UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

MAPS AND TABLES DESCRIBING AREAS OF METALLIFEROUS MINERAL RESOURCE POTENTIAL OF CENTRAL ALASKA

(Text and tables to accompany Open-file Report 78-1-D)

by

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INTRODUCTION

This report constitutes an appraisal of the known and potential metallic mineral resources of central Alaska, utilizing the best and most up-to-date geologic and resource data available. Its main purpose is to provide information for forthcoming decisions on classification of Alaska's lands arising from the Alaska Native Claims Settlement Act of 1971. The report is one of five resource appraisals of Alaska (U.S.G.S. Open-file reports 78-1-B to F) that constitute end products of the U.S. Geological Survey's Regional Alaska Mineral Resource Assessment Program (RAMRAP). Four of the appraisals (B-E) describe mineral resources, and one (F) describes oil and gas resources. This report consists of two 1:1,000,000-scale maps (designated sheets 1 and 2 of open-file report 78-1-D) showing areas of known and speculative mineral resource potential, a summary of pertinent geologic and mineral resource data and of conclusions pertaining to resource potential (table 2), grade and tonnage models (table 3), and this explanatory text.

Central Alaska as considered in this report embraces an area of approximately 631,000 km^2 (156,800,000 acres; 245,000 mi^2; approximately 42 percent of Alaska's total land area) that extends from the Canadian boundary (meridian 141°) on the east to the Bering Sea on the west and from the approximate southern boundary of the Brooks Range on the north to the northern flank of the Alaska Range on the south.

Specifically excluded from this analysis are the fossil fuels, geothermal energy resources, and deposits of nonmetallic minerals, excepting asbestos. However, maps and tables that provide an inventory of the known coal and thermal spring occurrences in central Alaska are included in the folio of background data outlined in table 1, and areas of interest for oil and gas in central Alaska are described in U.S. Geological Survey Open-file report 78-1-F of this series.

ACKNOWLEDGMENTS

Most of the Alaskan information upon which this analysis is based has been derived from published and unpublished works of previous investigators--mainly geologists and mining engineers representing both government and private sectors. These sources have been cited individually in the publications listed in table 1. We are especially indebted to W. P. Brosgé, R. M. Chapman, H. L. Foster, J. M. Hoare and W. W. Patton, of the U.S. Geological Survey, who are presently engaged in Alaskan mineral resource investigations and who have greatly enhanced our assessment by contributing relevant up-to-date unpublished information on the distribution and geologic controls of certain previously known and newly discovered mineral deposits in central Alaska. The authors are also grateful to D. A. Singer and J. H. DeYoung, Jr., for their contributions to the development of grade/tonnage models for certain deposit types (table 3). This assessment has also been improved by several industry geologists who generously supplied pertinent data on the results of recent company exploration programs. Particularly cooperative in this regard have been C. L. Sainsbury and Don Stevens. The timely completion of this report would not have been possible without the technical assistance of Judith S. Gassaway, Beth Abramson, Anelia Lott, Mark Sander, Voncille Johnson and Barbara Thompson.

PHILOSOPHY AND METHODOLOGY

Information concerning a region's mineral endowment is an essential part of intelligent land use planning. It should be at a scale that permits the evaluation of individual tracts of land and should be in a form that is useful for analysis from a number of perspectives, including national mineral needs, economics, currently available and/or projected technologies, and competing land uses. The information should include a resource inventory of known

Table 1.--Reports prepared as a foundation for mineral resource assessment of central Alaska

U.S. Geological Survey Open-file report numbers	Author(s)/Compiler(s)	Title[1]
77-168-A	G. Donald Eberlein, Judith S. Gassasay, and Helen M. Beikman	Preliminary geologic map of central Alaska
77-168-B	Edward H. Cobb	Placer deposits map of central Alaska
77-168-C	David F. Barnes	Preliminary Bouguer gravity map of central Alaska
77-168-D	G. Donald Eberlein, Robert M. Chapman, Helen L. Foster, and Judith S. Gassaway	Map and table describing known metalliferous and selected nonmetalliferous mineral deposits in central Alaska
77-168-E	John Decker and Susan Karl	Preliminary aeromagnetic map of central Alaska
77-168-F	John Decker and Susan Karl	Preliminary aeromagnetic profiles of central Alaska
77-168-G (in press)	Judith S. Gassaway	Map (with table) showing occurrences of coal in central Alaska
77-168-H (in press)	Judith S. Gassaway	Map showing distribution of known thermal springs and selected igneous rocks in central Alaska

[1]All maps at scale: 1:1,000,000

deposits and numerical estimates of possible undiscovered mineral deposits grouped according to similar physical, chemical, mineralogical, and grade/tonnage characteristics.

The present analysis should be considered as a first step toward a comprehensive assessment of central Alaska's mineral resources and has used the following approach:

(1) Relevant data on the more than one-thousand known lode and placer mineral occurrences in central Alaska were systematically reviewed and analyzed to determine the types of deposits present and, insofar as possible, their geologic controls and regional settings.

(2) Using the information in (1), areas of mineral resource potential have been delineated (see map sheets 1 and 2) on the basis of existing deposit type(s) and/or on geologic factors and relations permissive for the occurrence of specific deposit types.

(3) For a number of deposit types it has been possible to construct models of their expected grades and tonnages of mineral commodities or of contained metals (grade times tonnage). These models have been constructed following the procedure of Singer, Cox, and Drew (1975) and utilize data derived from similar deposit types world-wide (see table 3). These models are referenced (table 2, column 10) in cases where they have been judged to be representative of known or speculated deposit types in given areas, and they provide an indication of relative resource abundance.

(4) In the seven cases where the data have permitted, subjective probability estimates of the number of deposits, by type, likely to exist within a delineated area have been made on the basis of

the number of known deposits, favorable geologic considerations, the nature and extent of exploration and any favorable geochemical and/or geophysical indicators. These estimates are presented in terms of high (90 percent), intermediate (50 percent), and low (10 percent) confidence levels that the indicated number of deposits, or more, may occur. For most areas, however, the information level is insufficient to permit estimation of the probable number of deposits present. In such cases qualitative statements as to resource potential and, where appropriate, applicable grade-tonnage models have been entered into table 2.

The four mineral resource assessments prepared under RAMRAP share a common philosophy, methodology and format, but details of the individual assessments differ as a function of the amount and mix of information available. For some parts of central Alaska the information level is so low that it has been possible only to generally delimit very large regions of potential for the occurrence of one or more deposit types, largely on the basis of geologic analogy and favorable setting (for example, map areas 4, 12 and 14). As geologic and mineral resource information increases and our understanding of various deposit types improves, it should become possible to better define and delimit such regions into smaller areas for which more specific and precise future assessments of contained mineral resources can be made. Thus, this assessment will become outdated as geologic and mineral resource information increases.

STATUS OF GEOLOGIC AND MINERAL RESOURCE INFORMATION ON CENTRAL ALASKA

The adequacy of any assessment of mineral resource potential to satisfy land use planning, regional mineral exploration and other requirements is determined in large measure by the level and completeness of the available geologic information. The assessment must be made at a scale that is consonant with the information base.

Information about the geology and mineral deposits of central Alaska has been developed over a period of more than 75 years, but prior to 1959 it was mainly of a reconnaissance nature and with few exceptions was very strongly controlled by the occurrence and distribution of placer gold. Accordingly, the information level differed drastically from region to region and in many cases has proven to be inadequate as a basis for obtaining much more than the crudest perspective of overall mineral resource potential, especially in regions removed from gold-producing districts. Furthermore, even the most comprehensive of the earlier surveys did not develop certain kinds of geologic data necessary to evaluate the likelihood that some of the more recently recognized deposit types (e.g., volcanogenic sulfide deposits, stratabound and stratiform base metal deposits, island arc porphyry copper deposits, composite porphyritic biotite granite intrusives having a potential for tin-tungsten deposits) may occur in a given area. Notable exceptions were commodity-oriented investigations for tin, tungsten and quicksilver in selected areas by the U.S. Geological Survey and U.S. Bureau of Mines during World War II under the Strategic Minerals Program and reconnaissance examinations for radioactive deposits by the Geological Survey on behalf of the Division of Raw Materials, U.S. Atomic Energy Commission, during the middle and late 1940's and early 1950's.

Although great disparities still exist among different parts of central Alaska, considerable progress has been made since 1959 toward improving the level of geologic information. Mainly as a result of the Geological Survey's 1:250,000-scale regional geologic mapping program slightly more than 50 percent of the region is now covered by published, modern, ground-based geologic mapping at that scale (Bartsch-Winkler, 1977a). However, only about 3.3 percent of central Alaska is covered by geologic maps at a scale of 1:63,360 or larger (Bartsch-Winkler, 1977b), the minimum considered acceptable to satisfy most regional mineral exploration requirements in the western conterminous United States.

Considerable progress also has been made in recent years toward improving the quality and extent of geophysical and geochemical data for central Alaska. Contoured and/or profile aeromagnetic coverage, suitable for regional extrapolations at scales between 1:500,000 and 1:63,360, is now available for approximately 71 percent of the region, and reconnaissance soil, stream-sediment and bedrock geochemical data, ranging from spotty to fairly extensive, now exist for almost 40 percent of the region.

In July 1974, the Geological Survey initiated a multidisciplinary Alaskan Mineral Resource Assessment Program (AMRAP) directed toward evaluating the endowment of terranes having high economic mineral potential on a 1:250,000-scale quadrangle format. Unfortunately for this analysis the results of AMRAP investigations to date are available for all or parts of only five of the forty-eight 1:250,000 Alaska Topographic Series quadrangles that cover the region. However, from these early results it is evident that such studies are generating the kinds of data that are essential to modern regional resource analyses. As a result, future assessments can be expected to have a considerably improved geologic and mineral resource information base that will enable them to be more definitive, precise, and conclusive.

Perhaps the most serious hindrance to the development of an understanding of the bedrock geology of central Alaska, especially as it bears on mineral resource evaluation, has been, and will continue to be, imposed by the region's natural environment. With few notable local exceptions, central Alaska physiographically is characterized by unglaciated uplands and lowlands whose evolution has been controlled mainly by periglacial erosional processes operating under a subarctic permafrost climate. The uplands have been sculptured largely by creep and solifluction, and their lower slopes are commonly mantled by windborne silt. Thus, large areas are covered by transported material and by vegetation that obscure bedrock. Unglaciated lowlands have been formed mainly by depositional processes that blanket bedrock with materials brought in from highlands and tend to erase irregularities in the lowland surface. Underlying permafrost prevents downward percolation of groundwater, and summer melting of ice at the top of permafrost keeps extensive vegetation cover relatively saturated. Thus, large areas of unglaciated lowlands are marshy flats almost wholly lacking in bedrock exposures. It is estimated that 40 percent of central Alaska (252,000 km^2; 98,000 mi^2) is blanketed by a Quaternary surficial cover of alluvial, glaciofluvial, moraine, muck, swamp, lacustrine, flood-plain, and windblown deposits, and undeformed subaerial volcanic rocks (1.4 percent). Accordingly, most bedrock geologic investigations in these extensive areas of surficial cover are and doubtless will continue to be much less conclusive than desired for definitive mineral resource evaluation purposes, even on a regional scale.

EXPLANATION OF MAPS AND TABLE PERTAINING TO DESIGNATED AREAS OF MINERAL RESOURCE POTENTIAL

Delineation and designation of areas

This report includes two 1:1,000,000-scale maps (designated sheets 1 and 2), covering the eastern and western parts of central Alaska, and on which 77 areas of mineral resource potential have been delineated. Each area is identified by a number which keys it to the same numbered entry in table 2. The numerical order is progressive in general from west to east and carries no implications as to the relative importance or favorability of one numbered area with respect to any other. Areas considered favorable or permissive for the occurrence of one or more of the same deposit type(s) and known or believed to have similar regional geologic characteristics from a mineral resource standpoint have been assigned the same number. Most of the major and minor commodities known or suspected to occur within each area are indicated by standard chemical symbols. Minor and suspected commodities are listed parenthetically. The order of their listing is random and is not indicative of relative abundance or potential importance.

It should be emphasized that important differences exist in the basis for delineating the various areas of resource potential. Certain areas have been identified on the basis of known deposits and on extensions of their geologic features. Other areas have been outlined because results of preliminary or reconnaissance geologic and/or mineral exploration investigations indicate that they could contain certain deposit types that have been productive in similar geologic settings elsewhere. Some areas in the first group are known to contain important resources; the resource potential of those in the second group can only be speculative; the remainder fall between these two extremes.

The maps show that some parts of central Alaska have not been included among those designated as having significant mineral resource potential. For the most part these areas have been excluded because (1) they contain no known deposits or only a few scattered small deposits in a generally unfavorable geologic setting, and/or (2) they are mantled by a thick cover of unconsolidated surficial deposits, or by young volcanic rocks. Although such areas may contain concealed deposits at depth, it is felt there is little likelihood of their being discovered and exploited using presently known or foreseeable techniques.

Summary of mineral resource information

The principal data used for defining areas of mineral resource potential are summarized in telegraphic style in table 2. Included are qualitative and, where the data permit, probabilistic estimates of potential. The table contains ten columns, which are discussed briefly in numerical order from left to right below. For more detailed information on individual deposits and mining districts, the reader is invited to consult U.S. Geological Survey Open-file Report 77-168-D.

Column 1. Area outlined on maps.--The entry number shown in this column correlates with corresponding numbered area(s) of mineral resource potential on sheets 1 and 2 of the map.

Column 2. Types of known deposits.--Major types of mineral deposits known to occur within the area are identified in column 2 using terminology commonly accepted among most economic geologists. In most cases there is evidence of production. Where more than one deposit type is listed, they are prefixed by lowercase letters to facilitate reference to related comments in the other columns. Principal and subordinate (in parentheses) resources are indicated by standard chemical symbols.

Column 3. Suspected or speculative types of deposits.--Listed here in the same format as in column 2 are deposit types whose occurrence within the designated area is considered permissive because of favorable geologic considerations and/or exploration history. Also included are minor occurrences.

Column 4. Geologic controls of mineral resources.--Geologic characteristics of known, suspected, or speculative deposit types listed in columns 2 and 3 are briefly stated and, where possible, principal geologic factors believed responsible for their localization are indicated.

Column 5. Production and resource information.--Available data and estimates of production, estimates of identified resources and generalized statements about potential for the deposit types listed in columns 2 and 3 are summarized here.

Column 6. Status of geologic information.--This column contains a summary of the status and scale of geologic mapping, geophysical and geochemical surveys, and mineral resource investigations. Recent industry exploration and mining activities are also noted.

Column 7. Additional comments.--Statements in this column in general are intended to further clarify or amplify the statements concerning geologic controls in column 4. Additional information bearing on the potential for the occurrence of speculative deposit types is also presented here.

Column 8. Summary of mineral resource potential.--This column contains generalized information relevant to the overall mineral resource potential of the area, as well as a summary of the principal geologic factors that render the area permissive for the occurrence of certain deposit types.

Column 9. Estimated number of deposits.--Where warranted by the available information, subjective probabilistic estimates of the number of deposits, by type, likely to exist within the designated area are presented in this column. These estimates are assigned high (90 percent), intermediate (50 percent), and low (10 percent) levels of confidence that the indicated number of deposits, or more, may be present. The absence of an entry in this column indicates that data necessary to construct such estimates are lacking.

Column 10. Grade and tonnages for deposit types.--Where occurrences in a given area are judged representative of a designated deposit type, reference is made to the appropriate grade-tonnage or contained-metal model to provide an indication of expected size (table 3). Not all models presented in table 3 have been referenced in this column because not all of the deposit types modeled are known to be represented in central Alaska.

TABLE 2. METALLIFEROUS MINERAL RESOURCE DATA FOR CENTRAL ALASKA

(See map sheets 1 and 2)

AREA OUT-LINED ON MAPS	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 (ALL UNITS METRIC UNLESS OTHERWISE INDICATED)	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 3)
1.	(a)Pt, Au--placer	(b)(Cr, Hg)--placer	(a)Mainly modern stream and bench placers of Salmon River and its western tributaries that drain Red Mountain dunite intrusive (Jurassic ?) and that is considered to be the ultimate source of the platinum metals. Gold reconcentrated into placers from glacial outwash (b)Small amounts of chromite and locally native mercury and cinnabar in beach and stream placers	(a)Total platinum production from Goodnews Bay district estimated to be well over 20,000 kg (650,000 troy ounces), plus about 485 kg (15,600 ounces gold). Most productive ground involved two paystreaks mined over a distance of about 10 km (6 miles) in Salmon River valley. Drilling demonstrates Salmon River platinum-bearing ground extends at least as far south as Happy Creek but not as far as Chagvan Bay about 5.6 km (3½ miles) farther south. Platinum reportedly present in sediments of Goodnews Bay, but results of industry sampling program not available. No workable lodes containing platinum have yet been found. Although Red Mountain dunite intrusive is not considered a favorable site for the discovery of any large low-grade workable ores of platinum metals, some small high-grade concentrations may exist. Total identified resources in beaches, bays and lodes has been estimated at 210,000 kg (6.8 million troy ounces). Platinum metals potential of offshore area essentially unknown but could be sizable (b)Beach placers locally contain low grade chromite resources and restricted occurrences of gold and platinum	Reconnaissance USGS 1:250,000 geologic mapping of late 1940's and 1950's, updated 1974-1976 under AMRAP. Regional and local detailed geochemical sampling and aeromagnetic surveys by government and industry. Comprehensive USGS study of Goodnews Bay district platinum deposits	Preservation of placer ground largely controlled by extent of glacial scouring. Platinum placer mining Goodnews Bay District ceased 1975. Attempts to sample sea floor west of Red Mountain for platinum have been generally inconclusive. Bedrock and stream sediment geochemical mercury anomaly south of Goodnews Bay	Significant past production of placer platinum > 20,000 kg; (> 650,000 oz) and byproduct gold (485 kg;15,600 oz) from bench and stream placers in Salmon River area. Significant additional resources of platinum probably exist in extensions of the Salmon River placers, and in beaches, bays and lodes		

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2.	Au, (Pt)--placer	- - -	Bench and stream placers. Ultimate source of gold probably Tertiary granitic intrusive rocks and reconcentration from glacial deposits	Total production not known but estimated less than 3,100 kg (100,000 ounces) mainly from Slate and Wattamuse Creeks, which have been extensively explored and drilled. A small amount of platinum recovered from Bear Creek placers	Area covered by recent (1961) 1:250,000 scale regional geologic mapping, updated under AMRAP studies. State contoured aeromagnetic coverage (1:250,000 scale)		Estimated production of gold from stream and bench placers has been < 3,100 kg (< 100,000 oz). One stream produced a little byproduct platinum. The area has been extensively explored		
3.	Au (Pt)--placer	- - -	Ultimate source of gold in Pre-Pleistocene (?) bench and present stream gravels may have been the mineralized major deep-seated fault zone that separates Precambrian Kanektok terrane from the Ordovician to early Cretaceous Ahklun terrane to southeast. Byproduct platinum probably derived from Tertiary mafic intrusives	Total production not known, but may have exceeded 3,100 kg (100,000 oz) small amount of byproduct platinum also locally recovered	Recent (1961) 1:250,000 scale USGS geologic mapping updated under AMRAP studies. State contoured aeromagnetic coverage (1:250,000 scale)		Estimated production of gold from stream and bench placers has been < 3,100 kg (< 100,000 oz). Some streams have produced a little byproduct platinum		

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4.	(a)Hg(Sb)--vein and open space filling (low temperature hydrothermal) (b)Au--placer	(c)Au, (Ag, Hg, Sb, Zn, Cu, Pb, W, Sn)--mainly quartz veins associated with lower Tertiary granitic intrusives; in part porphyry gold	(a)Principal deposits and groups of deposits localized along major, deepseated, through-going fault zones. Local controls related to structurally and chemically suitable sites that offered sufficient permeability for the passage of the ore-forming solutions and adequate porosity for the deposition of cinnabar and stibnite. Most (but not all) productive deposits are in or adjacent to faulted and altered mafic dikes and sills (Tertiary?) that intrude sedimentary and volcanic rocks of the Kuskokwim (Cretaceous) and Gemuk (Carboniferous to Cretaceous) Groups. (b)Ultimate source of gold in many of the most productive present stream and bench placers believed to be irregular quartz veins in granitic plutons (early Tertiary) and in associated hornfels zones. Especially rich placers locally formed where present streams transect older bench gravels. (Compare Ruby district placers, area 14.) Some gold also reconcentrated from glacial and/or glaciofluvial deposits. Semi-residual placers locally developed over deeply weathered quartz monzonite intrusives (early Tertiary) as near Flat	(a)Total production of mercury over past 75 years about 1,300 tons (38,000 flasks; 76 lbs. per flask), mainly from the Red Devil Mine about 1,100 tons (32,000 flasks). A small amount of byproduct antimony also produced. A few known regional mercury geochemical anomalies. (b)Placer deposits wide distributed throughout region and have accounted for almost 13% about 70,000 kg (2,252,000 fine ounces) of Alaska's total placer gold production, plus byproduct silver, through 1960. Principal producers include Iditarod-Flat area about 41,400 kg (1,330,000 ounces) Innoko area about 17,000 kg (550,000 ounces) and Candle Creek about 3,100 kg (100,000 ounces) (c)Of 13 occurrences, only two known mines had small production (gold, silver, lead, and zinc) and are now inactive. "Porphyry gold" deposits associated with quartz monzonite stocks probably have a significant low grade resource potential	Southwestern part of region covered by reconnaissance 1:250,000 scale geologic mapping, updated by AMRAP studies, including state contoured aeromag. (1:250,000 scale). Most of remainder covered by pre-1955 reconnaissance mapping and ranks among geologically least known areas in Alaska. Much of region characterized by poor exposures. Most known lode mercury-antimony deposits have been examined by USGS and many have been sampled by USBM. Also USBM sampling programs in Flat area for gold and mercury. Extensive regional geochemical sampling program by industry in early 1970's	(a)About two dozen mercury-antimony lode deposits are known in addition to the ten that have been productive and more are likely to be found. A few regional geochemical anomalies. Cinnabar also present in many gold placers, but none has produced more than a few flasks of mercury. (b)Placer concentrates also contain ubiquitous cinnabar, stibnite, scheelite, and base metal sulfide minerals; locally cassiterite, platinum, monazite, orpiment, realgar, allanite, and bismuth also present. Chromite found in some of the placers probably derived from small ultramafic intrusives	(a)Ten lode deposits have produced mercury in this region and approximately two dozen additional deposits are known to occur. The region is considered favorable for the occurrence of more deposits (b)Bench and stream placers have produced approximately 70,000 kg (2,252,000 oz) of gold (c)Production from two small gold-bearing quartz vein deposits was about 84 kg (2,700 oz) of gold and 81 kg (2,600 oz) of silver, about 4 tons of lead and a little zinc (< .5 ton). Additional deposits are possible. "Porphyry gold" deposits, associated with quartz monzonite stocks, probably contain a significant resource of low-grade gold	90% 50% 10% chance that there are 30 70 110 deposits or more	(a)mercury model

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4. (cont.)			(c)Irregular quartz veins up to two inches thick cut lower Tertiary quartz monzonite stocks and contain gold, scheelite and base metal sulfide minerals, and a little cassiterite. Others contain cinnabar and stibnite. Emplacement of the plutons may have been controlled by Iditarod-Nixon fault and related structures. Widely scattered mineralized quartz veins also associated with small lower Tertiary albite rhyolite porphyry intrusions						

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5.	(a)Fe(Ti)---magmatic	- - - (b)Au--placer (c)Mo--vein (hydrothermal?) (d)Hg (Sb)--possible vein and open space filling lode deposits	(a)Single known southeastward dipping tabular titaniferous magnetite bearing pyroxenite intrusive at least 1,200 m (4,000 feet) thick, underlying area of 10 km^2 (4 square miles) or more (Kemuk Mountain). (b)Stream and/or bench placers. (c)Auriferous quartz-carbonate veinlets in contact zone between serpentinite and fine grained mafic intrusive. (d)Similar to notation #1 under area 4(a)	(a)Estimated 2.4 billion tons of hypothetical resources containing 15-17% total iron and 10.5-12% magnetic iron. No production (b)No known production. (c)Single known occurrence. Channel samples contain up to 11 ppm gold. No known production	(a)Company airborne and ground geophysical surveys and diamond drilling program. Small area north of Dillingham covered by USGS contoured aeromag (1:125,000 scale). Regional geology poorly known. Western part covered by pre-1940 reconnaissance 1:250,000-scale geologic mapping by USGS Extensive glacial cover (including eolian).	(a)Deposit covered by 90-400 feet of glacial deposits. Most rocks are silicified argillite quartzite and limestone (Permian-Triassic?). (c)One occurrence of molybdenite reportedly found near head of Silver Horn on Lake Beverly (d)No known deposits but available geologic information suggest that undiscovered deposits may be present in western part of area Note: adjoins area 8, southern Alaska (USGS Open-file report 78-1-E)	(a)A single titaniferous magnetite-bearing pyroxenite intrusive contains an estimated 2.4×10^9 tons of 15-17% total iron (10.5-12% magnetic iron) (d)Although there are no known mercury mines or prospects within this region, its western portion is similar in geology to area 4, a region of known mercury deposits and prospects		(d)mercury model
6.	(a)Au(Pt, Hg, Sb)--placer	(b)(Au, Cu, Sb)--vein (hydrothermal) (c)(Cu)--magmatic (?) (d)(Cu, Zn, Ag)--possible submarine volcanogenic sulfide deposits relate to mafic lavas (?)	(a)Modern stream, bench, and fossil placers. Source of most of gold was gold-quartz veins in and adjacent to Upper Cretaceous quartz monzonitic plutons and smaller Upper Cretaceous-lower Tertiary albite rhyolite intrusives. Byproduct platinum probably derived from small ultramafic (Jurassic ?) intrusives. (b)Quartz veins associated with some of the Cretaceous granitic intrusives contain gold, stibnite and copper minerals. (c)Tuluksak River dredge yielded specimens of bornite and asbestos from ultramafic bedrock (d)Although their occurrence has not yet been demonstrated, the belt of Jurassic (and some Permian) mafic volcanic rocks that underlies the NW part of the area may have some potential for submarine mafic volcanogenic sulfide deposits	(a)Most of the major gold production from bench placers, as at Bear Creek, where still older underlying gravels may have potential for more gold. Minor platinum recovered from some of the placers but the amount is unknown. Many of the streams draining northward into Kuskokwim R. contain traces of gold and may have some placer potential, especially beneath the blanket of glacial outwash. (b)No known production. (c) - - - (d) - - -	Reconnaissance 1:250,000 scale-geologic mapping (1959) by USGS. Little prospecting. Essentially no presently available geochemical coverage. Northern half covered by ERDA aeromag and gamma ray and profiles (1:500,000 scale)	(a)Cinnabar a common constituent of many of the placers, notably those of Bear Creek	(a)Bench, stream and fossil placers have been mined. Fossil placers may have potential for additional gold. (b)Quartz veins, which carry gold, copper and antimony minerals, are scattered throughout the region (d)The belt of Permo-Jurassic mafic volcanic rocks, that occurs in the northwest part of the region, is permissive for the occurrence of mafic volcanogenic deposits. No occurrences are known in this generally poorly explored region		(d)mafic volcanogenic model

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7.	(a)Au(Pt)--placer	(b)Au(Cu, Pb, Mo, Ag) vein (hydrothermal)	(a)Mainly modern stream placers. Source of gold probably quartz veins related to Upper Cretaceous-lower Tertiary granitic intrusives into mafic volcanic and associated clastic rocks (Permian-Jurassic) (b)Quartz-calcite veins up to 30 cm (12 ins.) thick contain native gold, galena, molybdenite, chalcopyrite and traces of scheelite and wolframite. Arnold prospect reportedly contained high silver values	(a)Estimated total gold production about 3,000 kg (96,000 fine ounces) plus byproduct silver and a little platinum, mainly from five deposits (b)Lode deposits known since about 1914, but none has been productive. Potential exists for discovery of additional vein deposits but theirs total precious and base metal resources probably are small	Recent (1959, 1976) 1:250,000-scale reconnaissance geologic mapping by USGS. Little known company activity. Regional aeromagnetic, gamma ray profiles (ERDA), and reconnaissance geochemical (USGS) coverage.	(a)Cinnabar present in many of the placer concentrates. Minor scheelite at Elephant Creek. Area includes pillow basalts, diabase and gabbro with minor chert argillite and volcaniclastic rocks that may correlate with Rampart belt of volcanic ophiolitas (see area 11)	(a)Stream gold placers have been mined (3,000 kg; 96,000 oz). Some of the streams carry byproducts, including silver, platinum and tungsten (b)A number of gold and sulfide bearing quartz veins are known in the region. To date none has been productive. Potential exists for additional discoveries, but resource potential considered small (c)Region contains rock types which are geologically permissive for the occurrence of mafic volcanogenic deposits. No occurrences are presently known		(c)mafic volcanogenic model
8.	(a)Hg---veinlets and open space fillings (b)Au, Ag (Cu, Fe, Bi, W, Th, REs)--contact metamorphic (c)Au (Bi, Sn, W, Th, U)-- placer	(a)(Sb)---possible stibnite associated with mercury minerals in veinlets, disseminations and open space fillings (?)	(a)Cinnabar occurs mainly as breccia filling in dolomite and dolomitized limestone (Middle? Ordovician) along southeastward dipping faults that are probably related to Farewell fault zone (see also item #4 above) (b)Tactite zones (including skarn) in lower Paleozoic platform carbonate rocks adjacent to quartz monzonite stocks (Upper Cretaceous-lower Tertiary). Gold also disseminated in the monzonite (porphyry gold?). (c)Stream placer deposits, especially those that cross contacts between quartz monzonite intrusives and carbonate rocks (see above)	(a)White Mountain deposit has produced an estimated 14+ tons (400+ flasks) of mercury since 1964. Cinnabar distributed over an area 6-8 km (4-5 miles) long and up to 1.6 km (1 mi) wide (b)Lode mines in Nixon Fork area have produced an estimated 1,600 kg (50,000 ozs) of gold and a little silver, mainly between WWI and WWII. Copper content ranges from 2-12% but no attempt made to recover it. (c)Production data on gold placers lacking but in Nixon Fork area the amount probably was less than that from the lode deposits	Southern part of region is one of the geologically least known areas of Alaska. Northern part included in AMRAP studies now in progress. Geochemical studies in Nixon Fork mine area by state and USGS. Central areas covered by 1977 USGS aeromagnetic profiles (1:250,000-scale)	(a)Stibnite not a recognized constituent of the White Mountain deposit, but could be present in as yet undiscovered lodes. (b)Nixon Fork lodes contained auriferous pyrite, chalcopyrite, copper carbonate minerals, native bismuth, and minor amounts of bornite, scheelite and traces of radioactive minerals (parisite, allanite) (c)Placer concentrates in Nixon Fork area also included scheelite, cassiterite, allanite and thorianite	(a)One deposit, White Mountain, has produced 14+ tons (400+ flasks) of mercury. Other deposits may occur (b)3 skarn deposits are known. One, Nixon Fork, has produced about 1,600 kg (50,000 oz)of gold and a little silver; copper was present but not produced. Region is favorable for the occurrence of additional deposits (c)Stream placers have been mined		

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9.	- - -	(a)(Cu, Zn, Ag)--possible submarine volcanogenic sulfide deposits related to mafic lavas (?) (b)(Cu, Pb, Zn, Mo, Au)--- vein and porphyry deposits associated with granitic and rhyolitic igneous rocks (?) (c)(Pt, Cr, Fe, Ti)---magmatic deposits (?) (d)(Au)--placer (?)	Although the only known mineral resources derive from a single occurrence of chalcopyrite in contact zone of a diorite pluton and from placer gold on bars of the Anvik River and its tributaries, the following features contribute to an overall geologic setting considered suitable for the occurrence of deposits types indicated as speculative in the adjacent column: (1)widely distributed marine mafic volcanic rocks (Lower Cretaceous), in part propylitically altered, and intruded both by granitic plutons (Upper Cretaceous) and high-level rhyolitic bodies with their extrusive counterparts (Upper Cretaceous-lower Tertiary; (2)major northeastward trending faults; (3)several mafic and at least 1 known ultramafic intrusive body	Area has no known recorded production; definitive resource data lacking	Reconnaissance geologic mapping by USGS (1:2,500-scale). Southern quarter covered by ERDA aeromagnetic and gamma ray profiles (1:500,000-scale). Little known prospecting	Area also included in the belt of upper Cretaceous-lower Tertiary rhyolitic intrusive and extrusive rocks described under area 11 below	Although this region contains only 1 known mineral occurrence, it has been little prospected and the geologic setting is permissive for the occurrence of the following deposit types: mafic volcanogenic deposits (associated with Cretaceous basalt and andesite), porphyry copper deposits (associated with Cretaceous-Tertiary rhyolitic volcanics and high level intrusives), podiform chromite deposits (associated with ultramafic rocks) and gold stream placers (associated with Quaternary alluvial deposits)		(a)mafic volcanogenic model (b)porphyry copper model (c)podiform chromite model
10.	- - -	(a)(Cr, Asbestos)---possible podiform chromite, chromite layers and cross-fiber asbestos deposits associated with ultramafic rocks. (b)(Ni)---possible nickeliferous residual deposits (?)	(a)Known occurrences of chromite and small seams of cross-fiber asbestos in typical alpine serpentinized dunite and peridotite tectonite (and overlying layered gabbro) that constitute the ultramafic parts of allochthonous ophiolite complexes. (b)Potential residual deposits enriched in nickel (laterites) ultramafic rocks, particularly at the edge of and beneath overlapping non-marine coal-bearing mid-Cretaceous-lower Tertiary sedimentary rocks that border the ultramafic ophiolite belt northwest of the Ray Mountains	(a)Chromium values range as high as 9% in selected USGS grab samples of dunite streaked with grains of chrome spinel from the Kanuti-Kilotna Creeks area. Composite chip samples contained 2400-3000 ppm chromium, 1900-2400 ppm nickel and below detectable (atomic absorption) amounts of platinum group metals. Since no visible sulfide minerals have been detected the anomalously high nickel content is considered to be present in silicate mineral(s). Bedrock samples from ultramafic rocks in the Yuki River region contain 1000-1500 ppm nickel and generally 700-1500 ppm chromium	Recent 1:250,000 geologic mapping and more detailed studies of the ophiolites by USGS. Locally good bedrock and stream sediment sampling coverage. Contoured state aeromagnetic maps available for most of the areas except in Nulato quadrangle. Little known industry activity	These ultramafic and layered gabbro ophiolitic complexes have been interpreted as representing the root zones of allochthonous sheets, the leading edges of which are the basalt-diabase-chert complexes noted under area 11 below. Area 10 on map also locally contains elements described under area 12 below	(a)Known occurrences of chromite and asbestos in alpine ultramafic bodies. Podiform chromite deposits are possible (b)Although there are no known deposits, the geologic setting is permissive for the occurrence of laterite nickel deposits	90% 50% 10% chance that there are 6 20 66 deposits or more	(a)podiform chromite model

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11.	- - -	(Cu, Zn, Ag)---possible submarine volcanogenic sulfide deposits	Pillow basalt, diabase and gabbro with minor chert, argillite, volcaniclastic rocks and limestone of the Rampart belt of dismembered ophiolite complexes (Mississippian to Jurassic) offer a potentially suitable geologic setting for the occurrence of massive and/or disseminated stratabound volcanogenic sulfide deposits associated with pillow lavas similar to those at Cyprus, Oman, and elsewhere	No known occurrences and resource data essentially lacking. Limited geochemical data indicate the ophiolitic assemblage northwest of Livengood carries the highest values of copper, (generally 15-700 ppm; 1 sample showed 15000 ppm) and up to 0.1 ppm silver in bedrock samples	Most of the indicated areas covered by post 1966 USGS 1:250,00D-scale geologic mapping except for Kaiyuh Mountains-Yuki River area. Regional ERDA aeromag and gamma ray profile coverage (1:500,000-scale). Reconnaissance USGS geochemical data exists for most of the areas. Little known exploration activity by industry	Small mafic and ultramafic intrusives associated with these ophiolites may have some potential for chromium and asbestos. (Bedrock samples locally carry >5000 ppm Cr).	Geologic setting is considered permissive for the occurrence of mafic volcanogenic sulfide deposits although no such deposits, or even occurrences, are presently known. Region has not been throughly prospected for this deposit type		mafic volcanogenic model
12.	- - -	(Pb, Zn, Ag, Cu, Au)---possible disseminated sulfide deposits and veins associated with silicic intrusive and extrusive igneous rocks (?)	Numbered areas define a belt at least 725 km (450 miles) and up to 128 km (80 miles) wide that contains swarms of porphyritic rhyolitic to dacitic dikes, sills and other small plutons and non-marine extrusives (Upper Cretaceous-lower Tertiary) that are for the most part localized along northeast trending faults. Some are as young as Miocene. Locally developed pyritiferous zones are extensively oxidized. Altered zones of silica and sericite. Area may contain undiscovered porphyry copper deposits	No known productive deposits and relevant resource data almost totally lacking. However, one such altered zone about 90 m (100 yards long) in the upper Kanuti River area contains disseminated galena, sphalerite and pyrite. Grab samples contain 700-20,000 ppm lead, trace to 3,000 ppm zinc, 3-30 ppm silver and 70-500 ppm copper. Similar altered rhyolite bodies on the Indian River about 120 km (75 miles) to the southwest contain small, but anomalous, amounts of lead copper, silver, gold and molybdenum	Northeastern half covered by recent USGS 1:250,000 scale regional geologic mapping. Other data include ERDA aeromag and gamma ray 1:500,000 profiles, and some USGS bedrock and stream sediment geochemical data. Southwestern part generally poorly known. No known systematic prospecting for the indicated speculative targets	The geologic setting is also considered potentially suitable for the occurrence of uranium	This region has not been throughly prospected for base metals. The rock types present (small felsic intrusive and extrusive rocks) and their structural setting, together with extensive altered areas and associated geochemical anomalies, contribute to a geologic setting which is considered permissive for the occurrence of porphyry copper deposits and uranium deposits associated with granitic and rhyolitic rocks		porphyry copper model

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13.	(a)Au, W(Sb)---placer	- - - (b)(W, Sn)---placer (c)(Sb, Au)---vein	(a)Gold in bench and modern stream placers of Ungalik River area probably derived from small mineralized intrusives (Upper-Cretaceous) into marine Cretaceous (Albian?) sedimentary rocks. (b)Beach placers (c)Scores of claims staked pre-1909 on Christmas Mountain Upper Cretaceous quartz monzonite-granodiorite intrusive body	(a)Production data lacking, but probably well over 370 kg (12,000 oz) of gold. Mining (including dredging) has spanned over 60 years at least through 1975. A few pounds of scheelite recovered 1918. Placer gold may also be concentrated at base of submerged alluvium along former valley of Ungalik River and as an offshore residual deposit formed when sea level rose to its present position. (b)Beach deposits along northwest shore Norton Bay contain traces of cassiterite (tin) and scheelite (tungsten). (c)Stibnite float and colors of gold from streams draining Christmas Mountain, but no record of any development work or production	Recent reconnaissance unpublished 1:250,000-scale geologic mapping and coastal studies by USGS; USBM reconnaissance sampling of beach and river deposits, Norton Bay	(a)Stibnite present in heavy concentrates. Offshore and beach placers may be present at mouth of Ungaluk River (c)Stibnite reported in quartz veins on ridge between Shaktolik and Ungalik Rivers	(a)Stream and bench gold placers have been mined as recently as 1975. Total production well over 370 kg (12,000 oz). A few kilograms of byproduct sheelite (tungsten) have been recovered. Buried Pleistocene stream channels beneath Norton Bay have some potential for placer gold (c)Stibnite-gold veins associated with Upper Cretaceous granitic intrusive bodies occur in the region		

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14.	(a)Au(Sn, Pt, Bi)--placer (b)Ag, Pb(Zn, Cu, Au, Mo)--polymetal veins	(c)(U, Th)--possible disseminations in igneous rocks(?) (d)(Sn, W, Be)--possible vein, disseminations and/or tactite deposits (e)(Cu, Zn, Pb, Ag)--possible stratabound (volcanogenic?) massive and/or disseminated sulfide deposits	Areas outlined generally define the Ruby geanticline which is underlain by pelitic and calcareous schist, quartzite, and carbonate rocks (Paleozoic and Precambrian?) and widely intruded by Cretaceous quartz monzonite, biotite granite and by granidiorite, and smaller granitic plutons of Late Cretaceous-early Tertiary age. (a)About 75% of the more than 70 placer gold mines, prospects and occurrences are concentrated in the Poorman-Long-Ruby area where pay streaks are for most part, deeply buried, discontinuous, and bear little relation to present stream channels. Ultimate source of metals considered to be small quartz veins in highly decomposed metamorphic bedrocks and related to Upper Cretaceous-early Tertiary granitic intrusives. (Compare Ophir district, area 4.) (b)Mainly argentiferous galena-bearing quartz veins in quartz-mica schist. (c)Quartz monzonite and granite of the Melozitna pluton contain above-average amounts of uranium and thorium. Radiometric anomalies over parts of the Sithylemenkat Lake and Melozitna plutons suggest possible disseminated uranium and thorium in intrusives and wall rocks. (d)Many of the Cretaceous granitic plutons of the Ruby geanticline and their associated contact zones contain pegmatites and quartz-tourmaline veins, as well as geochemically anomalous amounts of tin, boron, beryllium, lithium and, locally, lead and rare earths. These and other geologic considerations make the indicated areas permissive for the occurrence of	(a)Poorman-Ruby-Long areas has produced well over 12,000 kg (400,000 fine ounces) of gold (about 2% of Alaska's total placer gold output), plus byproduct silver and a little platinum. A few tens of tons of cassiterite also recovered, but most was not shipped to smelter. Some of the ground was exceedingly rich. Geologic nature of the placers suggest some undiscovered pay streaks may still exist. Production from the Morelock and Tozimoran Creeks area probably did not exceed 150 kg (5,000 oz) of gold, plus byproduct silver. Cassiterite a common constituent of those placers and some was recovered, but it is uncertain that any was ever marketed. (b)Of seven known occurrences only one has produced. Perseverance mine and adjacent Valley claims yielded 204 tons (225 short tons) of ore that averaged 73% lead and 3.6 kg per ton (104 oz silver per short ton). Undiscovered vein deposits probably exist, but their resource potential for the indicated metals is likely to be low. (c)(d)(e)No production. Definitive resource data lacking	Recent 1:250,000-scale geologic mapping by USGS. Government airborne magnetic and radiometric regional coverage fairly complete except southwest part of area. Some USGS bedrock and stream sediment geochemistry. Recent claim staking in Melozitna Hot Springs area (radiometric anomaly). Otherwise little known systematic prospecting except for lode and placer gold	(a)Native bismuth, platinum, scheelite and allanite present in some of the placer concentrates. Locally includes elements of area 12 NOTE: There are differences in distribution and boundaries of area 14 between Central and Northern Alaska (USGS Open-file Rept. 78-1B) regions owing to differences in geologic interpretations of the available data in the respective regions	(a)Fossil gold placer deposits have been mined in the region. Production has been well over 12,400 kg (400,000 oz). By-products recovered include silver, platinum and tin. There is a potential for additional deposits in the region. (b)One deposit and six occurrences of argentiferous galena-bearing quartz veins are known in the region. The one deposit was low tonnage (204 tons) but very high grade (73% lead and 3.6 kg silver per ton). Some potential exists for additional deposits. (c)The rock types (granitic intrusives) and known local radiometric and geochemical anomalies signify a geologic setting permissive for the occurrence of disseminated uranium and thorium minerals. (d)The rock types present (granitic intrusive rocks), together with anomalously high values of tin, beryllium and lead in geochemical samples, suggest a geologic setting permissive for the occurrence of tin and tungsten in vein, greisen and/or tactite deposits. (e)Although this region contains no known occurrences of acid-intermediate volcanogenic sulfide deposits, it is not known to have been thoroughly prospected for base metal deposits, especially of that type. The rocks present are coextensive with and		(d)tungsten tactite model (e)felsic and intermediate volcanogenic sulfide model

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14. (cont.)			tin-tungsten vein or greisen deposits and metalliferous tactite (skarn) deposits, especially where the plutons have intruded calcareous schist. (e)The pelitic schists and associated metamorphic rocks or the Ruby geanticline are lithogenetically similar to, and are considered to be coextensive with, the low- to medium-grade metamorphic rocks of the southern Brooks Range that contain the recently discovered Arctic and Picnic Creeks stratabound (volcanogenic?) massive and/or disseminated sulfide deposits. This region of central Alaska is therefore considered to be geologically permissive for the occurrence of such as yet undiscovered deposits				lithologically similar to pelitic schists in the southern Brooks Range that contain the Arctic and Picnic Creek deposits. Thus, the region is considered permissive for the occurrence of felsic and intermediate volcanogenic sulfide deposits		
15.	(a)Au--placer	(b)Cu, Pb, An, Ag, (Mo, Au, W)--veins and disseminations	(a)Mainly modern stream gravels that drain contact zones between Lower Cretaceous andesitic rocks and Upper Cretaceous quartz monzonite and granodiorite plutons, as well as mineralized zones in the volcanics. Some reconcentration from glaciofluvial deposits. (b)Tetrahedrite-galena-sphalerite veins in altered andesitic volcanic rocks (Lower Cretaceous) near the Indian Mountain granodiorite-quartz monzonite pluton (Upper Cretaceous); disseminated sulfide minerals in fault controlled, altered, silicified, fine-grained felsic intrusive rocks (Upper Cretaceous or lower Tertiary) and andesitic host rocks (see area 12 above)	(a)Total known production about 260 kg (8,500 oz) gold plus byproduct silver, an amount much too small in view of the extensive mining on Indian River and Bear and Utopia Creeks. Dredging on Bear Creek as recently as 1975. (b)Anomalous amounts of copper (up to 1,500 ppm), lead (up to 3,000 ppm), zinc (up to 3,000 ppm), silver (up to 700 ppm), and gold (up to 6 ppm) in stream sediment and/or selected grab samples. No known development work. Potential resource for indicated metals in known and undiscovered lodes is probably small	Reconnaissance 1:250,000 geologic mapping (1966, 1977) and reconnaissance geochemical sampling of selected areas by USGS. Regional ERDA aeromag and gamma-ray profiles (1:500,000 scale)	Some creeks contain abundant barite bounders with fine-grained tetrahedrite, galena and sphalerite. Cassiterite and platinum group metals reported in Bear Creek placer concentrates. Area contains elements of area 12 above	Stream gold placers have been extensively mined locally. Production has been well over 260 kg (8,500 oz) of gold plus byproduct silver		

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16.	(a)Au, Sn (Cr, W, RE's)--placer	(b)(Pb, Ag, Au, Cu)--mineralized shear zones and veins	(a)Placer deposits restricted to several pay streaks in lower Quaternary stream gravels and generally related to the drainage basin that existed before 3 to 52 m (10 to 170 ft) of silt and muck covered the area. Definite lode sources for the gold and cassiterite have not been found anywhere in area. Placer gravels may have been derived from unexposed quartz veins immediately north of the well defined tin belt. The veins may have been brecciated and mineralized with cassiterite and tourmaline during Tertiary intrusive activity. Cassiterite and gold need not have come from same source. Chromite, picotite, ilmenite and magnetite were probably derived from several serpentinized ultramafic bodies in area. (b)Mineralized shear zones in hornfels related to Tertiary granitic intrusives	(a)Gold production 1899-1961 about 14,000 kg (451,000 oz, about 2.2% Alaska's placer output), plus several hundred tons byproduct cassiterite from belt about 19 km (12 mi) long and 1.6 km (1 mi) wide. 238 tons (262 short tons) cassiterite reportedly produced 1911-1919. Wayland (USGS, 1961) estimated as of 1941 tailings contained about 201 tons (222 short tons) of cassiterite (indicated reserves) and about 820 tons (900 short tons) of proven and indicated cassiterite reserves in buried placers in areas with systematic drilling and near mined pay streaks. Additional inferred cassiterite in the basins of Patterson and Baker Creeks and west of Woodchopper Creek amounted to about 1,000 tons 1,100 short tons). Reserves of gold in tailings were estimated to be about 130 kg (4,300 oz). Lode resources entirely speculative. Resource estimates probably valid at least through 1958 (b)None of the lode deposits has been productive. Their resource potential appears to be small	Area covered by recent (1975) 1:250,000-scale regional geologic mapping. USGS contoured aeromag at 1:250,000 scale. Local detailed aeromag by industry. (a)Detailed studies and sampling programs in Tofty tin belt by USGS and USBM. (b)USBM diamond drilling and sampling program (1954) on Hot Springs Dome mineralized zones	(a)Rare earth minerals (monazite, aeschunite, and xenotime) rather widespread among the placers but not concentrated into minable deposits. Small amounts of scheelite, cinnabar and native copper locally present in concentrates	(a)Stream gold placers have yielded about 14,000 kg (451,000 oz) of gold plus byproduct silver and several hundred tons of cassiterite (tin). Remaining cassiterite resources (all categories) probably do not exceed a few thousand tons of cassiterite. (b)Mineralized shear zones and quartz veins in contact zones of Tertiary granitic intrusives contain sulfide minerals (Pb, Ag, Au, Cu). No production is known		

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17.	(a)Au(Ag, Sn, W, Cr, Pb, Bi, Hg, RE's)--placer (b)Sb(Ag, Pb, Cu, Mn)--vein	- - -	(a)Bench and present stream placers. Source of gold probably in mineralized quartz veins in schistose lower Paleozoic rocks and contact zones related to Upper Cretaceous-lower Tertiary plutons. Locally common chromite and some of the copper present in heavy concentrates probably derived from mafic and ultramafic rocks of the Rampart ophiolitic belt. (b)Small vein deposits bearing silver-lead, lead-gold-copper, and antimony may be related to Upper Cretaceous-lower Tertiary intrusive activity. Two manganese occurrences consist of irregular masses and thin seams of psilomelane of probably hydrothermal origin in lower Paleozoic chert and/or quartzite	(a)Production data incomplete but small- and large-scale placer mining operations probably have accounted for up to 3,100 kg (100,000 oz) of gold from the 1880's to present. Much of the gold quite pure (>900 fine). Potential for future mining not known but for most part little virgin ground remains. Some streams (e.g., Minook Creek) may warrant reevaluation for large-scale operations at elevated gold prices. (b)Seven known occurrences. Only recorded lode production has been a few hundred tons of antimony ore in the early 1950's from a deposit on Sawtooth Mountain. Potential for future lode mining unknown but probably small. Area may contain plutons that have characteristics of tin granites	Recent (post 1970) 1:250,000-scale geologic mapping and regional geochemical sampling by USGS. Contoured aeromag at 1 mi spacing (USGS). ERDA aeromag and gamma-ray profiles (1:500,000 scale)	(a)Noneconomic amounts of chromium, copper, lead, silver, tungsten, bismuth, mercury, and rare earth minerals present in concentrates of many of the placers. (b)Geochemically anomalous amounts of tin, lead, silver, copper, zinc, arsenic and rare earths present in bedrock and stream sediment samples in vicinity of granitic intrusives	(a)Bench and stream gold placers have been mined. Production has been approximately 3,100 kg (100,000 oz) of gold. Potential for future production is unknown, but probably little virgin ground remains. (b)One of seven known polymetal vein deposits has produced a few hundred tons of antimony ore		
18.	- - -	(Ni, Cr, Pt, Asbestos)--Podiform chromite	Discontinuous belt about 113 km (70 mi) long and up to 3 km (1 3/4 mi) wide of tectonically emplaced alpine-type serpentinite contains occurrences of podiform chromite, minor cross-fiber veinlets of asbestos, and geochemically anomalous amounts of nickel with respect to similar rocks in other parts of the world	Grab rock samples contain up to 0.51% nickel and low, but detectable, amounts of platinum, palladium and rhodium. One selected sample of chromite contained 12.8% chromium. General absence of sulfide minerals suggest the observed anomalous nickel content may be associated with silicate minerals. Additional covered bodies of	Regional 1:250,000-scale geologic mapping by USGS (1971); USGS contoured aeromag (1:250,000 scale). USGS regional bedrock and stream sediment sampling. Much of belt staked by industry about 1970	Serpentinized ultramafic rocks may represent part of dismembered ophiolitic complex	The occurrence of chromite and minor cross-fiber asbestos in serpentinite suggests that the regions have a potential for the occurrence of podiform chromite and asbestos deposits	90% 50% 10% chance that there are 4 14 45 deposits or more	podiform chromite model

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18. (cont.)				tectonized serpentinite may occur on strike with or parallel to the major ultramafic trend. Total resource potential not known					
19.	(a)Au--placer (b)Sb, Hg (Au, Ag)--vein and breccia filling	(c)(Sn, W)--possible vein, disseminated and/or tactite deposits (d)(Au)--possible low-grade disseminated deposits	(a)Stream and bench gold placers representing modern and ancient stream-channel deposits developed on mature Quaternary erosion surface and largely buried by later sediments including silt and muck (frozen). Source of gold believed to be metalliferous quartz-calcite veins that constitute small lodes associated with numerous small quartz monzonite and monzonite (Tertiary?) intrusives. (b)Mainly small quartz-carbonate veinlets containing gold, silver and stibnite spatially related to monzonite stocks and dikes or probable Tertiary age. Altered granite at head of Olive Creek contains low-grade deposits of cinnabar. (c)The known local occurrence of cassiterite, scheelite, topaz, tourmaline and rare earth minerals in selected placer concentrates, as well as geochemically anomalous amounts of boron in stream sediment samples, within an area known to contain Tertiary granitic intrusives (including biotite granite) suggests the possibility that unrecognized or undiscovered tin granites with associated tin-tungsten vein deposits may be present. (d)The geologic setting and suite of geochemically anomalous metals (especially arsenic, mercury and antimony) known to be present in certain of the drainage areas suggest the region may be permissive for the occurrence of low-grade disseminated gold deposits (Carlin-type)	(a)Livengood placer district has produced well over 12,000 kg (330,000 fine ounces) of gold (about 2% of Alaska's total gold placer production). One of the most recently developed placer districts in state. Available data suggest district contains sizable gold resources that merit additional economic appraisal. Information from 640 drill holes in gravels of Livengood Creek area alone indicates about 13 million m^3 (17 million yd^3) of material with average recoverable gold content of 0.8 g/m^3 [\$3.20/yd^3 (gold at \$5.14/g; \$160/oz)]. Area may contain as yet undiscovered placers representing former stream channels buried beneath frozen muck. (b)Of the eight known lode occurrences, only two have had even token production. A small amount of stibnite was shipped from a vein on Livengood Creek and a little cinnabar was recovered from the deposit at the head of Olive Creek. Stream sediment and spring sediment samples locally contain anomalous amounts of	See area 18 above (a)Considerable company exploratory drilling of placers, especially in Livengood Creek area. (b)USGS bedrock, stream sediment and spring sediment sampling in vicinity of Livengood (1967)	(a)Heavy minerals identified in concentrates include chromite and chrome spinel (derived from ultramafics--see area 18), cinnabar, stibnite and less abundant scheelite, cassiterite, and uranium-thorium-rare earth minerals	(a)Stream and bench placers have produced well over 12,000 kg (380,000 oz) of gold. Considerable potential for additional production exists. Based on 640 drill holes, indicated resources in the Livengood Creek area alone are equal to 13×10^6 m^3 (17×10^6 yd^3) at 0.8 g/m^3 (\$3.20/yd^3; gold at \$160/oz). (b)Eight sulfide-bearing quartz-carbonate veins are known to occur within the region. Only two have produced even small amounts of ore. Some potential for additional deposits exists. (c)The presence of Tertiary granites, together with anomalous amounts of boron in stream sediment samples and the presence of cassiterite, scheelite, topaz, tourmaline and rare earth minerals in placer concentrates, suggests a geologic setting permissive for the occurrence of tin and tungsten in veins, greisens and/or tactite deposits. (d)The region has an unknown potential for low-grade disseminated gold deposits (Carlin type)		(c)tungsten tactite model

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19. (cont.)				gold, arsenic, mercury, antimony, molybdenum, silver and boron, especially along fault zones cut by Tertiary intrusive rocks. Although the known lode deposits have heretofore proven uneconomic because they are too small and low grade to mine, they suggest the possibility of additional concealed deposits in this poorly exposed region of seemingly favorable geology. Some company exploration for lode deposits. (c)No production. Definitive resource data lacking. (d)Definitive resource data lacking					

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20	(a)Au(Sn, W, Sb)--placer (b)Au, (Ag)--vein (c)Sb--vein (d)W--contact metamorphic and vein	(e)(W, Sn)--possible vein, greisen, and/or contact metamorphic (tactite) deposits	(a)Principally stream placers formed in creek valleys in Pliocene and Pleistocene time during a complex series of events that included an early period of gold-bearing gravel deposition, followed by erosion and reconcentration of much of the gold from the earlier gravels into later placers that were offset from the location of the earlier channels. Some of the initial accumulations remain as fragmentary bench deposits. Deposits buried beneath cover of later Quaternary loess and frozen silt and muck. Source of the gold and associated heavy metals believed to be local, mainly from mineralized quartz veins associated with Upper Cretaceous(?)-lower Tertiary granitic intrusives. (b)Fissure veins 2 in. to 3 ft thick that cut schist and are spatially related to Upper Cretaceous-lower Tertiary granitic intrusive rocks, including quartz diorite, biotite granite, and related porphyries. (c)Stibnite and sulfantimonide minerals generally present in the same quartz vein systems and geologic setting as the lode gold-silver deposits. However, at a few places, stibnite was deposited to the practical exclusion of other sulfide minerals and gold. The deposits occur principally in the Pedro Dome, Ester Dome, and Sourdough Creek areas in a belt about 21 km (13 mi) long northeast of Fairbanks. (d)Scheelite in tactite zones developed at contacts between pegmatitic granitic intrusive rocks and lenses and beds of marble and calcareous schist. Scheelite	(a)1902 through 1963, Fairbanks area was largest placer producer in Alaska, yielding about 240,000 kg (7,650,000 fine ounces) of gold roughly (37% of total Alaskan placer production) plus byproduct silver. Main producing creeks were Cleary, Ester, Fairbanks, Dome, and Goldstream and their tributaries. Placer operations by USSR & M, once involving as many as six dredges, were closed down in 1964. Most of the potential ground has been extensively drilled by former operators. Some of the marginal placer gold resources doubtless remain, especially in tailings and areas that could not be worked during former dredging operations, but quantitative resource data are unavailable. (b)About 7,500 kg (240,000 oz) of gold and 1,200 kg (39,000 oz) of silver produced to 1960 from 65 mines. Most of the silver occurs in lead sulfantimonide and sulfide minerals. In some cases, gold content of closely spaced quartz veinlets was sufficient to permit mining over zones 8-12 ft wide. Lode potential unknown but probably moderate	Regional USGS 1:250,000-geologic mapping of Fairbanks (1966) and Livengood (1977) quadrangles, and 1:24,000-scale coverage of D-1, 2, 3 Fairbanks subquadrangles. Detailed USGS and University of Alaska studies of surficial and bedrock geology, Fairbanks area. Contoured 1:250,000-scale aeromagnetic coverage by USGS and State. Area considered to be rather thoroughly prospected for gold, antimony, and tungsten deposits, but outcrops are poor owing to extensive cover of surficial deposits. (b)(c)(d)Fair to good geologic information level exists as result of detailed examinations and exploration programs by government, industry, and University of Alaska	(a)Heavy minerals in placer concentrates mainly the same as in lodes and include stibnite, scheelite, wolframite, chromite, and a wide variety of sulfide minerals. Locally, native bismuth, galena, native copper, cinnabar, and uranium, thorium and rare earth minerals also present. No known lode source for cassiterite which occurs in minor amounts in stream concentrates throughout area. Scheelite fairly common in several creeks but no known lode tungsten resources. (b)(c)(d)Current mine activity almost nil	(a)Stream and buried bench placers have produced large (240,000 kg; 7,650,000 oz) amounts of gold. The area has been extensively drilled by previous operators and only marginal lands are thought to remain unworked (b)Production from 65 mines has been about 7,500 kg (240,000 oz) of gold and 1,200 kg (39,000 oz) of silver from gold bearing quartz veins. Potential for additional production unknown but considered to be moderate to small (c)Approximately 2,700 tons of antimony have been produced from sulfide bearing quartz veins. Deposits generally contain small tonnages of ore (d)Tungsten has been produced from tactite deposit and as a byproduct from gold-quartz veins. The largest known deposit (Stepovich) produced 36 metric tons of WO_3. Some potential exists for additional tactite deposits but they are likely to be small and scattered (e)The presence of cassiterite in placer concentrates and granitic intrusions (including porphyritic varieties) suggests the area is geologically permissive for the occurrence of tin granite with associated tin and tungsten vein deposits	90% 50% 10% chance that there are 1 1 3 deposits or more	(d)tungsten tactite model

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20 (cont.)			also present in auriferous quartz veins in schist and in granitic and pegmatic dikes. (e)The presence of minor but ubiquitous amounts of cassiterite in placer concentrates of streams draining poorly exposed bedrock areas underlain by Late Cretaceous-early Tertiary biotite granite plutons with associated porphyries and local pegmatites that have intruded calcareous schist and marble suggests the area could conceivably contain as yet undiscovered tin granites with associated tin and tungsten vein or contact metamorphic deposits	to small. (c)Total production of antimony ore has been about 2,700 metric (3,000 short) tons, mainly prior to World War II and from 18 of more than 50 localities known to contain antimony minerals. Most of the production was from five mines, two of which were operated mainly for antimony. The remaining production was a byproduct of gold mining. In 1942 USGS estimated about 27 tons (30 short tons) of stockpiled high-grade ore containing more than 30% antimony, about 2,700 tons (3,000 short tons) of low-grade dump material and about 45 tons (50 short tons of proven high-grade material at various mines and prospects. Inferred resources not estimated, but doubtless present. Probably several hundred tons of ore shipped since 1942. (d)Scheelite lode deposits known at about two dozen localities, all in Pedro Dome area. Largest known deposit (Stepovich) produced about 36 tons (4,000 units, 20 lbs to a short ton) of WO_3 through 1944, mainly from tactite zones developed at intersections of pegmatite dikes and marble. Small tonnages of scheelite concentrate also produced					

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20. (cont.)				as byproduct from gold-quartz veins. Known resources are small. Area may contain undiscovered deposits, but they are likely to be small and sparsely distributed					
21.	(a)Au, Sn, W (Pb, Bi, Th, U, RE's)--placer	(b)Au, Ag, Pb, Cu--vein and vein networks (c)(Sn, W, Cu, Pb, Mo, Th, RE's)--vein; disseminations in igneous rocks; porphyry(?)	(a)Stream and bench placers 1.2-4.6 m (4-15 ft) thick buried beneath 0-3 m (0-10 ft) of muck (mostly unfrozen). Gold believed locally derived from mineralized quartz veins (some of which contain visible gold) in schist and Upper Cretaceous-lower Tertiary granitic plutons that constitute the bedrocks of the drainage basins. (b)Quartz veins and vein networks in schist, spatially related to small Upper Cretaceous-lower Tertiary intrusives, contain gold, argentiferous galena, and malachite. (c)Bedrock samples from small Upper Cretaceous-lower Tertiary intrusives, including both equigranular and porphyritic varieties of biotite granite, contain small amounts of scheelite, galena, molybdenite, stibnite, monazite, and allanite, with accessory fluorite and topaz. Associated quartz veins contain scheelite, wolframite, and cassiterite. The primary and secondary (placer) occurrence of these minerals in the indicated geologic settings suggests that the area may contain unrecognized and/or undiscovered porphyry copper deposits and tin granites with associated tin-tungsten veins [see (c), additional comments column].	(a)Gold placers have produced about 26,000 kg (835,000 fine ounces) or more of gold since their discovery in 1893. Many of the placers contain subeconomic amounts of cassiterite which was recovered with gold and wolframite at Deadwood Creek. (b)No known production from three occurrences. Known resources thus are small but potential exists for the discovery of additional deposits. (c)Three known occurrences. No production or known development work. (d)Definitive resource data lacking	Area poorly known geologically. Little or no geochemical control. Recent USGS (1974) contoured aeromagnetic coverage (1:250,000 scale). University of Alaska thesis work in Mount Prindle area. (d)Reconnaissance mineral sampling program by USBM/BLM/USGS (1977)	(a)Heavy concentrates also locally include wolframite, allanite, bismuthenite, galena, cinnabar, xenotime, topaz, and tourmaline. Some of these are slightly uraniferous. (b)... (c)At Mount Prindle, lower Tertiary porphyritic, fine- to coarse-grained biotite granite pluton is cut by aplite, quartz porphyry, and tourmaline-bearing pegmatite dikes, and contains vein fluorite, as well as anomalously high tin and boron	(a)Stream and bench placers have produced about 26,000 kg (835,000 oz) of gold (b)Though none has produced, two prospects and one occurrence of gold bearing quartz veins are known in the region. There is some potential for the discovery of additional deposits of small tonnage (c)The rock (porphyritic granites) and the minerals present in bedrock samples (scheelite, galena, molybdenite, stibnite, monazite, allanite, flourite and topaz) suggest a setting which is geologically permissive for the occurrence of porphyry copper deposits and possibly tin-bearing granites. (d)Values of uranium (up to 400 ppm) in stream sediments from the contact area of the Mount Prindle pluton suggests that some of the granitic intrusions of the region have some potential for uranium		(c)porphyry copper model

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21. (cont.)			(d)Anomalous uranium detected in stream sediment (up to 400 ppm) and spring sediment (up to 570 ppm) samples from contact zone of Mt. Prindle granitic pluton (early Tertiary) [see (c), additional comments column] suggests that this and similar intrusives have some potential for disseminated uranium						
22.	(a)Au(Sn, W, Bi)--placer	(b)(Cr, Ni)--possible magmatic deposits (c)(Sn, W, Bi)--possible vein, greisen, and/or tactite deposits	(a)Buried stream placers. Gold and subeconomic amounts of scheelite, cassiterite and bismuth, probably derived from quartz-carbonate veinlets in Paleozoic and/or Precambrian(?) schist. (b)Area contains several known small ultramafic intrusive bodies with a virtually unknown but probably small potential for chromium, cross-fiber asbestos, and nickel. (c)Presence of small but ubiquitous amounts of cassiterite, locally abundant scheelite, and bismuth, as well as accessory tourmaline in some stream concentrates, suggests the possibility of as yet undiscovered tin-tungsten vein, greisen and/or tactite deposits especially associated with Upper Cretaceous-lower Tertiary granitic intrusives known to occur in the area	(a)Total gold production from ten known deposits not known but probably did not exceed 310 kg (10,000 oz). Stream concentrates from Salcha River drainage area contain locally abundant native bismuth and scheelite, but there is no record of either having been recovered. Cassiterite also present in concentrates. (b)Definitive resource data lacking. (c)Early AMRAP stream-sediment sample results show anomalous tin values	Area currently being studied under USGS AMRAP program. State and USGS contoured aeromagnetic coverage (1:250,000 scale). Area believed to have been thoroughly prospected but mainly for gold placers. Bedrock exposures generally poor below 2,000-3,000 ft altitude due to heavy vegitation and cover of surficial deposits	(b)General absence of sulfide minerals suggests that any nickel present is likely to be silicate phases	(a)Ten known placer deposits have produced less than 310 kg (10,000 oz) of gold. The region has been extensively prospected but mainly for gold (b)The presence of small bodies of ultramafic rock suggests the area is permissive for the occurrence of podiform chromite and cross-fiber asbestos deposits (c)The rock types present (granitic intrusions into locally calcareous schist), together with the presence of cassiterite and tourmaline in stream concentrates suggest the area is permissive for the occurrence of tin and tungsten in veins or greisen and/or tactite zones		(c)tungsten tactite model

AREA OUT-LINED ON MAPS	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 (ALL UNITS METRIC UNLESS OTHERWISE INDICATED)	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 3)
23.	(a)Au(Sn, W, Pb)--placer	(b)(Sn, W)--possible vein, greisen and/or tactite deposits	(a)Deeply buried stream and residual gold placers. Gold derived from mineralized quartz veinlets in schist (Paleozoic and/or Precambrian?). Deposits in Banner Creek area confined to vicinity of Upper Cretaceous rhyolite porphyry intrusives believed to have been emplaced along the Richardson lineament and throughout which the gold may have been disseminated. (b)Presence of scheelite, cassiterite and tourmaline in heavy mineral concentrates from several of the streams draining the area suggests the possible presence of undiscovered tin-tungsten lode deposits associated with Upper Cretaceous-lower Tertiary granitic intrusives	(a)Total production of placer gold about 3,000 kg (95,000 oz) of gold and 440 kg (24,000 oz) of silver, mainly from Tenderfoot Creek. Most of the ground is low grade over a length of about 6 km (3.75 mi). Production since 1930 not known. Stream-sediment samples show greater than threshold amounts of lead and copper, and/or zinc. Area has been well prospected. Potential for recovery of significant additional amounts of placer gold from virgin or previously worked ground probably low. (b)No known occurrences. Resource data lacking	Area included in Big Delta quadrangle presently being studied under USGS AMRAP program. State-contoured aeromagnetic coverage (1:250,000 scale) and stream-sediment and bedrock sampling program (1976). Area poorly exposed due to extensive cover of surficial deposits and vegetation cover	Stream heavy mineral concentrates contain galena, scheelite, cassiterite, and tourmaline	(a)Buried stream and residual placers have produced more than 3,000 kg (95,000 oz) of gold. The area has been extensively explored for placer gold (b)The rock types present (granitic intrusions into locally calcareous schist), together with the presence of scheelite, cassiterite and tourmaline in stream concentrates suggest the area is permissive for the occurrence of tin and tungsten in veins or greisen and/or tactite zones		(b)tungsten tactite model
24.	(a)Au--placer	(b)(Cr, Ni, asbestos)--possible podiform chromite and cross-fiber asbestos deposits associated with ultramafic rocks. (c)(Cu, Pb, Zn, Co, Ag, Sn)--possible submarine volcanogenic sulfide deposits associated with mafic lavas. (d)Au--vein	(a)Stream placer. (b)Discontinuous belt of small, tectonically emplaced, alpine-type serpeninite and serpentinized peridotite bodies, with associated masses of silica-carbonate rock, considered to have a low potential for occurrence of podiform chromite and cross-fiber asbestos. May represent part of dismembered ophiolitic complex. (c)Basaltic greenstone and argillite along the Tintina fault zone contains locally high but sporadic concentrations of base metals, tin, and silver. Geologic setting is permissive for the occurrence of undiscovered disseminated volcanogenic sulfide deposits, but likelihood of developing	(a)Three known placers, one of which has produced at least 31 kg (1,000 oz) of gold since early 1900's. (b)One known occurrence of podiform and low-grade disseminated chromite. Chromite present in heavy concentrates of streams draining some areas where a serpentinized ultramafic and mafic rocks are present. Stream-sediment and bedrock samples locally contain anomalous chromium (up to 5,000 ppm). Silica-carbonate rocks in Flume-Alder Creeks area contain garnerite(?),	Parts of belt in Eagle and Charley River quadrangles covered by recent USGS (1976, 1969, respectively) 1:250,000 geologic mapping and regional geochemical stream-sediment and bedrock sampling. Entire belt covered by contoured USGS 1:500,000-scale aeromag. Also state-contoured aeromag (1:250,000) and ERDA 1:500,000 aeromag. and gamma ray profiles. Belt has been well explored by industry for asbestos. Western area in Big Delta quadrangle where USGS AMRAP studies currently underway	(b)Sulfide-bearing greenstone, encrusted with cobalt bloom (erythrite) has long been known at Eagle Bluff	(a)One of three known placer deposits has produced at least 31 kg (1,000 oz) of gold (b)The presence of serpentinized ultramafic rocks, together with one known occurrence of podiform and disseminated chromite, as well as the presence of chromite in stream concentrates indicate a geological setting with some potential for the the occurrence of podiform chromite and cross-fiber asbestos deposits (c)The existence of basaltic volcanics (greenstone) and argillite with locally high concentrations of base metals, tin and silver in bedrock samples suggest that the region could contain undiscovered, disseminated sulfide deposits associated with submarine mafic volcanic rocks	90% 50% 10% chance that there are 1 10 40 deposits or more	(b)podiform chromite model (c)mafic volcanogenic model

AREA OUT-LINED ON MAPS	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 (ALL UNITS METRIC UNLESS OTHERWISE INDICATED)	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 3)
24. (cont.)			significant resources is considered small. (d)Gold-bearing quartz-carbonate veins associated with mafic and ultramafic igneous rocks.	up to 5,000 ppm nickel and up to 7,000 ppm arsenic. Since no sulfide mineral phases recognized, nickel probably present in silicate mineral. Silicate-carbonate rock also locally contains traces of gold (0.9 ppm) and silver (0.5 ppm). (c)Bedrock samples from Eagle Bluff contain 7 to >10,000 ppm copper, <10 to 1,500 ppm lead, <200 to 1,500 ppm zinc, <5 to 2,000 ppm cobalt, <0.5 to 1.5 ppm silver and <10 to 500 ppm tin. (d)Two known occurrences. Samples across one zone 19 m (63 ft) wide yielded up to 11 ppm gold. Undiscovered occurrences probably exist, but they are likely to be small and of negligible potential					
25.	(a)Au(Pt, RE's)--placer	(b)(U, Th)--possible peneconcordant deposits(?)	(a)Modern stream placers and less productive bench placers localized within a belt of Upper Cretaceous to Pliocene (?) nonmarine sandstone, mudstone, and quartz-rich conglomerate that straddles the Tintina fault zone and from which most of the placer gold is believed to have been reconcentrated. Irregular distribution of the gold in modern placers probably related to initial erratic distribution in the older conglomerates. Original source of gold considered at least in part to be quartz veins in metamorphic and granitic intrusive rocks that	(a)Total production not known but probably amounts to at least 930 kg (30,000 fine ounces) of gold, plus byproduct silver. Gold also alloyed with as much as 0.42% platinum metals, claimed as seigniorage by U.S. Treasury. Gold placer remaining resources not known. Although gold is present in the nonmarine Late Cretaceous to Pliocene conglomerates, it is sparsely and erratically distributed. (No known gold placer	Entire area covered by recent (1969, 1972) USGS 1:250,000 geologic mapping. Eastern part near Eagle covered by 1:63,360-scale USGS geologic mapping. Part in Eagle quadrangle covered by state contoured aeromag (1:250,000 scale); that in Charley River quadrangle covered by 1:1,000,000 scale contoured aeromag and ERDA 1:500,000 aeromag and gamma ray profiles. USGS geochemical sampling in Eagle quadrangle	Placer concentrates locally include native platinum, native silver, cinnabar, monazite, cassiterite, and chromite. Bedrocks in Tintina fault zone contain locally high but sporadic concentrates of copper, lead, zinc, and tin. (b)Selected samples of black shale from Calico Bluff formation (Upper Mississippian-Lower Pennsylvanian) contain 0.001-0.009% uranium, up to 0.68% V_2O_5 and 1.9% P_2O_5	(a)Stream and bench deposits have probably produced at least 930 kg (30,000 oz) of gold plus byproduct silver (b)The lithology and organic content of the Upper Cretaceous-Tertiary conglomerates together with the presence of small amounts of uraniferous, thorium and rare earth minerals in some of the placer deposits suggest a geologic setting permissive for the occurrence of sandstone uranium deposits		

AREA OUT-LINED ON MAPS	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 (ALL UNITS METRIC UNLESS OTHERWISE INDICATED)	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 3)
25. (cont.)			underlie region to south. However, not all lithic constituents in the conglomerate are represented in that igneous and metamorphic bedrock terrane. Platinum locally present in heavy concentrates probably derived from ultramafic intrusives	occurrences in northeastern area.) (b)Geologic relationships, including the presence of small amounts of uraniferous thorium and rare earth minerals in some of the placer concentrates suggest that the areas of continental, coal-bearing clastic rocks may be permissive for the occurrence of penecordant uranium deposits					
26.	(a)Fe--sedimentary	---	(a)Low-grade banded hematitic red beds of sedimentary origin occur in Tindir Group (late Precambrian). Hematite occurs in beds a fraction of an inch to 1 in. thick, as a replacement mineral of volcanic fragments, as a cement, and as a matrix constituent	Section considered to have best potential about 550 m (1800 ft) thick. (a)USBM sampling of 40 and 60 m (133 and 200 ft) intervals judged to have highest iron content showed 20.10% and 21.85 soluble iron, respectively. One 2 cm (3/4 in.) bed arrayed 33.4% soluble iron, the maximum tenor found. Hypothetical and speculative resources could amount to several billion tons or more	Recent (1969) 1:250,000-scale geologic mapping by USGS. USGS aeromag coverage at 1:1,000,000 scale. ERDA aeromag and gamma-ray profiles (1:500,000 scale). USBM sampling program in Tatonduk River area		Low-grade hematitic beds of the Tindir Group occur in this region. The portion of the stratigraphic section with the greatest known resource potential is 550 m (1800 ft) thick. Sampling of two portions of the section judged to have the highest iron content showed approximately 20% soluble iron. Speculative and hypothetical resources could amount to several billion tons		
27.	(a)Au(Sn, W. Hg, Cr, Ag, RE's)--placer	(b)Au, Ag, Pb, Cu, Zn, Sb--vein (c)(Cu, Pb, Zn)--possible stratabound volcanogenic(?) massive and/or disseminated sulfide deposits. (d)(Sn, W)--possible vein, greisen, and/or tactite deposits	(a)Stream and bench placers in zone of discontinuous permafrost. Much of ground permanently frozen. Loess, derived from proglacial flood plains, mantles much of area. Source of gold considered to be mineralized quartz veins in Paleozoic metamorphic rocks near contacts with felsic intrusives, mainly of Late Cretaceous-early Tertiary age.	(a)Approximately 13,000 kg (417,000 oz) (about 2% total Alaska placer gold production) of gold produced from 1887 through 1961. Production figures not available since 1961, but large dredge operated at Chicken Creek through 1967. No reliable	Area of generally poor exposures covered by recent (1976) 1:250,000-scale USGS geologic mapping. Most of area covered by 1965 or later 1:63,360 USGS geologic mapping. Regional USGS geochemical sampling control generally good except southeastern part. State contoured aeromag coverage (1:250,000 scale). Area has been target of considerable	(a)Stream concentrates locally include noneconomic amounts of scheelite, cassiterite, cinnabar, chromite, native silver, monazite and allanite. Lode source of the cinnabar not known. Area also contains small serpentinized ultramafic intrusive bodies considered to have a	(a)Stream and bench placers have produced approximately 13,000 kg (417,000 oz) of gold. Small-scale (<31 kg/yr; 1000 oz/yr) operations continue to produce gold in 1977. Area has been actively prospected for almost 100 years. Potential for undiscovered stream		(c)felsic and intermediate volcanogenic sulfide model. (d)tungsten tactite model

AREA OUTLINED ON MAPS	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 (ALL UNITS METRIC UNLESS OTHERWISE INDICATED)	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 3)
27. (cont.)			(b)Polymetal quartz-carbonate veins in metamorphic rocks (Paleozoic and/or Precambrian?) near contacts with granitic intrusive rocks (mainly Upper Cretaceous-lower Tertiary). (c)Although no such deposits are presently known, the area contains geologic elements (including metamorphosed rocks of probable felsic to intermediate volcanic origin) considered permissive for the occurrence of stratabound (volcanogenic?) base metal sulfide deposits. (d)The presence of ubiquitous scheelite and cassiterite in several of the gold placers suggests that the area has some potential for the occurrences of as yet undiscovered tin-tungsten vein, disseminated, or tactite deposits, especially in the vicinity of composite intrusives of Upper Cretaceous-lower Tertiary porphyritic biotite granite	estimate of amount of gold mined annually since then, but it probably has not exceeded 31 kg (1,000 oz), even in good years. At least 20 known active placer operations, 1977. Potential for undiscovered modern stream placers probably small because district has been actively prospected for almost 100 years. Remaining gold resources mainly are in ground that could not be profitably worked earlier at lower gold prices (especially dredged area) and in tailing piles. Principal virgin placer ground lies in high level terraces, which could contain rich pay streaks (e.g., Napoleon Creek). (b)Of six known occurrences, only one is known to have recorded production from a rich gold-quartz vein which extended to depth of about 2 m (6 ft). Resource potential of such vein deposits not known but believed to be small	recent prospecting and exploration activity by industry	low potential for cross-fiber asbestos, chromite, and possibly nickel	placers is probably low. Potential does exist for undiscovered placers in high-level terraces. (b)Six occurrences of sulfide-bearing quartz veins are known. One has produced a small quantity of gold. (c)The presence of metamorphosed felsic and intermediate volcanic rocks suggests a geologic setting permissive for the occurrence of felsic and intermediate volcanogenic sulfide deposits. (d)The presence of scheelite and cassiterite in placers, together with the occurrence of composite intrusives of granitic composition, suggest a geologic setting permissive for the occurrence of tin and tungsten veins, greisen and/or tactite zones		

AREA OUTLINED ON MAPS	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 (ALL UNITS METRIC UNLESS OTHERWISE INDICATED)	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 3)
28.	(a)Cu (Mo)--porphyry (b)Au, Ag (Pb, Sb, Cu, Zn, Mo)--polymetal vein (c)Au--placer	(d)(Pb, Zn, Cu)--possible stratbound (volcanogenic?) sulfide deposits (e)(Sn, W)--possible vein, greisen and(or) tactite deposits	(a)Chalcopyrite, chalcocite, and subordinate molybdenite in veinlets and as disseminations in altered (potassic and phyllic) high-level Upper Cretaceous-lower Tertiary intrusive porphyries and their extrusive counterparts. Cu-bearing skarn zones also locally developed at contacts of intrusives with calcareous schist and marble. (b)Quartz veins containing gold and locally silver, lead, antimony, copper, and molybdenum minerals, mainly in and along contact zones of Cretaceous and Tertiary granitic rocks. (c)Mainly modern stream placers. Gold believed derived from small quartz veins in schist near contacts with granitic intrusives. Eluvial and bench placers occur over decomposed granodiorite bedrock (Mesozoic) adjacent to Canadian boundary in southeastern part of region. (d)Parts of area underlain by quartz-muscovite-chlorite and quartz-actinolite schist locally contain disseminated sulfide minerals and show anomalously high concentrations of lead, zinc, and other metals, suggesting they are permissive for the occurrence of stratabound volcanogenic(?) sulfide deposits similar to 29(a) (e). The local occurrence of quartz-tourmaline-topaz-sulfide veins and pegmatites spatially related to Upper Cretaceous-lower Tertiary high level composite granitic intrusives, together with local geochemically anomalous values in tin and tungsten in some stream-sediment samples suggest	(a)Eight known and several other possible porphyry occurrences and prospects all discovered since 1970. Several have been subject to physical exploration programs, including drilling, by industry, but results generally not known. At most thoroughly studied prospects (Taurus-Bluff), chalcopyrite-molybdenite mineralization is known to have extended to a depth of 280 m (918 ft), the maximum depth drilled. Combined tenor of copper and subordinate molybdenum is in the range of the lower grade Arizona porphyries. The potential for developing significant tonnages of low grade material in known and as yet undiscovered deposits is considered good. (b)Eleven known lode prospects. Only recorded production has been from Tibbs Creek area where total from five properties was 1 kg (32 oz) gold and 0.75 kg (25 oz) silver from 136 tons (150 short tons) of ore. Some lodes may be related to porphyry occurrences (area 28a). Known resources are small but region may include a significant number of widely scattered	Area covered by USGS AMRAP investigations. State contoured aeromag coverage (1:250,000 scale). Intensive exploration activity by industry during last decade. Area has poor bedrock exposures	(a)Vein systems at best explored deposits contain up to 5% by volume disseminated magnetite. Quartz-tourmaline-topaz-pyrite veins also occur locally. (e)Small amounts of cassiterite and scheelite present in stream concentrates	(a)Eight possible porphyry copper occurrences are known to occur within the region. All have been discovered since 1970. The region is being actively explored by industry and it is likely that additional deposits will be discovered. Copper scarn deposits, associated with the porphyries, are possible (b)Numerous, scattered gold bearing quartz veins occur within the region. Only recorded production has been from Tibbs Creek area and amounted to less than 1 kg each of gold and silver from about 136 tons of ore. Region may contain a significant number of such vein deposits. (c)Stream placers have produced less than 31 kg (1,000 oz) of gold since 1900 (d)The presence of metamorphosed felsic and intermediate volcanic rocks suggests a geologic setting permissive for the occurrence of felsic and intermediate volcanogenic sulfide deposits (e)Known occurrences of quartz-tourmaline-topaz-sulfide veins associated with composite granitic intrusions, together with high values of tin and tungsten in stream sediments suggest the region could contain unrecognized tin granites with associated veins, greisens and tactite zone	90% 50% 10% chance that there are 5 9 13 deposits or more	(a)porphyry copper model copper skarn model (d)felsic and intermediate volcanogenic sulfide model (e)tungsten tactite model

AREA OUT-LINED ON MAPS	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 (ALL UNITS METRIC UNLESS OTHERWISE INDICATED)	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 3)
28. (cont.)			that the area may be permissive for the occurrence of tin granites with associated vein, greisen, and/or tactite deposits	polymetal lodes. (c)Small total production of gold (<31kg; <1000 oz) since early 1900's from a few small scattered placer operations. Resource potental all categories, probably low. (d)Definitive resource data lacking. (e)Definitive resource data lacking					
29.		(a)(Pb, Zn, Cu)--possible stratabound (volcanogenic?) sulfide deposits (b)(Cu, Mo)--possible porphyry deposits	(a)Lead and zinc stratabound volcanogenic(?) massive and/or disseminated sulfide deposits in chlorite-muscovite-quartz schist with interfoliated augen gneiss and amphibolite believed to be mainly metamorphosed felsic to intermediate volcanic rocks. (b)Northern part of area contains Upper Cretaceous-lower Tertiary felsic intrusive and extrusive porphyries with geochemically anomalous concentrations of copper, molybdenum, and other base metals, especially in oxide residues of spatially related stream-sediment samples. Area is accordingly permissive for the occurrence of porphyry-type copper-molybdenum deposits. (See area 28(a) above)	(a)Host rocks locally contain visible disseminated sulfide minerals. Geochemical studies under USGS AMRAP program show anomalous concentrations of lead and zinc, especially in oxide residues of stream-sediment samples. 1977 industry-sponsored airborne and ground geophysical and ground geochemical sampling programs have identified numerous sizable anomalies, several of which are spatially related to anomalously high lead-zinc values in soil samples. Resource potential remains unidentified in absence of test drilling but could involve a sizable tonnage	(a)Poorly exposed area in eastern Tanacross quadrangle covered by completed USGS AMRAP studies. Intense industry exploration interest		(a)Favorable host rocks, together with anomalous values of lead and zinc in stream and soil samples at places spatially related to geophysical anomalies (conductors) suggest the region may contain felsic and intermediate volcanogenic sulfide deposits (b)The northern part of the region contains geologic elements similar to those in (a)28, and is therefore considered permissive for the occurrence of undiscovered porphyry copper deposits	90% 50% 10% chance that there are 0 2 4 deposits or more	(a)felsic and intermediate volcanogenic sulfide model (b)porphyry copper model

TABLE 3. GRADE AND TONNAGE MODELS

[Related data occur on line from column to column; all data in metric units; NS, not significant; *, significant at 5-percent level; **, significant at 1 percent level]

Deposit Type	Tonnage and grade variables (units in parenthesis)	Number of deposits used in developing model	Correlation coefficient of listed variable with variable on line with it in column 2	90 percent of deposits have at least	50 percent of deposits have at least	10 percent of deposits have at least
Porphyry Copper	Tonnage of ore (millions of tons)	41		20	100	430
	Average copper grade (percent)	41	with tonnage of ore = -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 of ore (millions of tons)	41		20	100	430
	Average copper grade (percent)	41	with tonnage of ore = -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 of ore (millions of tons)	31		1.6	24	340
	Average molybdenum grade (percent Mo)	31	with tonnage of ore = -0.05 NS	0.065	0.13	0.26
Podiform Chromite	Tonnage of Cr_2O_3 (tons)	268		15	200	2,700
Copper Skarn	Tonnage of ore (millions of tons)	38		0.08	1.4	24
	Average copper grade (percent)	38	with tonnage of ore = -0.44**	0.86	1.7	3.5
	Average gold grade locally significant, but not determined					
Mafic Volcanogenic	Tonnage of ore (millions of tons)	37		0.24	2.3	22.0
	Average copper grade (percent)	37	with tonnage of ore = -0.13 NS	1.1	2.2	4.1
	Average zinc grade excluding deposits without reported grades (percent)	19	with tonnage of ore = 0.03 NS	0.3	1.3	5.5
	Average gold grade-locally significant but not determined					
Felsic and Intermediate Volcanogenic Massive Sulfide	Tonnage of ore (millions of tons)	89		0.19	1.9	18.0
	Average copper grade (percent)	89	with tonnage of ore = -0.41**	0.54	1.70	5.40
	Average zinc grade excluding deposits without reported grades (percent)	41	with tonnage of ore = 0.25 NS	1.40	3.80	10.00
	Average lead grade excluding deposits without reported grades (percent)	14	with tonnage of ore = -0.02 NS	0.20	0.95	4.80
	Tonnage contained gold excluding deposits without reported gold (tons)	38	with tonnage of ore = 0.78**	0.27	2.90	32.00
	Tonnage contained silver excluding deposits without reported silver (tons)	46	with tonnage of ore = 0.82**	5.00	30.00	1300.00
Nickel Sulfide	Tonnage of ore (millions of tons)	48		0.23	1.20	5.90
	Average nickel grade (percent)	48	with tonnage of ore = -0.03 NS	0.32	0.61	1.20
	Average copper grade (percent)	48	with tonnage of ore = 0.03 NS with nickel grade = 0.04 NS	0.18	0.47	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	33.00
Skarn/Tactite Tungsten	Tonnage of ore (millions of tons)	31		0.024	0.63	17
	Average tungsten grade (percent W)	31	with tonnage of ore = -0.34 NS	0.24	0.51	1.10

SUMMARY AND CONCLUSIONS

This report summarizes the relevant geologic and mineral resource information for the large and relatively poorly known region of central Alaska and identifies and evaluates areas within that region where undiscovered resources may exist. Because this analysis places a heavy reliance on geologic knowledge and because great disparities exist in the scale and completeness of the geologic information base for different parts of the region, the extent to which it has been possible to evaluate mineral resource potential differs greatly from one area to another. For most of the designated areas, estimates of potential mineral endowment at different levels of confidence are not yet possible and only qualitative conclusions have been drawn. Nevertheless, we feel our analysis serves a useful purpose in (1) pointing up deficiencies in detail and scope of existing geologic data for mineral resource appraisal purposes, and (2) calling attention to areas geologically favorable for the occurrence of several relatively new deposit types that may have been overlooked in the past when lode and placer gold deposits were prime exploration targets.

Central Alaska is well endowed with a wide variety of mineral commodities that occur in a number of different deposit types. Historically, the region is probably best known for its production of placer gold, which amounts to about 389,000 kg (12.5 million troy ounces) or about 61 percent of the state's total placer gold output. Most of the production has come from the Fairbanks (233,000 kg; about 7.5 million ounces) and Iditarod (about 43,500 kg; 1.4 million ounces) districts. The source of gold is believed to have been mainly small lode deposits disseminated throughout large areas of bedrock, especially in the vicinity of granitic plutons. Considering the extent to which central Alaska has been actively prospected and tested for gold placers over the past 90 years, and the fact that there have been no new major discoveries since that of the Livengood district in 1914, the prospects for the discovery of one or more new gold placer districts with major resources are not very promising. The total placer gold resources of central Alaska are therefore concluded to be primarily within known districts in extensions of known placer concentrations, in marginal ground that could not be worked profitably by dredging or other large-scale operations at former lower prices, and in old tailings piles. The best prospects for new discoveries appear to be where buried (fossil) placers could have escaped detection because of a complex, poorly understood geomorphic history and in glaciated areas (e.g., where preglacial streams, originating in areas underlain by granitic plutons, were protected from ice scour). Such protected locations would exist in the lee of mountains that were not overrun by ice (e.g., Canyon and Butte Creek placers, southwestern Alaska) and where preglacial channels were oriented transverse to ice tongues (e.g., Wattamuse and Platinum Creeks, southwestern Alaska). The latter, of course, would be obscured by a cover of glacial deposits.

From available data, we cannot yet make estimates of gold resources in placer deposits in central Alaska, but we believe that these resources could equal at least half of the gold previously produced and could be considerably more. Large, low-grade resources also may occur in residual and eluvial placers derived from porphyry-type gold lodes, as at Flat Creek (Iditarod quadrangle).

Lode gold deposits, widely distributed throughout central Alaska, occur principally in quartz vein systems that are spatially related to Upper Cretaceous-lower Tertiary granitic intrusives. Only a few such deposits have recorded more than token production and most have none. The most significant production has been from the Fairbanks district (area 20), where about 7,500 kg (240,000 ounces) of gold and 1,200 kg (39,000 ounces) of silver were produced from 65 mines. By far the largest percentage of that production came from about six mines. Significant lode gold production (about 1,600 kg; 50,000 ounces) also has been recorded from contact metamorphic deposits in the Nixon Fork area near Medfra.

Any estimate of central Alaska lode gold resources would be highly speculative. From what is known about the overall occurrence and distribution of known gold-quartz vein deposits the likelihood for discovery of additional lodes is considered good, but they are likely to be small and widely scattered. The known and undiscovered deposits of this type could easily contain as much lode gold as has already been produced and perhaps much more.

Essentially all the Alaskan mercury mines and prospects are scattered widely throughout an area of several thousand square miles of southwestern Alaska, mostly within the drainage basins of the Nushagak and Kuskokwim Rivers (area 4). The region is one of the better defined metallogenic provinces of Alaska. Total production over a period of about 75 years has been from 10 of about 3 dozen known lode deposits and amounts to about 1,300 metric tons (38,000 flasks). Most of the production has come from the Red Devil mine (1,100 metric tons; 32,000 flasks). Analysis of known deposits in Alaska and similar types of deposits elsewhere indicates that they individually tend to contain small amounts of mercury. Nevertheless, the large size of the delineated area of potential alone renders it permissive for the occurrence of a large number of deposits--perhaps three to four times the number already discovered. Accordingly, the total mercury resources could conceivably amount to 100,000 flasks or more.

For years, until operations ceased in 1975, the prime source of U. S. platinum production (only 1-2 percent of annual consumption) came from placer deposits in the Goodnews Bay district of southwestern Alaska. Total production is estimated to have been well over 20,000 kg (650,000 troy ounces) of platinum, plus about 485 kg (15,600 ounces) of gold. A small amount of platinum also has been recovered as a byproduct of some gold placer operations. Reserves in the Goodnews Bay placers are believed to be small and although sizable total identified resources have been estimated for the beaches, bays and possible lodes, they doubtless are of very low grade.

In the Yukon-Tanana upland of east-central Alaska (area 28) eight known prospects and several other possible occurrences of porphyry copper deposits have been discovered since 1970 and exploration interest continues to run high. So far, the richest of these deposits appears to be comparable in grade to the lower grade porphyries of the southwestern U. S. and the potential for developing significant tonnages of low grade material in known and as yet undiscovered deposits is considered good. Furthermore, geologic relations in several other areas (e.g., areas 9, 12, 21 and 29) of mineral resource potential are considered permissive for the occurrence of as yet undiscovered copper or possibly molybdenum porphyry deposits.

Recent exploration activity in the Yukon-Tanana upland near the Canadian border has also resulted in identifying areas with potential for the occurrence of volcanogenic sulfide deposits on the basis of regional geologic, geophysical and geochemical data. Such deposits are of interest mainly for copper, silver, zinc and, in some cases, lead, and tend to be of high grade. Other parts of central Alaska that are geologically permissive but which are largely unexamined for the occurrence of sulfide deposits of the submarine volcanogenic type are included in areas 6, 7, 9, 11, 14, 24, and 27. Areas numbered 14 contain pelitic schists and associated metamorphic rocks of the Ruby geanticline that are lithologically similar to and considered to be coextensive with host rocks of the recently discovered Arctic and Picnic Creek stratabound (volcanogenic?) sulfide deposits of the southern Brooks Range. Areas numbered 11 contain submarine volcanic rocks of the Rampart belt of dismembered ophiolite complexes which offer a potentially suitable setting for the occurrence of volcanogenic sulfide deposits of the mafic type, similar to those at Cyprus and Oman.

Alpine-type serpentinized dunite and peridotite that constitute the ultramafic parts of the allochthonous Rampart ophiolitic belt (areas 10a) have known occurrences of chromite and asbestos, and may contain deposits of podiform chromite. Such deposits tend to be small and distributed erratically within their metamorphosed ultramafic host. Other areas considered to have a potential for the occurrence of podiform chromite deposits are Nos. 18 and 24.

Cassiterite, often with associated scheelite, in numerous gold placer concentrates throughout central Alaska in a belt that extends from the Canadian border westward and southwestward into the drainage area of the lower Kuskokwim River, suggests at least parts of that extensive region are geologically permissive for the occurrence of tin granites with possible associated vein, greisen and/or tactite deposits. The lode sources of the tin have not been discovered, although in a number of areas sufficient cassiterite occurred in the concentrates to warrant recovery as a byproduct of placer gold operations (e.g., Tofty district, area 16). Accordingly, the resource potential for lode tin and associated metals throughout this large region cannot now be evaluated. A deliberate search for composite intrusives of biotite granite that show alteration and petrochemical characteristics generally associated with tin granites in areas drained by streams that contain a significant amount of cassiterite in placer concentrates might lead to identification of significant tin resources.

In conclusion, central Alaska is endowed with significantly large amounts of gold, silver, platinum, and quicksilver and some copper, chromite, iron, lead, zinc, molybdenum, antimony, tungsten and tin. The latter are almost certainly present in amounts significantly greater than presently known. Bismuth, beryllium, arsenic, cobalt, rare earth elements, uranium and thorium are also known to occur, but the recovery of these most likely would be as byproducts. These commodities are systematically grouped and identified with specific deposit types whose typical geologic characteristics and environment are generally known. Those that appear to have the greatest current potential for development of significant additional resources appear to be the volcanogenic sulfide deposits (mainly for copper, silver, zinc and minor lead) and high level porphyry-type deposits for copper and/or molybdenum.

It should be stressed that this analysis is but a first step in the assessment of the mineral endowment of a large, generally poorly exposed and in many places geologically poorly known region. Future assessments can be expected to be more complete, definitive and precise as more information becomes available from resource-mindful geologic investigations and systematic mineral exploration programs.

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