suspected tin deposits associated with Tertiary granitic rocks (h) Favorable rocks that contain some uranium minerals in area 30 extend into area 39	No production or identified resources; however, this scantily explored area is regarded as having at least a moderate resource potential	Covered by modern U.S. Geological Survey reconnaissance investigations, including geologic mapping, geochemical sampling, and a broad-scale aeromagnetic survey; also U. S. Bureau of Mines sponsored studies of part of area; little or no recent interest by industry	The area is in a remote, rugged, and largely glacier-covered part of the Alaska Range; no mines or prospects are within the area, largely a reflection of the lack of prospecting; numerous occurrences discovered during recent U.S. Geological Survey investigations accentuate the area's favorable mineral resource potential	(a) Disseminated and massive chromite; poorly exposed; largest observed pod 2 m thick and 20 m long; numerous occurences recently discovered and not completely explored; undiscovered deposits probable (b) Molybdenum-bearing veins; probably small tonnages (c) Small tonnage copper-bearing veins; some local disseminations and one possible replacement; commonly contain some gold (d) One known, apparently low copper grade, porphyry-type deposit; a few others possible (e) Possible porphyry molybdenum deposits; some indications and favorable geology (g) Suspected tin deposits; lack of prospecting and favorable geology (h) Favorable rocks that contain some uranium in area 30 extend into this area; some chance of uranium deposits in veins in this area		(a) podiform chromite model (d) porphyry copper model (e) porphyry molybdenum model

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS(INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS	SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS)	GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
40.	(a)Cu(Ag,Zn,Pb)--submarine volcanogenic (b)Sb(Au)--vein (c)Au(Ag)--placer (d)Au(Ag)--vein	(e)Cu(Mo)--porphyry	Northeast flank of eastern Alaska Range; contains Paleozoic and probably Precambrian metamorphosed volcanic and sedimentary rocks, Mesozoic and Tertiary granitic rocks, and Cenozoic surficial deposits (a)Massive and disseminated polymetallic sulfide deposits associated with Paleozoic metamorphic rocks, chiefly felsic metavolcanic rocks; local veins (b)Stibnite-rich veins, as much as 6 m thick, that mainly cut Paleozoic metamorphic rocks (c)Stream and bench placers (d)Thin precious metal-bearing quartz veins in diverse host rocks;probably related to Tertiary igneous activity (e)Speculative porphyry-type deposits on the basis of favorable host rocks	The only known lode production from the area consists of small tonnages of antimony ore that have been mined intermittently during recent years; small quantities of gold with subordinate byproduct silver have been recovered from the placer deposits; the predominant resource potential of the area is in recently discovered submarine volcanogenic deposits, which, although not as yet thoroughly explored, portend significant resources; potential resources in the other deposit types, with the exception of the speculative porphyry-type deposits, are believed to be small	The Nabesna and Tanacross quadrangle parts of the area are covered by modern reconnaissance geologic, geochemical, and geophysical studies; knowledge of that part of the area in the Mount Hayes quadrangle is based on older U.S. Geological Survey work supplemented by local studies by State geologists; active recent prospecting for submarine volcanogenic deposits and intermittent small-scale activity at an antimony mine and a few gold deposits, chiefly placers	Recent prospecting interest focusing on the submarine volcanogenic deposits has been high and has resulted in a rash of claim staking; these deposits constitute a highly significant potential resource, but although several are under exploration, we currently lack sufficient data for mineral resource estimates; most of the area is considered geologically favorable for the submarine volcanogenic deposits, yet large tracts remain that lack systematic exploration	(a) Large area favorable for submarine volcanogenic deposits that contain copper, lead, zinc, and silver; recent claim staking, yet large tracts remain that lack systematic exploration; possibly large number of deposits some of which could contain large tonnages (b) Antimony-bearing veins; two deposits are as much as 6 m thick; other deposits possible (c)Small tonnage placer gold deposits; placers are both stream and bench; small amounts of gold and silver produced (d) Gold-bearing veins having small tonnages; no recorded production (e) Favorable host rocks for porphyry copper and molybdenum deposits; no deposits known		(a) felsic and intermediate volcanogenic massive sulfide model (e) porphyry copper model

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS
41.	(a)Cu(Au,Ag,Zn,Pb)--submarine volcanogenic (b)Au(Ag)--placer (c)Cu(Mo,Ag)--porphyry (d)Cu(Fe)--contact metamorphic (e)Zn(Ag,Pb,Cu)--replacement (f)Au,Ag--vein (g)Sb(Au)--vein (h)U--sedimentary	(i)Mo(Au)--vein and porphyry? (j)Cu--magmatic (k)Au,Ag(Cu,Pb)--breccia pipes	Central Alaska Range and its northern flanks; area underlain by Precambrian and Paleozoic metamorphosed volcanic and sedimentary rocks, Mesozoic and Tertiary sedimentary and volcanic rocks, and Mesozoic and Tertiary intrusive rocks (a)Massive and disseminated sulfide deposits in or near metavolcanic rocks, chiefly metarhyolite (b)Stream, bench, and flood plain placers (c)Disseminated sulfides and sulfide-bearing veinlets, in or near altered granitic rocks (d)Massive and disseminated sulfides and magnetite in metamorphic rocks, chiefly marble, near granitic or gabbroic intrusives (e)Sphalerite-rich disseminations and masses in carbonate rocks (f)Mainly thin, polymetallic precious metal-bearing veins; generally localized in schist (g)Thin stibnite-bearing veins and small lenses, mainly in schist; both (f) and (g) are probably genetically related to shallow Tertiary plutons (h)Mainly secondary uranium minerals localized in near-basal parts of Tertiary subaerial sedimentary rocks (i)One prospect on molybdenite-bearing quartz veins in granitic rocks; speculative molybdenum porphyry deposits (j)Prospect on mafic intrusive rock that contains disseminated sulfides, including sparsely distributed chalcopyrite (k)Speculative base and precious metal-bearing breccia pipes associated with Tertiary intrusive centers	The main production from the area consists of between 1,400 kg and 1,600 kg (45,000 and 50,000 ounces) of gold and some by-product silver recovered from placer operations prior to 1960; since 1960 about 10 of the placer mines have been worked on intermittent small scales; small amounts of gold and silver have been recovered from a few lode deposits; the mineral resource potential of the area is large; in particular, the submarine volcanogenic deposits, which are the focus of much current exploration, probably contain significant resources of several metals; resources in zinc-rich replacement deposits in the Mount Eielson district probably are fairly large; potentially significant resources may be in several other deposit types, such as the porphyries and contact-metamorphic deposits, both of which are scantily explored; resources in the precious metal- and stibnite-bearing veins are probably small, but some of these deposits may support small-scale mining; identified placer gold resources are sufficient to sustain continued small mining operations; potential placer gold resources may be large; the uranium resource potential of the area is unknown and is based on favorable geology and small-scale exploration	Geologic knowledge of area based on local studies by State and Federal geologists that range from semi-detailed to reconnaissance; some geochemical and geophysical studies; no systematic investigations of entire area; strong recent exploration activity related to submarine volcanogenic deposits; less intense recent exploration of gold placers and a few other deposit types, including sedimentary uranium deposits	Submarine volcanogenic deposits mainly associated with metarhyolite of the mid-Paleozoic Totatlanika Schist are the focus of much recent exploration interest; several of these deposits have been drilled or are slated for drilling, but the drilling results are not yet available; there is a strong likelihood that these deposits contain large resources of several metals including copper, zinc, gold, and silver; Tertiary and Cretaceous subaerial sedimentary rocks with associated volcanic rocks mantle large parts of the area; favorable host rocks are locally exposed throughout this cover as windows and underlie the Cretaceous and Tertiary cover at shallow depths at many places; the Cretaceous and Tertiary sedimentary rocks are geologically favorable for uranium deposits, but, to date, the small-scale uranium prospecting in them has not disclosed significant deposits

SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS)	GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
(a) Several submarine volcanogenic deposits are known but not completely drilled; deposits contain copper, lead, and zinc and locally economic grades of gold and silver; large favorable area and recent incomplete exploration suggest that many deposits could be in area 41 (b) Stream, bench, and flood plain placers containing gold and some silver are numerous; past production of about 1500 kg gold; future production from known deposits likely and undiscovered deposits possible.	90% 50% 10% chance that there are 4 9 20 deposits or more	(a) felsic and intermediate volcanogenic massive sulfide model
(c) Three possible porphyry copper deposits; area might contain a few porphyry deposits	90% 50% 10% chance that there are 1 2 4 deposits or more	(c) porphyry copper model
(d) Contact metamorphic deposits containing copper, iron, and possibly gold	90% 50% 10% chance that there are 5 deposits or more	
(e) Several replacement deposits containing zinc and lead with some silver and copper (f) Small tonnage veins that have gold and minor silver contents (g) Many small tonnage veins that contain antimony and gold		
(h) Favorable geology for sandstone uranium deposits; recent exploration activity has been encouraging; possibly a number of unfound deposits		
(i) Molybdenum- bearing quartz veins at one prospect; small tonnages; may be indicative of porphyry molybdenum deposits in area		

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL (S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS	SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS)			GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
42.	(a)Au(Ag)--placer (b)Au,Ag(Pb,Zn,Cu)--vein (c)Sb(Au)--vein (d)Zn,Cu,Ag(Pb)--submarine volcanogenic	(e)Cu(Ag,Zn)--contact metamorphic (f)Cu--magmatic	Kantishna district and nearby area; contains Paleozoic and Precambrian metamorphic rocks, including metavolcanic rocks; local, mainly Tertiary, intrusive rocks; and small areas of Cretaceous and Tertiary subaerial sedimentary and volcanic rocks (a)Mainly stream and bench placers (b)Generally thin polymetallic precious metal-bearing veins that cut metamorphic rocks; typically high grade but small; probably genetically related to Tertiary igneous activity (c)Stibnite-rich veins and lenses, as much as 1 m thick; commonly localized in metamorphic rocks (d)Massive and disseminated sulfides mainly in or near metarhyolite of the Totatlanika Schist (mid Paleozoic) (e)One skarn-type deposit known in area; probably small (f)Occurrence of disseminated sulfides, including chalcopyrite, in gabbro	Before 1960 the placer deposits had an estimated production between 1,400 kg and 1,600 kg (45,000 and 50,000 ounces) of gold and subordinate byproduct silver; small post-1960 placer production from intermittent operations; small amounts of gold and silver have been recovered from the veins; more than 1,800 t (2,000 st) of antimony have been mined from the area, mainly from the Stampede mine, which is Alaska's foremost antimony producer; both the gold-silver lodes and the placers have some identified resources and probably significant potential resources; identified resources at the Stampede mine are more than 6,3000 t (7,000 st) mainly containing between 10 and 15 percent antimony; potential antimony resources of the area are much larger; the untested recently discovered submarine volcanogenic deposits in the northern part of the area may contain significant resources	The area is covered by reconnaissance and local detailed mapping by State and Federal agencies; some geochemical, but very meager geophysical coverage; moderate recent exploration interest by industry	The area is well mineralized and probably contains significant resources; although most of its major deposit types have been known for many years, many have not been adequately explored; the submarine volcanogenic deposits in the northern part of the area represent recent discoveries that merit exploration	(a) Numerous gold-bearing placers; past production about 1500 kg gold and subordinate byproduct silver; probably significant amounts of gold remain in known deposits (b) Generally small tonnage but high grade polymetallic veins; one of the vein systems produced about 200 kg gold and slightly more silver; possible future production primarily of gold and silver (c) Antimony-bearing veins some of which are as much as 6 m thick; Alaska's foremost antimony producer with past recorded production more than 1,600 t; identified resources at largest mine are more than 6,300 t mainly containing between 10 and 15 percent antimony; potentially higher tonnages at known deposits and some undiscovered deposits (d) Several recently discovered submarine volcanogenic deposits that are incompletely explored are known; deposits contain zinc, copper, and silver with some lead and possible gold; known deposits are in northern part of area 42; lack of systematic exploration and extent of favorable geology suggest that area could contain more deposits	90% 5	50% 7	10% chance that there are (2 deposits or more	(d) felsic and intermediate volcanogenic massive sulfide model

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTRIB.(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS	SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS)	GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
43.	(a)Cu,Zn(Ag,Pb)--submarine volcanogenic (b)Sn,Ag(Pb)--vein and disseminated (c)Ag(Pb)--replacement, metamorphic? (d)Ag,Pb,Zn(Sb,U,Sn)--vein (e)Cu--sedimentary? (f)Cu(Zn)--contact metamorphic (g)Sb(Hg)--vein	(h)Cu--magmatic (i)Au--vein (j)Be,Sn--greisen	Northwest flank of part of west-central Alaska Range; adjoins a favorable area on sheet 2 to the west; underlain by locally metamorphosed Paleozoic sedimentary rocks and Tertiary granitic plutons; small areas of Mesozoic sedimentary and volcanic rocks near southern margins of area (a)Massive and disseminated sulfides associated with submarine basalt of Mesozoic age (b)Cassiterite-bearing veins and disseminations in hornfels near Tertiary granite (c)Disseminated silver-rich sulfides in dolomite and pyrrhotite-rich lenses in schist (d)Silver-bearing base metal veins that locally contain minor amounts of tin, antimony, and uranium; typically thin veins that are associated with Tertiary granite (e)Recently discovered thin stratiform lens of chalcocite in Paleozoic phyllite (f)Two old prospects on contact-metamorphic (skarn)-type deposits marginal to Tertiary granitic plutons (g)Thin quartz veins that contain stibnite and, rarely, a little cinnabar (h)Occurrence of disseminated sulfides in a mafic dike (i)Prospect on thin gold-bearing quartz vein that cuts Paleozoic rocks (j)Beryl in greisen; speculative tin-bearing greisens	No production; small identified resources, mainly in the submarine volcanogenic, silver, and tin lodes; the area has been scantily prospected, and its known deposits are inadequately explored; possibly, the area contains important resources	Most of the area is in the Talkeetna quadrangle, which is covered by modern reconnaissance geologic, geochemical, and geophysical studies; that part of the area in the Mount McKinley quadrangle has scant coverage; recent exploration at a few of the tin, silver, or submarine volcanogenic deposits	This remote and inadequately explored area is favorable for additional discoveries; at least two of its potentially important deposits were discovered during recent U.S. Geological Survey investigations, and at least one other was found during recent private exploration	(a) Submarine volcanogenic deposits bearing copper, zinc, silver, and lead with gold possible; known deposits incompletely explored and the area is generally not well explored; probably other as yet undiscovered deposits (b) Tin and silver-bearing disseminations and veins; extent not fully known; other deposits possible (c) One known deposit containing silver and lead minerals disseminated in carbonate rocks; other deposits possible (d) Silver, lead, zinc, and minor amounts of tin, antimony, and uranium contained in veins that are probably small tonnage (e) Thin (5 cm thick) stratiform lens containing copper; extent not known; possibly related to large tonnage sedimentary deposit (f) Two skarn deposits that contain copper and some zinc; a few others possible (g) Several antimony-bearing veins are known in the northern part of area 43; tonnages probably small (i) Several greisen deposits that contain beryl or minor tin; tonnages probably small		(a) mafic volcanogenic model (f) copper skarn model

TABLE 2. METALLIFEROUS MINERAL RESOURCE DATA FOR WESTERN SOUTHERN ALASKA
(Refers to sheet 2)

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS	SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS)			GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
1.	(a)Au(Ag)--vein (b)Au(Ag,Pt)--placer	(c)W--disseminated?	Central parts of Kodiak and Afognak Islands; underlain by upper Mesozoic flysch and local Tertiary granitic plutons (a)Gold-bearing quartz veins, mainly less than 1 m thick, that generally are localized in upper Mesozoic flysch (b)Beach placers and a few stream and dune placers (c)Tungsten prospects in upper Mesozoic graywacke	Production data sketchy; the lode deposits probably produced less than 32 kg (1,000 ounces) of gold and a little byproduct silver; placer gold production probably a little larger and includes minor amounts of byproduct silver and platinum; some resources in the gold lodes and placers, but they probably are small	Recent reconnaissance mapping by U.S. Geological Survey and University geologists; scant recent exploration interest by industry; little geochemical or geophysical data	Much of area 1 is covered by dense vegetation and is difficult to prospect; on the basis of known geology and known deposits, the area's main resource potential is for gold, but this is regarded as only of moderate significance	(a) Gold-bearing quartz veins; generally small tonnage; total production probably less than 32 kg gold; probably more deposits in this difficult to prospect area (b) Beach, a few stream, and dune placers that contain gold and some silver and platinum; some past production; probably small amounts remain				
2.	(a)Cu(Au,Zn,Pb)--submarine volcanogenic (b)Au(Ag)--placer	(c)Cu--magmatic; one occurrence (d)Au(Ag)--vein	Southeastern part of Kodiak Island and some nearby islands; area contains Tertiary, mainly flyschoid, rocks and scattered Tertiary plutons (a)Disseminated sulfides, including chalcopyrite, in Tertiary sedimentary and volcanic rocks (b)Mainly beach placers (c)Weakly disseminated sulfides in a gabbro sill (d)Areas near Tertiary plutons are favorable for this, gold-bearing quartz veins	Possibly a little placer gold produced; otherwise no production; known resources are scant; resource potential rests on significant new discoveries, particularly of submarine volcanogenic deposits	Recent reconnaissance mapping by Government and University geologists, but very little geochemical or geophysical data; scant recent interest by industry	The resource potential of area 2 is regarded as low; however the area is geologically favorable for submarine volcanogenic deposits associated with mafic lavas, and possibly, it contains significant, undiscovered deposits of this type	(a) Several submarine volcanogenic deposits associated with mafic lavas are known; deposits usually contain copper zinc, and gold; several other deposits possibly exist (b) Gold-bearing beach placers; generally small tonnage	90% 50% 10% chance that there are 0 1 3 deposits or more			(a) mafic volcanogenic model
3.	(a)Au(Ag)--placer (b)Au(Ag)--vein	(c)Cu(Ag)--vein (d)Cu(Ag,Zn)--submarine volcanogenic (e)Cu(Mo)--porphyry (f)Cr--magmatic	Northwestern parts of Kodiak and Afognak Islands, northwest of Border Ranges fault; underlain by upper Paleozoic and Triassic sedimentary and volcanic rocks, Cretaceous and Tertiary granitic rocks, and local ultramafic rocks and gabbro (a)Mainly beach placers (b)Thin quartz veins in or near granitic rocks (c)One prospect on a thin copper-bearing vein in a fault zone (d)Suspected deposits associated with mafic volcanic rocks (e)Suspected deposits associated with granitic rocks (f)Some of the ultramafic rocks are favorable for chromite deposits	Small, but unknown amounts of gold recovered from the beach placers; otherwise no known production; known resources are small but area may contain important undiscovered resources	Covered by recent reconnaissance geologic mapping but little available geochemical or geophysical data; little recent exploration interest by industry	The area is geologically favorable for several types of mineral deposits, and it hasn't been thoroughly prospected; for these reasons it is inferred to have at least a moderate resource potential; the Barren Islands, to the north, are geologically similar to parts of area 3 and are regarded as having some favorability	(a) Mainly beach placers that contain gold and some silver; probably small tonnage (b) Small tonnage gold-bearing quartz veins; several are known, others possible				
							(d) Submarine volcanogenic deposits with copper, zinc and gold are possible; area is not well prospected and is geologically favorable	90% 50% 10% chance that there are 0 1 3 deposits or more			(d) mafic volcanogenic model
							(e) Possible copper-bearing porphyry type deposits; part of area is favorable and incompletely explored	90% 50% 10% chance that there are 0 1 2 deposits or more			(e) porphyry copper model
							(f) Portion of area is favorable for podiform chromite deposits; none known but area has not been thoroughly prospected				(f) podiform chromite model

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS	SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS	GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
4.	(a)Ag(Pb,Zn,Cu)--vein,replacement, breccia pipe (b)Cu(Pb,Zn)--vein and veinlet (c)Cu(Ag,Zn)--contact metamorphic (d)Ni,Cu(Zn)--magmatic (e)Au(Ag)--placer (f)Au--vein	------	Southeastern part of McGrath quadrangle and north-central part of Lime Hills quadrangle; mainly hilly terrain on northwest flank of Alaska Range; largely underlain by Paleozoic sedimentary rocks, including abundant carbonate rocks; local Tertiary and Cretaceous? plutons (a)Sulfide-rich veins, as much as 3 m thick, and pods and lenses; all with high silver contents; generally localized in Paleozoic carbonate rocks near Tertiary plutons; less commonly in the plutons (b)Mainly thin sulfide-bearing veins and veinlets (c)Chalcopyrite and sphalerite-bearing tactite zones as much as 3 m wide (d)Disseminated and locally massive sulfides in diabase (e)One stream placer known in area (f)Two prospects on thin, gold-bearing veins in or near Tertiary granitic plutons	No production; some identified resources in two of the silver-rich lodes that have been explored by a few diamond drill holes; probably significant potential silver resources and less important potential resources of the other commodities known in the area	Broad reconnaissance mapping accompanied by some geochemical sampling but scant geophysical studies; local detailed studies at two of the silver lodes; moderately active exploration by industry during the past several years	The area adjoins area 43 on sheet 1 and locally extends into the Central Alaska RAMRAP study region; the area is remote and during the early days attracted very little prospecting; recent exploration interest in the area is largely attributable to discoveries made during the course of U.S. Geological Survey investigations in the past decade	(a) Veins, replacement, and possible breccia pipe deposits containing silver, lead, zinc, and some copper; all known deposits have high silver contents; as much as 3 m thick; probably other undiscovered deposits; possibly other lead and zinc-bearing deposit types in the carbonate rocks (b) Veins containing copper and some lead and zinc; generally small tonnage; may, in some cases, be indicators of other forms of mineralization such as porphyry copper type (c) Several contact metamorphic deposits that contain copper, silver and zinc are known; others possible (d) Disseminated and locally massive sulfides containing nickel and copper exist in at least one locality (e) One gold-bearing stream placer is known in this area; others possible (f) Two small tonnage veins bearing gold are known; others possible		(c) copper skarn model (d) nickel sulfide model

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS	SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS)	GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
5.	(a)Cu(Mo,Ag,Zn)--porphyry (b)Mo(Cu,Au,Ag)--porphyry (c)Ag,Cu(Au,Pb,Zn)--breccia pipe (d)Au(Ag)--vein (e)Cu(Zn,Ag,Pb)--vein (f)Au(Ag)--placer	(g)Cu--contact metamorphic (h)Mo(Cu)--vein (i)Sb--vein (j)Cu(Ag,Zn)--submarine volcanogenic	Northwest flank of west-central Alaska Range; joins area 30 of sheet 1; underlain by locally metamorphosed Mesozoic sedimentary and volcanic rocks, small areas of Tertiary volcanic rocks, and Mesozoic and Tertiary granitic rocks (a)Disseminated sulfides and sulfide-bearing veinlets in altered Tertiary plutons that probably mainly represent subvolcanic phases of Tertiary igneous activity (b)Similar to (a) except that the chief ore mineral is molybdenite (c)Precious and base metal lodes associated with Tertiary eruptive centers (d)Thin veins genetically related to Tertiary plutonism; a few are silver rich (e)Typically thin polymetallic veins in diverse host rocks (f)Stream placers (g)Occurrence of sulfide blebs and disseminations in metasedimentary rocks adjacent to Tertiary granite (h)Thin molybdenite-bearing quartz veins in Tertiary granite; two known occurrences (i)Occurrence of a thin stibnite-bearing vein in Mesozoic sedimentary rocks (j)Occurrences of submarine volcanogenic deposits, mainly associated with felsic volcanic rocks	No production; the main potential resources of the area appear to be in porphyry-type deposits, both for copper and molybdenum; however the area has been poorly explored and it contains several deposit types that may contain signifficant resources	Reconnaissance mapping and geochemical sampling for most of area; reconnaissance gravity survey; aeromagnetic survey for that part of area in Lake Clark quadrangle; moderate recent exploration interest by industry	The area includes large and poorly explored remote tracts; current exploration interest in the area is largely a result of findings during recent U.S.Geological Survey and U.S. Bureau of Mines sponsored investigations	(a) A number of recently discovered porphyry copper deposits that contain minor contents of molybdenum, silver, and zinc are known; large and poorly explored area and incompletely explored deposits; possibly undiscovered deposits	90% 50% 10% chance that there are 5 9 15 deposits or more	(a) porphyry copper model
							(b) About five porphyry-type molybdenum deposits that contain some copper, gold, and silver are now known; others possible	90% 50% 10% chance that there are 3 6 10 deposits or more	(b) porphyry molybdenum model
							(c) Several deposits that are probably breccia pipes have been found; they contain silver and copper and some gold, lead, and zinc; geology is favorable for other deposits of this type		
							(d) Small tonnage veins containing gold and locally silver; three deposits known, others possible		
							(e) Copper, zinc, lead, and silver-bearing veins; two deposits known; probably low tonnage		
							(f) Several gold and silver-bearing stream placers have been found		
							(j) Two suspected submarine volcanogenic deposits are known; area is poorly explored and may contain other deposits of this type		(j) felsic and intermediate volcanogenic model

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS
6.	(a)Cu(Fe,Zn)--contact metamorphic (b)Ag,Au,Cu(Zn,Pb)--breccia pipe and vein (c)Cu(Mo,Ag)--porphyry (d)Au(Ag)--placer (e)Mo--vein and porphyry? (f)Au--vein (g)Cu(Ag,Au)--replacement? (h)Fe(Ti)--magnetic	(i)Cu(Zn)--submarine volcanogenic	Southwestern part of Alaska Range north of Iliamna Lake; contains Mesozoic and Tertiary sedimentary, volcanic, and intrusive rocks (a)Massive and disseminated deposits typically in Triassic carbonate rocks adjacent to Tertiary granite; generally contain abundant magnetite or hematite, but chief potential ore mineral is chalcopyrite (b)Polymetallic precious and base metal deposits mainly associated with young eruptive or intrusive centers; chief potential values generally in silver or copper (c)Apparently weakly mineralized porphyry-type deposits associated with Tertiary granitic plutons (d)Stream placers (e)One poorly documented probable porphyry molybdenum deposit and a few deposits represented by molybdenite-bearing quartz veins (f)Thin gold-bearing quartz veins that cut upper Mesozoic flysch (g)Massive and disseminated sulfides in a mineralized zone 6 to 12 m wide within Triassic marble (h)Breccia fragments of magnetite-rich pyroxenite in granite (i)Occurrences of copper and zinc sulfides in both felsic and mafic metavolcanic rocks; others suspected	Only production from area consists of small quantities of gold and byproduct silver obtained from placer deposits; exploration at the Kasna Creek prospect, a contact-metamorphic deposit, disclosed identified resources on the order of several million tons that contain slightly less than 1 percent copper and about 27 percent iron; other deposits in the area are mainly unexplored raw prospects, and their resource potentials are conjectural; several deposit types that may contain significant resources are known in the area, but many of these essentially unexplored deposits appear to be small	Most of the area is included in U.S. Geological Survey AMRAP investigations that are in progress and in resource oriented studies by the State survey and the U.S. Bureau of Mines; when completed, and integrated with previous work, these studies will provide modern geologic, geochemical, and geophysical data; except for activity at the Kasna Creek property, recent exploration interest in the area is low	Area 6 is diversely mineralized and probably contains significant resources in addition to the identified resources at Kasna Creek; most of its known deposits were discovered during reconnaissance surveys in the past decade; the area is favorable for new discoveries, and several of its known deposits appear to merit exploration

SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS)			GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
(a) Contact metamorphic deposits containing copper, iron, zinc, and gold have been discovered; one of the deposits has identified resource on the order of several million tons with slightly less than 1 percent copper and about 27 percent iron; area is favorable for additional discoveries				(a) copper skarn model
(b) Probably breccia pipe and vein deposits that contain silver and copper with local concentrations of gold, zinc and lead; other deposits possible				
(c) Several apparently weakly mineralized porphyry-type copper deposits are known; other possibly richer deposits may occur in area 6	90% 1	50% 3	10% chance that there are 8 deposits or more	(c) porphyry copper model
(d) About 6 stream placers that contain gold have been found; small production				
(e) One incompletely explored deposit that is probably a porphyry molybdenum type; other molybdenum-bearing veins are known; some may be related to porphyry type deposits	90% 0	50% 1	10% chance that there are 3 deposits or more	(e) porphyry molybdenum model
(f) Small tonnage gold-bearing veins; a few known, others possible				
(g) Probable replacement deposit containing copper and minor concentrations of gold and silver; mineralized zone is 6 to 12 m wide				
(h) Breccia fragments of iron-bearing (magnetite) pyroxenite in granite at one locality				
(i) Several probable submarine volcanogenic deposits containing copper and zinc; area is favorable for other deposits of this type				(i) felsic and intermediate volcanogenic massive sulfide model

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS(INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL (S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS	SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED (NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS))	GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
7.	(a)Cu,Fe(Au,Ag)--contact metamorphic (b)Fe(Ti)--magmatic (c)Cu(Au,Ag,Mo)--porphyry (d)Cu(Ag)--vein (e)Cu(Au,Ag)--intrusive breccia (f)Ag,Au(Pb,Zn)--vein (g)Au(Ag)--placer (h)Au--vein	(i)Mo(Cu,Ag)--porphyry (j)Ag(Au,Cu)--volcanic breccia	Part of Alaska Peninsula; dominated by intermediate and locally mafic granitic rocks of Jurassic age that form the core of the Alaska-Aleutian Ranges batholith; local upper Paleozoic and Mesozoic sedimentary and volcanic rocks that in places are metamorphosed, upper Mesozoic and Tertiary granitic plutons, and fairly extensive Tertiary volcanic rocks (a)Massive and disseminated contact-metamorphic, mainly skarn, deposits chiefly localized in carbonate rocks adjacent to granitic plutons; potential chief values mainly for copper contained in chalcopyrite; a few have principal potential values in iron (from magnetite) (b)Massive and disseminated iron-rich (mainly titaniferous magnetite) segregations typically localized in mafic phases of Jurassic granitic plutons (c)Copper-bearing porphyry-type deposits in Jurassic or Tertiary granitic plutons (d)Thin copper-bearing veins in diverse geologic settings (e)Disseminated sulfides in an intrusive breccia composed of Jurassic quartz diorite and gabbro; may be akin to porphyry-type mineralization (f)Thin polymetallic precious metal-bearing veins in limestone or volcanic rocks (g)Stream placers (h)Thin gold-bearing quartz veins in Tertiary volcanic rocks (i)Occurrences of weakly mineralized molybdenite-bearing porphyry deposits in Tertiary intrusive rocks (j)Suspected precious metal lodes associated with Tertiary eruptive centers	Production from the area consists of a reported small shipment of copper ore from one of the contact-metamorphic deposits and probably a little placer gold; the area contains large, but low-grade iron resources incorporated in mafic intrusive rocks; these have been estimated at several billion tons that contain between 12 and 15 percent ferrous oxide (FeO); several other deposit types, particularly the porphyry-type and contact-metamorphic deposits, probably contain significant resources	Most of the area is in the Iliamna quadrangle, which has good reconnaissance geologic coverage and some supplementary geochemical and geophysical studies; geologic and related data are sketchy for other parts of the area; industry interest currently low to moderate; the detection of numerous magnetic anomalies by an industry-sponsored aeromagnetic survey led to a flurry of claim staking on the iron-titanium mafmatic deposits during the mid 1960's	Although the area's magmatic iron-titanium resources are large, they are low in grade and, in view of the world's vast iron resources, they probably will retain their subeconomic status for a long time; estimating the potential resources in the other deposit types is hampered by the dearth of exploration on known deposits and the lack of thorough prospecting in search of new deposits	(a) Copper and iron-bearing contact metamorphic deposits chiefly in carbonate rocks; some gold and silver; about 6 deposits known, a few unfound deposits may remain (b) At least 11 iron-rich (mainly titaniferous magnetite) magmatic deposits have been found; total estimated resources in these deposits of several billion tons of low grade iron (between 12 and 15 percent ferrous oxide) (c) Two copper-bearing porphyry-type deposits that contain gold, silver, and molybdenum are known; favorable geology and scant exploration for this type suggest that unfound deposits remain (d) Several low tonnage copper and silver-bearing veins are known (e) Two probable intrusive breccia deposits containing copper, gold, and silver; may be akin to porphyry-type mineralization (f) Small tonnage veins containing silver, gold, lead and zinc (g) Several stream placer deposits probably with small gold production (h) Small tonnage gold-bearing quartz veins (i) Several occurrences of weakly mineralized porphyry deposits that contain molybdenum; others possible	90% 50% 10% chance that there are 5 7 10 deposits or more 90% 50% 10% chance that there are 11 12 14 deposits or more 90% 50% 10% chance that there are 1 2 6 deposits or more 90% 50% 10% chance that there are 1 2 3 deposits or more	(a) copper skarn model (c) porphyry copper model (i) porphyry molybdenum model

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS	SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS)	GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (SEE TABLE 4)
8.(Adjoins area 5 on central Alaska map)	(a)Fe(Ti)--magmatic (b)Au--vein (c)Au--placer	(d)Hg--vein	Mainly lowlands in central part of Dillingham quadrangle; largely mantled by Quaternary surficial deposits; Mesozoic sedimentary rocks and Cretaceous and Tertiary granitic rocks crop out on isolated low hills throughout the area (a)Large buried titaniferous magnetite deposit in pyroxenite; discovered by diamond drilling in magnetic area detected during an industry-sponsored aeromagnetic survey in 1958 (b)Thin quartz veins near margins of a granitic stock (c)Stream placers; one prospect and one occurrence (d)Suspected cinnabar-bearing veins related to young granitic rocks	The one known gold lode in the area reportedly yielded a small amount of gold; the dominant and probably only significant resources in the area are the magmatic iron-titanium deposits; these deposits, which have been explored by 16 diamond drill holes, are believed to contain about 2.4 billion tons of hypothetical resources averaging 15 to 17 percent total iron and 10.5 to 12 percent magnetic iron	The area is poorly known geologically and geochemically; industry-sponsored aeromagnetic survey, but otherwise, scant geophysical coverage; with the exception of diamond drilling the pyroxenite body during the 1960's, there has been scant industry interest in the region	The titaniferous magnetite deposits are the predominant potential resource of the area; the area may contain significant concealed deposits of other types, but, in general, these would be extremely difficult to discover	(a) One buried iron-rich (titaniferous magnetite) magmatic deposit has been discovered; it is believed to contain about 2.4 billion tons averaging 15 to 17 percent total iron and 10.5 to 12 percent magnetic iron; other concealed deposits of other types are possible (b) Several low tonnage gold-bearing veins have been found (c) Gold-bearing stream placers; one prospect and one occurrence known (d) Mercury vein deposits are suspected		(d) mercury model

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS	SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESENTED OR MORE DEPOSITS	GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
9.	(a)Cu(Au,Mo,Ag)--porphyry (b)Au(Ag)--vein and lens (c)Au(Ag)--placer (d)Mo(Cu)--porphyry (e)Cu(Ag)--vein (f)Cu(Au,Ag)--replacement (g)Fe--magmatic	(h)U--placer	Mainly northeastern part of Alaska Peninsula; geology dominated by Cenozoic volcanic rocks related to Aleutian arc volcanism; also contains Mesozoic and rare upper Paleozoic sedimentary and volcanic rocks, Cenozoic subvolcanic plutons and sedimentary rocks, and possibly some Mesozoic plutons (a)Porphyry-type deposits genetically related to subvolcanic plutons associated with Aleutian arc igneous activity; localized in the plutons or in various nearby host rocks (b)Locally rich gold-bearing quartz veins and lenses as much as several meters thick; typically localized in Tertiary volcanic or intrusive rocks (c)Beach and stream placers (d)Molybdenite-bearing porphyry-type deposits genetically related to Tertiary subvolcanic plutons (e)Generally thin copper-bearing veins mainly in shear zones in diverse host rocks (f)Chalcopyrite-bearing lenses in Jurassic sedimentary rocks (g)Local concentrations of magnetite in mafic phases of granitic plutons (h)Reported placer claim for uranium; probably contains some radioactive refractory heavy minerals	Lode gold production of approximately 3,200 kg (100,000 ounces) and some by-product silver, mainly from the Apollo mine on Unga Island; placer gold production on the order of 19 kg (600 ounces), chiefly from beach placers; some identified gold resources in the Apollo mine; the principal potential resources of the area are associated with the large, but generally low-grade porphyry copper deposits; about 20 of these deposits have attracted recent exploration activity, including exploratory drilling on several of them; in addition there are numerous unexplored and unexamined altered zones in the region that may indicate porphyry-type deposits; the one known porphyry molybdenum deposit in the area is currently under exploration; definitive information on the porphyry deposits is not available; unconfirmed information suggests that the porphyry deposits are large, contain less than 0.4 per cent copper, and are slightly richer in gold than the better known porphyry deposits in the Nabesna quadrangle; resource potentials of the other deposits in the area are probably low, but some deposits, particularly the copper-bearing replacements, may be worthy of exploration	Diverse degrees of geologic mapping, but, at least, sketchy reconnaissance mapping for entire area; the Chignik and Sutwik Island quadrangles are currently being investigated under the U.S. Geological Survey AMRAP program which will result in good reconnaissance geologic, geochemical, and geophysical coverage; some geochemical and geophysical studies in the area by industry, but the results of these investigations are mainly privileged; active industry exploration, mainly for porphyry-type deposits, during the past decade	The area includes a large part of a potentially major porphyry copper province associated with Aleutian arc tectonics and igneous activity; most of these deposits represent recent discoveries, mainly during the past 5 years, and most of them are unexplored; the potential resources of copper and byproduct commodities in the porphyry deposits is large and the likelihood of significant new discoveries is good; the beaches that border Bristol Bay (northwest of area 9) contain local iron-and titanium-bearing placers that carry minor to trace amounts of gold and, rarely, platinum; this extensive area is not outlined as favorable mainly because it is regarded as having a minor resource potential	(a) Porphyry copper deposits that also contain gold, molybdenum, and silver; related to subvolcanic plutons; more than 55 altered zones that may indicate porphyry type deposits have been found; most of the deposits are recent discoveries and few have been adequately explored; probably many deposits in this area (b) Locally rich gold-bearing veins and lenses as much as several meters thick; past production about 3200 kg gold (c) Numerous gold-bearing stream and beach placers; past production about 19 kg gold; beaches northwest of area 9 contain local iron and titanium-bearing placers that carry minor amounts of gold and, rarely, platinum (d) Molybdenum-bearing porphyry-type deposits; only a few known or suspected; others possible (e) Copper and gold-bearing veins; probably small tonnages; some may be related to other types of mineralization such as porphyry (f) Possible replacement deposits containing copper, gold and silver (g) Several local concentrations of iron (magnetite) in magmatic deposits	90% 50% 10% chance that there are 30 50 75 deposits or more 90% 50% 10% chance that there are 1 3 6 deposits or more	(a) Island arc porphyry copper model (d) porphyry molybdenum model

AREA OUTLINED ON MAP	MAJOR TYPES OF KNOWN DEPOSITS	SUSPECTED OR SPECULATIVE TYPES OF MINERAL DEPOSITS (INCLUDES MINOR OCCURRENCES)	GEOLOGIC CONTROL(S) OF MINERAL RESOURCES	PRODUCTION AND RESOURCE INFORMATION	STATUS OF GEOLOGIC INFORMATION	ADDITIONAL COMMENTS	SUMMARY OF MINERAL RESOURCE POTENTIAL	ESTIMATED NUMBER OF DEPOSITS (PERCENT CHANCE THAT THERE ARE THE NUMBER PRESCRIBED OR MORE DEPOSITS)	GRADES AND TONNAGES FOR THIS DEPOSIT TYPE (IN TABLE 4)
10. 11. 12.	-----	(a)Au(Ag)--vein	Area 10 includes the Semidi Islands; area 11, parts of the Shumagin Islands; and area 12, the Sanak Islands; all three areas are underlain by Tertiary granitic rocks and upper Mesozoic sedimentary rocks (a)Suspected thin gold-bearing quartz veins genetically related to the Tertiary granitic rocks	No known mineral deposits in any of the three areas; the suspected gold-bearing vein deposits are analogous to those found in upper Mesozoic flysch terranes in southern Alaska and are genetically related to Tertiary plutons; the mineral resource potential of areas 10, 11, and 12 is regarded as low	Some reconnaissance geologic mapping but no available geochemical or geophysical information; little or no exploration interest for metalliferous deposits	Chirikof Island, southeast of area 10, contains one known gold-bearing beach placer, but the resource potential of the island is regarded as minimal	(a) Gold-bearing quartz veins are suspected; tonnages generally low; no deposits known, but areas 10, 11 and 12 have favorable geology		
13.	(a)Cu(Mo,Au,Ag)--porphyry	-----	Southwestern part of Alaska Peninsula; geology dominated by Cenozoic volcanic rocks related to the Aleutian volcanic arc; local Tertiary subvolcanic plutons, Tertiary subaerial sedimentary rocks, and possibly some Cretaceous sedimentary rocks (a)Porphyry copper deposits related to the Aleutian volcanic arc; localized in Tertiary volcanic, intrusive, or sedimentary rocks; more than 20 known occurrences	No mines or prospects; this scantily explored area contains numerous porphyry copper occurrences and is favorable for significant copper resources and lesser resources of byproduct gold, molybdenum, and silver	Broad reconnaissance mapping; no available geochemical or geophysical data, although some geochemical exploration was conducted by mining companies; moderate recent interest by industry	Area 13 is part of a potentially major porphyry copper province that mainly is in area 9; it is poorly explored and is regarded as having a good resource potential	(a) Porphyry copper deposits associated with subvolcanic plutons; possible byproducts of gold, molybdenum, and silver; more than 20 altered areas that may be porphyry copper deposits are known; area is poorly explored and may contain many deposits	90% 50% 10% chance that there are 10 20 35 deposits or more	(a) Island arc porphyry copper model

TABLE 4. GRADE AND TONNAGE MODELS

(metric units)

NS, not significant; *, significant at 5-percent level; **, significant at 1 percent level

Deposit Type	Variable (units)	Number of deposits used	Correlation coefficients	90 percent of deposits have at least	50 percent of deposits have at least	10 percent of deposits have at least
Porphyry Copper	Tonnage (millions of tons)	41		20	100	430
	Average copper grade (percent)	41	with tonnage = -0.07 NS	0.1	0.3	0.55
	Average molybdenum grade (percent Mo)	41		0.0	0.008	0.031
Island Arc Porphyry Copper	Tonnage (millions of tons)	41		20	100	430
	Average copper grade (percent)	41	with tonnage = -0.07 NS	0.1	0.3	0.55
	Average molybdenum grade (percent Mo)	41		0.0	0.008	0.031
	Average gold grade-locally significant but not determined					
Porphyry Molybdenum	Tonnage (millions of tons)	31		1.6	24	340
	Average molybdenum grade (percent Mo)	31	with tonnage = -0.05 NS	0.065	0.11	0.28
Podiform Chromite	Tonnage of Cr_2O_3 (tons)	268		15	200	2,700
Copper Skarn	Tonnage (millions of tons)	25		0.08	1.4	24
	Average copper grade (percent)	38	with tonnage = -0.44**	0.86	1.7	3.5
	Average gold grade, locally significant, but not determined					
Mafic Volcanogenic	Tonnage (millions of tons)	37		0.24	2.3	22.0
	Average copper grade (percent)	37	with tonnage = -0.13 NS	1.1	2.2	4.1
	Average zinc grade excluding deposits without reported grades (percent)	19	with tonnage = 0.03 NS	0.3	1.3	3.6
	Average gold grade-locally significant but not determined					
Felsic and Intermediate Volcanogenic Massive Sulfide	Tonnage (millions of tons)	89		0.19	1.9	18.0
	Average copper grade (percent)	89	with tonnage = -0.11**	0.54	1.70	5.40
	Average zinc grade excluding deposits without reported grades (percent)	81	with tonnage = 0.25 NS	1.40	3.80	10.00
	Average lead grade excluding deposits without reported grades (percent)	14	with tonnage = -0.02 NS	0.20	0.95	4.80
	Tonnage contained gold excluding deposits without reported gold (tons)	38	with tonnage = 0.78**	0.27	2.90	32.00
	Tonnage contained silver excluding deposits without reported silver (tons)	46	with tonnage = 0.82**	5.00	80.00	1300.00
Nickel Sulfide	Tonnage (millions of tons)	48		0.23	1.20	5.30
	Average nickel grade (percent)	48	with tonnage = -0.03 NS	0.32	0.61	1.20
	Average copper grade (percent)	48	with tonnage = 0.03 NS with nickel grade = 0.04 NS	0.18	0.49	1.20
Mercury	Tonnage of contained mercury (tons)	165		0.09	3.10	120.00
Vein Gold	Tonnage of contained gold (tons)	43		0.29	3.30	38.00
Skarn/Tactite Tungsten	Tonnage (millions of tons)	31		0.024	0.63	17
	Average tungsten grade (percent W)	31	with tonnage = -0.34 NS	0.24	0.51	1.10