METALLIFEROUS LODE AND PLACER MINERAL OCCURRENCES, MINERAL DEPOSITS, PROSPECTS, AND MINES, MOUNT HAYES QUADRANGLE, EASTERN ALASKA RANGE, ALASKA

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INTRODUCTION

This report is one part of a folio of the Mount Hayes 1:250,000-scale quadrangle, Alaska. Known metalliferous lode and placer mineral occurrences, mineral deposits, prospects, and mines in the Mount Hayes quadrangle, eastern Alaska Range, Alaska, were studied as part of the geologic and mineral resource assessment investigations of the quadrangle. These investigations are part of the Alaskan Mineral Resource Assessment Program (AMRAP) of the U.S. Geological Survey. Data on mineral deposits and mineral occurrences were gathered mainly by (1) detailed geologic mapping of the quadrangle at a scale of 1:63,360; (2) sampling of bedrock, altered, and mineralized areas in the quadrangle; (3) detailed geologic mapping and sampling of selected mineral occurrences, mineral deposits, prospects, and mines; (4) detailed petrologic analysis of thin sections of host and mineralized rock samples and of polished thin sections of sulfide and oxide samples; and (5) literature compilation.

The purpose of this report is to provide a detailed summary of the known metalliferous lode and placer mineral occurrences, mineral deposits, prospects, and mines in the Mount Hayes quadrangle as of the time of publication. This summary is an essential data component for assessing the mineral resource potential of the quadrangle. The major parts of this report are (1) a map showing locations of metalliferous lode and placer mineral occurrences, mineral deposits, prospects, and mines; (2) three tables that summarize the important details of the metalliferous lode and placer mineral occurrences, mineral deposits, prospects, and mines; and (3) this text, which contains a list of previous studies; an explanation of the tables; definitions; a general bedrock geologic summary of the quadrangle to guide the reader in the interpretation of the data; a summary of the principal types of deposits in the quadrangle; a summary and interpretation of the lode and placer mineral occurrences, mineral deposits, prospects, and mines; and references. A generalized bedrock geologic map of the Mount Hayes quadrangle is part of the screened base used for the location of metalliferous lode and placer occurrences, deposits, prospects, and mines (see accompanying map sheet). A simplified version of this map (fig. 1) serves to guide the reader in the bedrock geologic summary given below.

This report is one part of the mineral resource assessment folio on the Mount Hayes quadrangle. Other portions of the folio provide detailed data and interpretations of the exploration geochemistry (Curtin and others, 1989), and assessment of mineral resource potential of the quadrangle (Nokleberg and others, 1990).

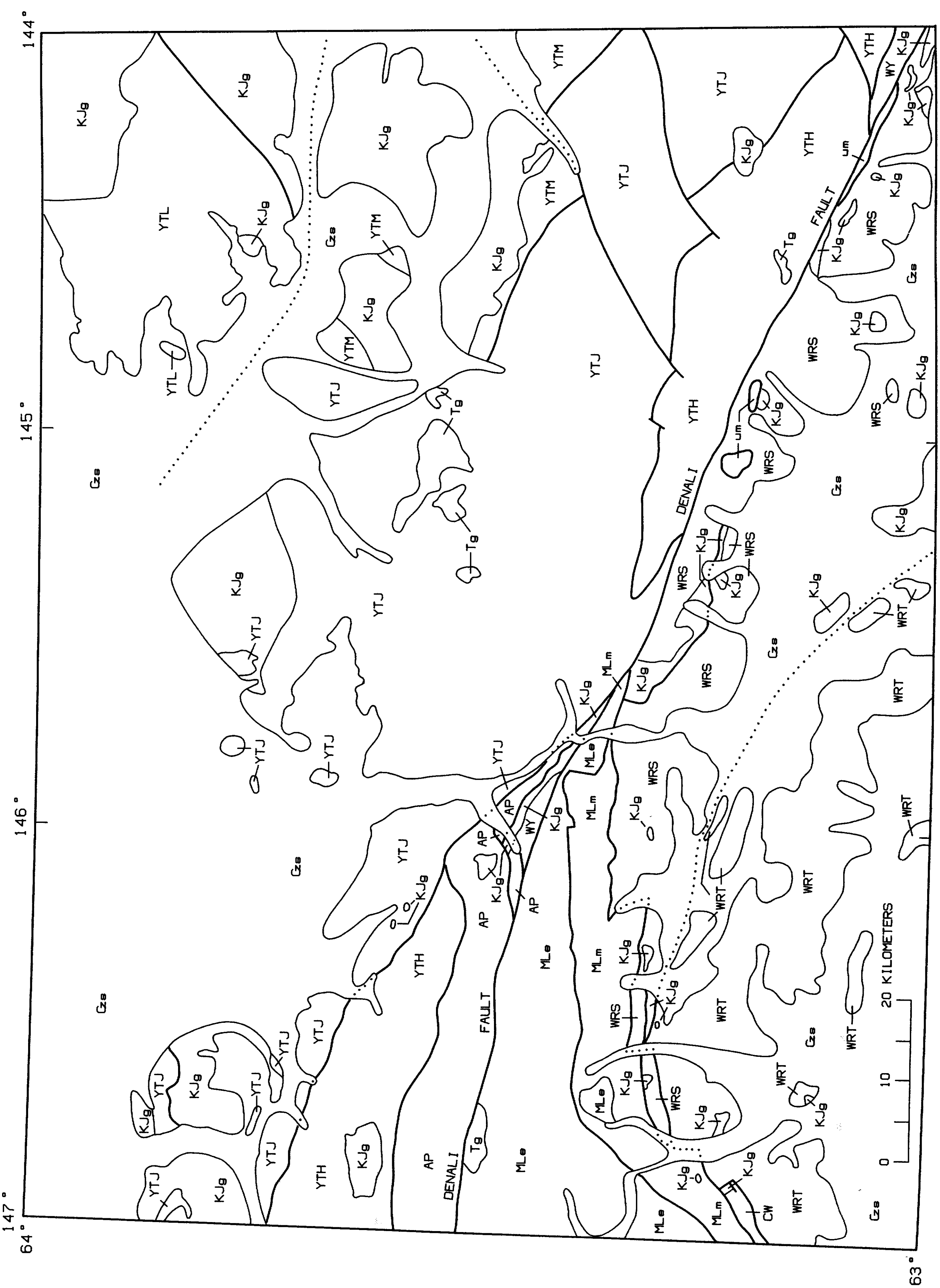
PREVIOUS STUDIES

A moderate number of studies of mineral deposits and mineral occurrences are published for parts of the Mount Hayes quadrangle. The principal earlier studies are those of Brooks (1918) and Moffit (1942). The principal later studies in the quadrangle are those of Ebbley and Wright (1948), Saunders (1961), Chapman and Saunders (1954), Hanson (1963), Kaufman (1964), MacKevett (1964), Richter (1967), Rose (1965; 1966a, b; 1967); Rose and Saunders (1965), Smith and others (1973, 1975), Stout (1976), Nauman and others (1980), Yeend (1980; 1981a, b), Lange and others (1981, 1987), Nokleberg and others (1981, 1984, 1985, 1990), Lange and Nokleberg (1984), LeHurray and others (1985), and Nokleberg and Lange (1985). An unpublished thesis on massive sulfide deposits in the eastern part of the Jarvis Creek Glacier subterrane of the Yukon Tanana terrane has been completed by Culp (1982).

Compilations of mineral deposits and mineral occurrences in the quadrangle have been published by Cobb (1972, 1979) and MacKevett and Holloway (1977). Compilations of mining claims in the quadrangle have been published by the U.S. Bureau of Mines (1973) and the Alaska Division of Geological and Geophysical Surveys (1982). A geologic bibliography of publications on the Mount Hayes quadrangle as of early 1980 was published by Zehner and others (1980). A location map and tables of semiquantitative analyses of rock, mineral occurrence, prospect, and deposit samples was published by Zehner and others (1985).

DEFINITIONS

The term "mineral occurrence" is defined as a concentration of potentially valuable minerals on which no visible exploration has occurred or for which no grade and tonnage estimates have been made. Mineral occurrences were identified mainly during geologic mapping in the course of studying hydrothermally altered and (or) iron-stained areas. The term "mineral deposit" is defined as those concentrations of potentially valuable minerals for which grade and tonnage



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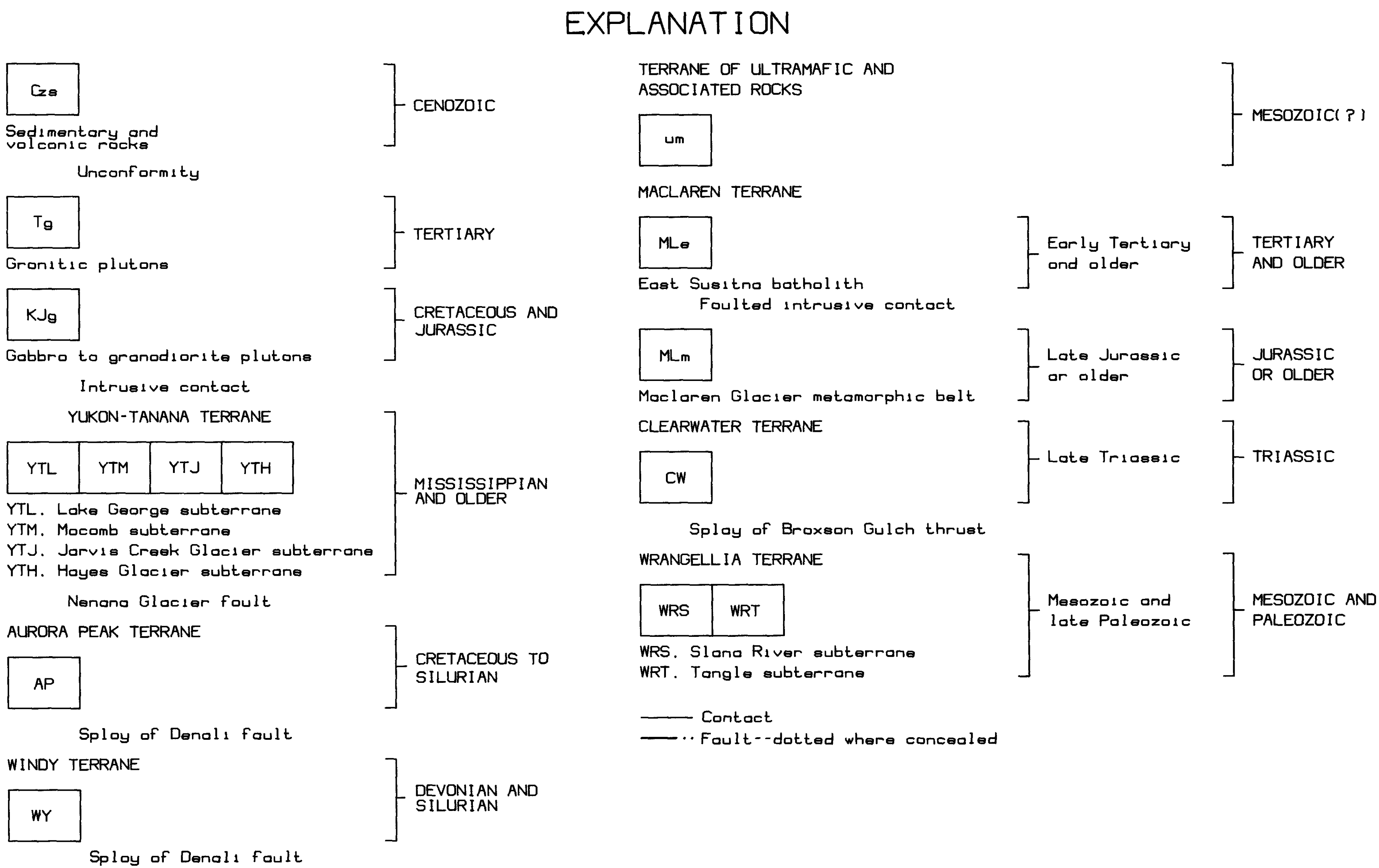

Figure 1. Simplified geologic map of the Mount Hayes quadrangle, eastern Alaska Range, Alaska.

estimates have been made. The term "prospect" is defined as a site of potentially valuable minerals in which excavation has occurred. The term "mine" is defined as a site where valuable minerals have been extracted. The term "deposit" is defined as any individual or group of lode or placer mineral occurrences, mineral deposits, prospects, and (or) mines.

All known major claims were investigated during the course of the geologic and mineral resource assessment studies. Lode and placer mineral occurrences, mineral deposits, prospects, and mines were identified by extensive literature search, from unpublished claim maps by the U.S. Bureau of Mines, from discussions with individuals and geologists employed by private mining companies, by observations of claim markers and notices found during field studies, and by observations made during field investigations.

SUMMARY OF BEDROCK GEOLOGY

The Mount Hayes quadrangle is located in the eastern Alaska Range, which forms a great, glacially sculptured, arcuate mountain wall extending approximately 1,000 km from the Canadian border in the east to the Aleutian Range in the west and southwest. The quadrangle is bisected by the Denali fault, which is a major geologic and geographic boundary between the Yukon River basin in interior Alaska and the Copper River basin in southern Alaska.

The bedrock geology of the Mount Hayes quadrangle is varied and complex and is subdivided into tectonostratigraphic terranes (fig. 1). The term "tectonostratigraphic terrane" (hereafter referred to as terrane) is defined as a fault-bounded geologic entity with distinct geologic history, stratigraphy, structure, and (or) deposits, all differing markedly from those of adjoining terranes (Jones and Silberling, 1979). In the last two decades, the Mount Hayes quadrangle has been the focus of extensive geologic studies (Zehner and others, 1980). North of the Denali fault are the Lake George, Macomb, Jarvis Creek Glacier, and Hayes Glacier subterranes of the Yukon-Tanana terrane, and the Aurora Peak and Windy terranes (fig. 1) (Zehner and others, 1980). South of the Denali fault are the Maclaren, Wrangellia, and Clearwater terranes and a terrane of ultramafic and associated rocks (Nokleberg and others, 1982, 1985).

YUKON-TANANA TERRANE

The most extensive bedrock unit north of the Denali fault is the Yukon-Tanana terrane (Jones and others, 1984), which is subdivided in this study, from north to south, into the Lake George, Macomb, Jarvis Creek Glacier, and Hayes Glacier subterranes (fig. 1; Aleinikoff and Nokleberg, 1985a; Nokleberg and Aleinikoff, 1985; Nokleberg and others, 1986). These subterranes are interpreted as various levels of a complex and highly metamorphosed, Devonian and Mississippian, continental-margin igneous arc (Nokleberg and Aleinikoff, 1985; Aleinikoff and Nokleberg, 1985a). Because of tilting toward the south near the Denali fault, the deeper, granitic-rock-rich levels of the arc occur to the north, whereas the shallower, volcanic-rock-rich levels of the arc occur to the south. The Lake George, Macomb, Jarvis Creek Glacier, and Hayes Glacier units were initially defined as separate terranes (Nokleberg and Aleinikoff, 1985); however, these units are now defined as subterranes in order to emphasize their genetic relations as various structural levels of the Yukon-Tanana terrane.

Lake George subterrane of Yukon-Tanana terrane

The Lake George subterrane (fig. 1; Aleinikoff and Nokleberg, 1985a, b; Nokleberg and Aleinikoff, 1985) is present in the northeastern part of the quadrangle and is composed of (1) polydeformed, coarse-grained, pelitic muscovite-quartz-biotite-garnet schist derived from quartz-rich to clay-rich shale of Devonian or older age and (2) relatively younger Devonian and Mississippian medium-grained, gneissose granodiorite and diorite, and coarse-grained augen gneiss derived from granite and granodiorite.

Macomb subterrane of Yukon-Tanana terrane

The Macomb subterrane (fig. 1; Nokleberg and Aleinikoff, 1985) is located south of the Lake George subterrane in the northeastern part of the quadrangle. The Macomb subterrane is composed of (1) older, poly-deformed, medium-grained pelitic schist, calc-schist, and quartz-feldspar-biotite schist derived from shale, marl, and sandstone of Devonian or older age and (2) a suite of relatively younger, shallow-level, fine- to medium-grained gneissose granite, granodiorite, quartz diorite, and diorite of Devonian age.

Jarvis Creek Glacier subterrane of Yukon-Tanana terrane

The Jarvis Creek Glacier subterrane (fig. 1; Nokleberg and Aleinikoff, 1985) is present across the northern part of the quadrangle south of the Macomb subterrane. The Jarvis Creek Glacier subterrane consists mainly of fine-grained, poly-deformed schist derived from Devonian or older sedimentary and volcanic rock. This unit is subdivided into a metasedimentary rock unit, rich in fine-grained metasedimentary rocks with minor metavolcanic rocks, and a metavolcanic rock unit, rich in fine-grained metavolcanic rocks with moderate amounts of fine-grained metasedimentary rocks. The metasedimentary rocks consist of pelitic schist, quartzite, calc-schist, quartz-feldspar schist, and marble. The metavolcanic rocks consist of varying proportions of abundant metaandesite and metaquartz-keratophyre, less abundant metadacite and metabasalt, and sparse metarhyodacite. In the north-central part of the quadrangle at Donnelly Dome, the Jarvis Creek Glacier subterrane is intruded to a minor extent by intensely deformed and schistose Devonian metagranodiorite and sparse augen gneiss derived from granite and granodiorite.

Hayes Glacier subterrane of Yukon-Tanana terrane

The Hayes Glacier subterrane (fig. 1; Nokleberg and Aleinikoff, 1985) is also present across the northern part of the quadrangle, south of the Jarvis Creek Glacier subterrane. The Hayes Glacier subterrane consists of poly-deformed phyllite and blastomylonite, derived from Devonian or older sedimentary and volcanic rocks, that are subdivided into a metasedimentary rocks unit with sparse metavolcanic rocks, and a metavolcanic rocks unit with moderate amounts of metasedimentary rocks. The metasedimentary rocks unit in the eastern part of the quadrangle consists of pelitic phyllite, quartz-rich phyllite, quartz-feldspar phyllite, and minor calc-phyllite and marble derived from shale, chert or less likely quartz siltstone, volcanic graywacke, marl, and limestone. In the western part of the quadrangle, the metasedimentary rocks unit consists predominantly of poly-deformed black to dark-gray pelitic schist, quartz-mica schist, and lesser quartzite, and calc-schist derived from shale, quartz-siltstone and sandstone, and marble. The metavolcanic rocks consist of metaandesite and metamorphosed quartz keratophyre and sparse metadacite and metabasalt.

Metamorphism of Yukon-Tanana terrane

The metasedimentary, metavolcanic, and metaplutonic rocks of the Yukon-Tanana terrane are generally ductily deformed and regionally metamorphosed. Metamorphic grade ranges from middle or upper amphibolite facies in the deeper-level Lake George subterrane, to lowest greenschist facies in the shallowest-level Hayes Glacier subterrane (Nokleberg and others, 1986). Medium-grained mylonitic schist and gneiss, in the deeper levels, grade upward into blastomylonite and phyllonite at shallow levels. Local extensive mid-Cretaceous retrogression to the lower greenschist facies occurs in the shallow-level subterranes, particularly in the Jarvis Creek Glacier and Hayes Glacier subterranes (Nokleberg and others, 1986).

Cretaceous and early Tertiary plutonic rocks in Yukon-Tanana terrane

A variety of widely distributed, Cretaceous and early Tertiary plutonic rocks intrude the Yukon-Tanana terrane (fig. 1). Most common are granitic plutons of mid-Cretaceous to early Tertiary diorite, quartz diorite, granodiorite, and granite. Granodiorite and granite constitute most of the granitic plutons. Small areas of some plutons are extensively hydrothermally altered and are locally slightly to moderately schistose and weakly metamorphosed at lower greenschist facies. In the central part of the Jarvis Creek Glacier subterrane is an intrusive suite of early Tertiary monzonite, alkali gabbro, lamprophyre, and quartz diorite, partly surrounded by a presumed ring dike of granite. Local comagmatic lamprophyre dikes also occur in the eastern part of the Jarvis Creek Glacier subterrane. The Hayes Glacier subterrane also contains sparse, early Tertiary, non-schistose lamprophyre dikes and one small alkali gabbro pluton. Locally abundant Cretaceous(?) gabbro, diabase, and metagabbro dikes and sills occur in the Jarvis Creek Glacier and Hayes Glacier subterranes.

AURORA PEAK TERRANE

The Aurora Peak terrane (fig. 1; Aleinikoff, 1984; Nokleberg and others, 1985) is located north of the Denali fault in the western part of the quadrangle and consists of (1) fine- to medium-grained and poly-deformed calc-schist, marble, quartzite, and pelitic schist of Silurian to Triassic age and (2) lesser amounts of regionally metamorphosed and deformed Late Cretaceous plutonic rocks consisting of schistose quartz diorite, granodiorite, and granite, and sparse amphibolite derived from gabbro and diorite. The Aurora Peak terrane exhibits an older, upper amphibolite facies metamorphism associated with mylonitic schist, and a younger, middle greenschist facies metamorphism associated with blastomylonite (Nokleberg and others, 1985). The Aurora Peak terrane is intruded by weakly metamorphosed to non-metamorphosed, Late Cretaceous to early Tertiary gabbro plutons and dikes and by granodiorite and granite plutons.

WINDY TERRANE

The Windy terrane (fig. 1; Jones and others, 1984; Nokleberg and others, 1985) is located between the Aurora Peak and Maclaren terranes along the Denali fault and consists of (1) argillite, quartz-pebble siltstone, quartz sandstone, graywacke, conglomerate, and minor limestone and marl of Silurian or Devonian age and (2) lesser andesite and dacite. The Windy terrane locally contains sparse phyllonite and protomylonite in narrow shear zones and exhibits incipient greenschist facies metamorphism. The Windy terrane is intruded in the central part of the quadrangle by a fault-bounded, Late Cretaceous pluton of locally slightly schistose diorite to granite. The Windy terrane is also intruded by dikes of Cretaceous(?) gabbro and diabase.

MACLAREN TERRANE

East Susitna batholith of Maclaren terrane

The East Susitna batholith (fig. 1) is present in the western part of the quadrangle and consists predominantly of regionally metamorphosed, mid-Cretaceous to early Tertiary gneissose diorite and granodiorite and lesser granite (Aleinikoff and others, 1981; Nokleberg and others, 1982). The batholith forms the northern part of the Maclaren terrane (Jones and others, 1984; Nokleberg and others, 1982, 1985). Locally the gneissose granitic rocks grade into migmatite and migmatitic schist and intrude coarse-grained schist and amphibolite-derived gabbro and diorite. Small roof pendants of calc-schist, quartzite, and amphibolite occur in the batholith near the west edge of the quadrangle. The East Susitna batholith is ductily deformed into mylonitic gneiss and schist and is regionally metamorphosed at the upper amphibolite facies with local retrograde metamorphism to lower greenschist facies (Nokleberg and others, 1985). A pluton of younger, non-schistose, middle Tertiary granite intrudes the northwest part of the East Susitna batholith immediately south of the Denali fault.

Maclaren Glacier metamorphic belt of Maclaren terrane

The Maclaren Glacier metamorphic belt is located south of the East Susitna batholith and is a pro-grade, Barrovian-type metamorphic belt formed in metasedimentary and metavolcanic rocks. From south to north, the principal units are pre-Upper Jurassic argillite and metagraywacke, phyllite, and schist and amphibolite (fig. 1; Nokleberg and others, 1982, 1985). Contacts between the three map units are generally faults with intense shearing and abrupt changes of metamorphic facies at each contact.

The Maclaren Glacier metamorphic belt is ductily deformed into protomylonite and phyllonite in the argillite and metagraywacke unit, phyllonite in the phyllite unit, and mylonitic schist in the schist and amphibolite unit. Metamorphic grade increases from south to north: lower greenschist facies metamorphism occurs in the argillite and metagraywacke unit, whereas lower or middle amphibolite facies metamorphism occurs in the schist and amphibolite unit (Nokleberg and others, 1985). A small pluton of hydrothermally altered biotite granite intrudes the argillite and metagraywacke unit.

CLEARWATER TERRANE

The Clearwater terrane (Jones and others, 1984; Nokleberg and others, 1982, 1985) is located in the western part of the quadrangle in a narrow, fault-bounded lens (fig. 1). The Clearwater terrane consists of chlorite and muscovite schist, schistose rhyodacite, Upper Triassic marble, and greenstone derived from pillow basalt. The Clearwater terrane is weakly deformed and metamorphosed at greenschist facies and is intruded by a locally fault bounded pluton of weakly schistose diorite and quartz diorite.

WRANGELLIA TERRANE

Slana River subterrane of Wrangellia terrane

The Wrangellia terrane is present across the southern part of the quadrangle and is subdivided into the Slana River subterrane to the north and the Tangle subterrane to the south (fig. 1; Jones and others, 1984; Nokleberg and others, 1982, 1985). The Slana River subterrane consists of upper Paleozoic island-arc volcanic, volcaniclastic, and sedimentary rocks of the Tetelna Volcanics, Slana Spur Formation and Eagle Creek Formation, disconformably overlying massive basalt flows of the Upper Triassic Nikolai Greenstone, Upper Jurassic and Lower Cretaceous flysch of the Gravina-Nutzotin belt, flysch, and sparse deposits of Tertiary sandstone, conglomerate, and rhyolite to dacite tuff, breccia, and flows (Nokleberg and others, 1982, 1985). The upper Paleozoic island-arc rocks are intruded by Permian hypabyssal dacite stocks, sills, and dikes and granite. Locally extensive Late Triassic(?) gabbro dikes and cumulate mafic and ultramafic sills intrude the Nikolai Greenstone and older rocks.

Tangle subterrane of Wrangellia terrane

Compared to the Slana River subterrane, the Tangle subterrane contains a relatively thinner sequence of upper Paleozoic and Lower Triassic sedimentary and tuffaceous rocks, a relatively thicker sequence of the Nikolai Greenstone, and a sparse, thin unit of Upper Triassic marble (fig. 1; Nokleberg and others, 1982, 1985). The upper Paleozoic and Lower Triassic rocks consist of aquagene tuff, dark-gray argillite, minor andesite tuff and flows, and sparse limestone. The Nikolai Greenstone is composed of a moderately thick basal member of pillow basalt and a thick upper member of massive, subaerial, amygdaloidal flows. Extensive Late Triassic(?) gabbro and cumulate mafic and ultramafic sills and plutons intrude the Nikolai.

Metamorphism and granitic rocks - Wrangellia terrane

The Wrangellia terrane is weakly regionally metamorphosed at lower greenschist facies (Nokleberg and others, 1985). Metamorphic minerals are generally sparse, and abundant relict sedimentary and volcanic minerals occur in most rocks. The Wrangellia terrane is locally intruded by weakly deformed to non-schistose, small- to moderate-size granodiorite and granite plutons of Late Jurassic(?) and Cretaceous age. Some granitic plutons are weakly to extensively hydrothermally altered.

TERRANE OF ULTRAMAFIC AND ASSOCIATED ROCKS

A narrow terrane of ultramafic and associated rocks is present in the eastern part of the quadrangle along and south of the Denali fault (fig. 1; Richter and others, 1977; Nokleberg and others, 1982). The ultramafic rocks are chiefly dark-green serpentinized pyroxenite and peridotite, light- gray to green dunite, and dark-green schistose amphibolite and lighter hornblende-plagioclase gneiss derived from gabbro. Interlayered with the gneiss are rare thin lenses of light-green and gray marble and zones of dark-gray graphitic schist. The ultramafic and mafic rocks are intruded by weakly schistose, light-gray tonalite and granite. The ultramafic and associated rocks are ductily deformed and regionally metamorphosed.

SUMMARY OF POSSIBLE AND KNOWN TYPES OF MINERAL DEPOSITS

Eleven types of mineral deposits are present in the Mount Hayes quadrangle. The term "type of mineral deposit" is defined as a set of mineral occurrences, mineral deposits, prospects, or mines that share a common geologic origin. The mineral deposit models in Erickson (1982), Cox (1983a, b), Cox and Singer (1986), Nokleberg and others (1987), and the cited references were used to formulate the types of mineral deposits that we consider important for mineral resource studies of the quadrangle. These types of mineral deposits are listed below:

Gold placer deposit type
Kuroko massive sulfide deposit type
Gold quartz vein deposit type
Copper-silver quartz vein deposit type
Polymetallic vein deposit type
Porphyry copper deposit type
Porphyry copper-molybdenum deposit type
Tungsten-molybdenum and copper-zinc-lead skarn deposit type
Porphyry tin deposit type
Gabbroic nickle-copper deposit type
Podiform chromite deposit type

New variants of known types of mineral deposits or possibly even new types may be present. In some cases, the type of deposit could not be defined because the available data are not sufficient for classification. Classification of each mineral occurrence, mineral deposit, prospect, or mine into a specific type of mineral deposit does not imply any economic evaluation. Each classification is the best estimation or, in some cases the best guess of the authors as to the process that formed that specific mineral occurrence, mineral deposit, prospect, or mine.

GOLD PLACER DEPOSIT TYPE

[References: Yeend, 1980, 1981a, b; Warren Yeend in Cox and Singer, 1986]

Gold placer deposits consist of elemental gold in grains and rarely nuggets in gravel, sand, silt, and clay, and their consolidated equivalents in alluvial, beach, aeolian, and rarely glacial deposits. The most common host rocks are alluvial gravel and conglomerate with white quartz clasts and heavy minerals that are indicative of low-grade metamorphic rocks containing quartz veins or of quartz veins in the upper-level exposures of granitic plutons. Sand and sandstone are of secondary importance. The deposits occur in a high-energy alluvial-depositional environment where gradients flatten and river velocities lessen. The major deposit minerals are gold, sometimes with attached quartz, magnetite, and (or) ilmenite.

GOLD QUARTZ VEIN DEPOSIT TYPE

[Reference: B. R. Berger in Cox and Singer, 1986]

Gold quartz vein deposits consist of gold in veins of massive quartz, sometimes with minor pyrite and arsenopyrite. Gold quartz vein deposits, termed low-sulfide gold- quartz vein deposits by Cox and Singer (1986), are generally hosted in greenstone belts--regionally metamorphosed and penetratively deformed oceanic strata, including graywacke, shale, and chert-- that are intruded by granitic plutons. Grade of metamorphism is usually greenschist facies. The ore depositional environment consists of a mobile belt of accreted terranes along a continental margin, which is sometimes associated with an Andean-type volcanic arc and associated batholith.

COPPER-SILVER QUARTZ VEIN DEPOSIT TYPE

[Reference: Nokleberg and others, 1987]

Copper-silver quartz vein deposits consist of quartz veins or adjacent altered areas with chalcopyrite, bornite, chalcocite, with local high values of silver and lesser gold and sparse native copper. The veins and altered areas occur in regionally metamorphosed and weakly deformed basalt, diabase or gabbro, and mafic to intermediate volcanic and hypabyssal rocks. Grade of metamorphism is either prehnite-pumpellyite or lower greenschist facies. The altered areas contain relict igneous and metamorphic minerals in the greenstone and volcanic rocks that are replaced by irregular aggregates of chlorite, epidote, actinolite, carbonate, or quartz. The ore depositional environment consists of simultaneous accretion, regional metamorphism, and deformation of oceanic basalts in terranes along a continental margin. Low-grade regional metamorphism and deformation appear to have generated hydrothermal fluids from which formed quartz veins and altered areas.

KUROKO MASSIVE SULFIDE DEPOSIT TYPE

[Reference: D. A. Singer in Cox and Singer, 1986]

Kuroko massive sulfide deposits consist of copper-, lead-, and zinc-sulfides that occur in submarine volcanic rocks of intermediate to felsic composition with lesser mafic volcanic rocks and locally abundant sedimentary rocks. The volcanic rocks occur as flows, ash flows, tuffs, breccias, and in some cases in felsic domes. The ore depositional environment is mainly hot springs related to marine volcanism in island arcs or extensional rifting regimes. The deposit minerals include pyrite, chalcopyrite, sphalerite, and lesser galena, tetrahedrite, tennantite, and magnetite. Local zeolite, clay, sericite, chlorite, and silica alteration may be present.

POLYMETALLIC VEIN DEPOSIT TYPE

[Reference: Dennis P. Cox in Cox and Singer, 1986]

This deposit type consists of quartz-carbonate veins often with silver, gold, and associated base-metal sulfides. The veins are related to hypabyssal intrusions in sedimentary and metamorphic terranes or to metamorphic fluids forming during waning regional metamorphism. The associated intrusions range in composition from calcalkaline to alkaline and occur in dike swarms, hypabyssal intrusions, and small- to moderate-size intermediate to felsic plutons locally associated with andesite to rhyolite flows. The depositional environment is near-surface fractures and breccias within thermal aureoles of small- to moderate-size intrusions, and within the intrusions. The deposit minerals include native gold, electrum, pyrite, and sphalerite, sometimes with chalcopyrite, galena, arsenopyrite, tetrahedrite, Ag sulfosalts, and argentite. Alteration consists of wide propylitic zones and narrow sericitic and argillic zones. Polymetallic vein deposit types locally occur along the margins of porphyry copper and porphyry copper-molybdenum deposit types and are often associated with Cu-Pb-Zn skarn deposit types.

PORPHYRY COPPER DEPOSIT TYPE

[Reference: D. P. Cox in Cox and Singer, 1986]

Porphyry copper deposits consist of chalcopyrite, bornite, or pyrite, and minor molybdenite, sphalerite, galena, or arsenopyrite in stockwork veinlets in hydrothermally altered, shallowly emplaced porphyry and adjacent country rock. The granitic host rocks include quartz diorite to quartz monzonite, syenite, and small, hypabyssal andesite to rhyodacite and trachyte stocks, dikes, and sills. Local disseminated and massive sulfide minerals may occur in coeval volcanic rocks along with quartz veins and in dikes with sulfide minerals. The ore depositional environment consists of epizonal intrusive rocks with abundant dikes, breccia pipes, and cupolas of batholiths that are intruded to shallow levels in either an island-arc or Andean-type arc setting.

PORPHYRY COPPER-MOLYBDENUM DEPOSIT TYPE

[References: White and others, 1981; D. P. Cox in Cox and Singer, 1986]

Porphyry copper-molybdenum deposits consist of pyrite with lesser chalcopyrite and molybdenite and minor sphalerite or galena. The sulfides occur in stockwork veinlets in porphyritic granitic rocks or hypabyssal intrusive rocks, or they occur in wallrocks adjacent to the igneous rocks. The intrusive rocks include quartz diorite to granite plutons or andesite to rhyolite stocks. Local replacement sulfide bodies may occur in coeval volcanic rock or in older wallrocks sometimes associated with quartz veins or dikes that also contain sulfide minerals. Associated alteration consists of sodic, potassic, phyllic, argillic, and propylitic types. The ore depositional environment consists of shallowly-emplaced granitic plutons in either an island-arc, Andean-type arc, or a rifted-continental setting. The areas of favorable environment are either surface outcrops of granitic rocks or areas adjacent to granitic rocks where geophysical data indicate favorable areas in the subsurface.

TUNGSTEN-MOLYBDENUM AND COPPER-ZINC-LEAD SKARN DEPOSIT TYPE

[References: D. P. Cox and T. G. Theodore in Cox and Singer, 1986]

Tungsten-molybdenum and copper-zinc-lead skarn deposits consist of various combinations of scheelite-powellite, molybdenite, chalcopyrite, bornite, sphalerite, galena, pyrite, pyrrhotite, and (or) magnetite with accessory arsenopyrite, tetrahedrite, gold, or other ore minerals that occur in contact metasomatized calcareous rocks or in nearby metasomatized granitic rocks. The contact metasomatic rocks or skarns are generally adjacent to granitic plutons ranging in composition from quartz diorite to granite. The extent of replacement of calcareous rocks varies from a few meters to a few hundred meters away from the granitic rocks. The extent of replacement is highly variable and often is controlled by fractures, faults, and folds. Skarns commonly exhibit a complex mineralogic zonation. Replacement minerals and textures are often extremely varied with the most common minerals being andradite-grossularite garnet, diopside-hedenbergite clinopyroxene, wollastonite, epidote, idocrase, hornblende, quartz, fluorite, white mica, and chlorite. The ore depositional environment consists of granitic plutons that intrude either continental shelf sedimentary rocks in an Andean-type arc setting or platform or oceanic sedimentary rocks in an island-arc setting.

PORPHYRY TIN DEPOSIT TYPE

[Reference: B. L. Reed in Cox and Singer, 1986]

Porphyry tin deposits consist of disseminated cassiterite and accessory tourmaline, topaz, and white mica in the upper, highly altered parts of leucocratic quartz monzonite or granite. The host granitic rocks are generally intensely hydrothermally altered to various combinations of potassium-feldspar, albite, sericite, chlorite, quartz, topaz, tourmaline, and fluorite. The ore depositional environment consists of intrusion of siliceous granitic rocks into a continental fold belt of thick platform rocks with minor volcanic rocks. This deposit type may be associated with Sn greisen deposits. However, no greisen occurrences were observed in the field either because of poor exposures in geologically favorable areas or because none are present.

GABBROIC NICKEL-COPPER DEPOSIT TYPE
[Reference: N. J Page in Cox and Singer, 1986]

Gabbroic nickel-copper deposits (adapted from synorogenic-synvolcanic nickel-copper deposit of N. J Page in Cox and Singer, 1986) consist of pyrrhotite, pentlandite, chalcopyrite, platinum-group minerals, and accessory pyrite that occur mainly as disseminations and lesser massive sulfide lenses in large sills of cumulate mafic and ultramafic rocks and in smaller dikes, sills, and masses of gabbro and norite. The mafic and ultramafic rocks generally intrude greenstone belts and are locally intensely deformed and metamorphosed. The host rocks consist of various combinations of olivine-pyroxene cumulates, plagioclase-pyroxene cumulate, or olivine-plagioclase cumulate, gabbro, and norite. The ore depositional environment consists of moderate to large bodies of cumulate mafic and ultramafic rocks and gabbro or norite dikes and sills intruded into greenstone belts, possibly associated with rifting, followed by a period of accretion, deformation, and regional-grade metamorphism.

PODIFORM CHROMITE DEPOSIT TYPE
[Reference: J. P. Albers in Cox and Singer, 1986]

Podiform chromite deposits consist of chromite and accessory platinum-group minerals that occur in pod-like masses in ultramafic rocks that in some cases are highly deformed and metamorphosed. The host rocks include dunite and harzburgite, associated mafic igneous rocks, and cumulate mafic and ultramafic rocks, sometimes extensively serpentinized. The ore-depositional environment consists of tectonized ultramafic rocks formed in the basal parts of ophiolite or cumulate igneous rocks formed in the upper parts of ophiolite or along rifts.

SUMMARY AND INTERPRETATION OF MINERAL OCCURRENCES, MINERAL DEPOSITS,PROSPECTS, AND MINES

Early in the study of lode mineral occurrences, mineral deposits, prospects, and mines in the quadrangle, each terrane was determined to possess a relatively unique suite of mineral deposit types. As a result, mineral deposit types are summarized and interpreted separately for each terrane and for younger Mesozoic and early Cenozoic granitic plutons.

YUKON-TANANA TERRANE-LAKE GEORGE AND MACOMB SUBTERRANES

The only and minor lode mineral occurrence in the Lake George subterrane (map No. 19, table 1) is on the south shore of Lake George where a grab sample of silicified iron-stained pyrite-quartz-actinolite schist contains 30 ppm Sn. The only and minor lode mineral occurrences in the Macomb subterrane (map Nos. 22, 28, table 1) are (1) on the north side of Elting Creek where a grab sample of pyrite-bearing iron-stained quartz-biotite schist contains 3.2 ppm Au and (2) on the northwest side of the West Fork of the Robertson River where a grab sample of pyroxene cumulate contains more than 5,000 ppm Cr. Mineral occurrences No. 19 in the Lake George subterrane and No. 22 in the Macomb subterrane are associated with metamorphic or post-metamorphic quartz veins or occur in regionally deformed and metamorphosed schist (table 1). These mineral occurrences may possibly be polymetallic vein deposit types. Mineral occurrence No. 28 in the Macomb subterrane is classified as a podiform chromite deposit type (table 1).

YUKON-TANANA TERRANE-JARVIS CREEK GLACIER SUBTERRANE

Several major lode mineral occurrences and mineral deposits occur in the Jarvis Creek Glacier subterrane (table 1). The major lode deposits are in the metavolcanic rock-rich member and consist of about 15 small- to moderate-size areas of Kuroko massive sulfide-type deposits. These deposits occur in two major belts: a western belt, west of the Delta River, between the Hayes and McGinnis Glaciers, and an eastern belt in the area southeast of the West Fork of the Robertson River.

Five mineral occurrences (map Nos. 5-9, table 1) in the western belt occur along a strike length of 32 km. The western belt deposits generally contain disseminated to massive chalcopyrite, galena, sphalerite, pyrite, pyrrhotite. Samples contain as much as 9,200 ppm Cu, 2,500 ppm Pb, 23,000 ppm Zn, 5,000 ppm As, 50 ppm Ag, 0.20 ppm Au, and 100 ppm Sn. Ten deposits (two mineral occurrences, seven mineral deposits and one prospect) (map Nos. 27, 30-38, table 1) in the eastern belt occur along a strike length of 26 km. The eastern belt of deposits consists of the same sulfide minerals as in the western belt. Samples contain as much as 110,000 ppm Cu, 110,000 ppm Zn, 15,000 ppm Pb, 10,000 ppm As, 300 ppm Ag, 1.9 ppm Au, 300 ppm Sn, and 2,000 ppm Sb. Most of the deposits in the eastern belt occur in the Delta district, which has been extensively explored and developed in recent years (Nauman and others, 1980). The Kuroko massive sulfide deposit types in both belts have been studied by Culp (1982), Lange and Nokleberg (1984), Nokleberg and Lange (1985), and Lange and others (1987).

In both belts the massive sulfide deposits occur discontinuously as variably sized, generally fault bounded pods and lenses. The host rocks for both belts of deposits are poly-deformed and poly-metamorphosed initially under conditions of the amphibolite facies and subsequently under conditions of the greenschist facies into mylonitic schist or phyllonite. Protoliths for the host rocks are mainly andesite, quartz keratophyre, less abundant dacite and metabasalt, and associated pelitic and calcareous sedimentary rocks. Locally abundant gabbro dikes of presumed Cretaceous age crosscut deposits of the eastern belt but are absent in the western belt.

Field, petrographic, geochemical, and isotopic data indicate these deposits formed in a Devonian submarine island-arc environment and subsequently were deformed, metamorphosed, and remobilized (Lange and Nokleberg, 1984; Nokleberg and Lange, 1985).

Nine lode mineral occurrences and one prospect are located principally in the metasedimentary rock-rich member of the Jarvis Creek Glacier subterrane and consist of (1) grab samples of quartz veins in iron-stained schist, usually with disseminated pyrite, containing as much as 310 ppm Pb or 5 ppm Ag (map Nos. 4, 11, 12, 13, 18, table 1); (2) grab samples of iron-stained schist, usually with disseminated pyrite, containing as much as 360 ppm Pb and 300 ppm Sn (map Nos. 16, 17, 25, 29, table 1); and (3) one grab sample of chalcopyrite and malachite in a quartz vein in metagabbro with 55,000 ppm Cu, 7 ppm Ag, and 0.10 ppm Au (map No. 10, table 1). Most of these deposits are associated with quartz veins or occur in regionally deformed and metamorphosed metasedimentary schist. Insufficient data preclude certain classification of most of these occurrences into deposit types. Some may be polymetallic vein deposit types. Prospect No. 10 is classified as a polymetallic vein deposit type (table 1).

LODE MINERAL OCCURRENCES RELATED TO LATE MESOZOIC AND EARLY TERTIARY INTRUSIVE ROCKS NORTH OF THE DENALI FAULT

Sparse lode mineral occurrences related to late Mesozoic and early Tertiary intrusive rocks occur north of the Denali fault (table 1). The Macomb subterrane in the east-central part of the quadrangle contains grab samples of (1) altered granite containing 0.25 ppm Au (map No. 23, table 1); (2) a small altered aplite dike containing 2.8 ppm Au and 70 ppm Sn (map No. 26, table 1); and (3) two areas of altered pyrite-bearing aplite or quartz monzonite containing as much as 7 ppm Ag and 130 ppm Pb (map Nos. 20, 21, table 1). These deposits are classified as possible porphyry copper-molybdenum deposit types.

The Jarvis Creek Glacier subterrane contains three areas of mineral occurrences, mineral deposits, and prospects related to late Mesozoic or early Tertiary intrusive rocks. The first area is located near or west of Molybdenum Ridge in the northwestern part of the quadrangle. Grab samples of granodiorite with possible molybdenite contain as much as 0.1 ppm Au, and 5 ppm Ag, or 70 ppm Mo (map Nos. 1-3, table 1). These deposits are classified as possible porphyry copper-molybdenum or porphyry copper deposit types. The second area consists of granite exposures in a possible ring dike complex on the Gerstle River where grab samples of iron-stained pyrite-bearing granitic or rhyolite porphyry dikes contain as much as 30 ppm Sn (map Nos. 14, 15, table 1). These deposits are classified as possible porphyry tin deposit types. The third area is located between the Johnson River and the West Fork of the Robertson River and consists of lamprophyre or alkalic gabbro, which contained pyrrhotite and as much as 50 ppm Sn (map No. 24, table 1). Insufficient data preclude classification as a deposit type.

WRANGELLIA TERRANE-SLANA RIVER SUBTERRANE

Abundant lode mineral occurrences, sparse mineral deposits, and one mine occur in the Slana River subterrane (table 2). Most of the lode mineral occurrences and deposits are hosted in upper Paleozoic submarine volcanic and sedimentary rocks and appear to be related to igneous activity during late Paleozoic island-arc volcanism (Lange and others, 1981; Nokleberg and others, 1984, 1985).

Fourteen mineral occurrences, one mineral deposit, and one prospect, all of small to moderate size (map Nos. 30, 42, 44, 49, 59, 100, 102, 105-109, 112, 136, 138, 140, table 2), are distributed in the south-central and south-eastern parts of the quadrangle and consist of disseminated to local small masses of chalcopyrite, bornite, malachite, and pyrite in or near metamorphosed and altered late Paleozoic dacite porphyry dikes, stocks, and sills. Samples from these occurrences contain as much as 100,000 ppm Cu, 5,000 ppm Pb, 530 ppm Zn, 70 ppm Ag, 2.0 ppm Au, 1,500 ppm As, 50 ppm Mo, and 30 ppm Sn. These deposits are classified as porphyry copper deposit types.

Eight small skarn deposits (seven mineral occurrences and one prospect) (map Nos. 58, 62, 63, 67, 68, 80, 122, 139, table 2) are distributed in the south-central and south-eastern parts of the quadrangle and are hosted mainly in marble interlayered with late Paleozoic metavolcanic rocks intruded mainly by late Paleozoic gabbro, diabase, or dacite. These skarn deposits consist of disseminated to local small masses of chalcopyrite and pyrite. Samples contain as much as 56,000 ppm Cu, 720 ppm Zn, 300 ppm Ag, 1.2 ppm Au, and 2,000 ppm Co. These deposits are classified as copper-lead-zinc skarn deposit types and are often present near or in the same general region as the deposits classified as porphyry copper deposit types. Both copper-lead-zinc skarn and porphyry copper deposit types probably formed during late Paleozoic island-arc volcanism and associated igneous activity.

One small prospect and two small mineral occurrences (map Nos. 55, 114, 115, table 2) in the south-central part of the quadrangle are distributed in hydrothermally altered submarine andesite and dacite flows and tuff locally intruded by diabase dikes. The deposits contain disseminated chalcopyrite and pyrite. Samples from the deposits contain as much as 7,200 ppm Cu and 7 ppm Ag. These deposits are classified as possible polymetallic vein deposit types and probably formed during late Paleozoic island-arc volcanism and associated igneous activity that occurred during the early history of the Wrangellia terrane (Nokleberg and others, 1984, 1985).

A related group of seven small mineral occurrences contains small to moderate amounts of disseminated pyrite with as much as 150 ppm Ag, 2.3 ppm Au, 240 ppm Pb, and 50 ppm Mo in sheared or altered, iron- or copper-stained volcanic or volcaniclastic rocks or argillite (map Nos. 54, 83, 98, 125, 128, 133, 141, table 2). Some of these deposits may be classified as polymetallic vein deposit types, but their origin is less certain than the occurrences described in the above paragraph.

Sixteen small mineral occurrences of disseminated to small lenses and stringers of chromite in cumulate ultramafic rocks occur in the central and western parts of the Slana River subterrane (map Nos. 37, 38, 41, 46, 51, 53, 56, 65, 66, 76-79, 81, 82, 99, table 2). Samples from these deposits contain as much as about 5,000 ppm Cr and 500 ppm Co. These deposits probably formed as products of crystal settling of chromite in ultramafic sills and are classified as podiform chromite deposit types. The ultramafic sills hosting the deposits are interpreted as being probably comagmatic with the basalt protolith for the Upper Triassic Nikolai Greenstone (Nokleberg and others, 1985).

Three small mineral occurrences in the Slana River subterrane consist of lenses containing chalcopyrite and pyrite, and local pyrrhotite, marcasite, and pentlandite(?) in sheared, serpentinized olivine cumulate with as much as 20,000 ppm Cu, 5,000 ppm Ni, and 10 ppm Ag (map Nos. 50, 64, 84, table 2). These deposits are classified as possible gabbroic nickel-copper deposit types. Two other mineral occurrences that may be part of this group and deposit type consist of (1) malachite along fractures in a metadiabase dike intruding olivine cumulate with 0.14 ppm Au (map No. 52, table 2) and (2) pyrite in a gabbro lens in metabasalt with 3 ppm Ag, 0.10 ppm Au, and 1500 ppm Ni. These deposits probably formed during intrusion of gabbro in the Late Triassic, during the waning stages of mafic magmatism that formed the Nikolai Greenstone (Nokleberg and others, 1984).

Twenty-one small- to moderate-size deposits (15 mineral occurrences and six prospects) of base-metal sulfides mainly in veins and altered areas (map Nos. 47, 52, 57, 60, 85, 101, 103, 110, 111, 113, 118-121, 131, 132, 135, 137, 142, 143, 145, table 2) are distributed throughout the Slana River subterrane in meta-andesite and metadacite of late Paleozoic age, in the Upper Triassic Nikolai Greenstone, and in metagabbro. These deposits consist of disseminated and locally small masses of chalcopyrite, bornite, malachite, and azurite. Samples contain as much as 56,000 ppm Cu, 5,000 ppm Pb, 5,000 ppm As, 4,200 ppm Zn, 300 ppm Ag, 6.5 ppm Au. These deposits are either in or near quartz veins or in areas of epidote-chlorite-actinolite-quartz alteration of the Nikolai Greenstone, gabbro, diabase, or metavolcanic rocks. Few if any are near granitic plutons. Because of these relations, these deposits are classified as copper-silver quartz vein deposit types that formed during low-grade regional metamorphism of the Wrangellia terrane, which occurred in the mid-Cretaceous (Nokleberg and others, 1984, 1985).

WRANGELLIA TERRANE-TANGLE SUBTERRANE

Abundant lode mineral occurrences and one lode mine occur in the Tangle subterrane (table 2). Most of the occurrences are in the Triassic Nikolai Greenstone or in mafic and ultramafic rocks that were probably comagmatic with the basalt protolith for the Nikolai Greenstone.

Eight small- to moderate-size mineral occurrences of chromite in cumulate ultramafic rocks are distributed in the central and western parts of the subterrane (map Nos. 40, 45, 70-74, 87, table 2) and consist of disseminated to local small lenses and stringers of chromite, mainly in olivine-pyroxene cumulate, containing as much as about 5,000 ppm Cr. These deposits are classified as podiform chromite deposit types and probably formed as products of crystal settling of chromite in small- to moderate-size mafic sills. The ultramafic sills hosting these deposits are interpreted as being probably comagmatic with the basalt protolith for the Upper Triassic Nikolai Greenstone (Nokleberg and others, 1985).

Thirty-five small- to moderate-size deposits (21 mineral occurrences, 12 prospects, and two mines) of base and precious metals are distributed in the Nikolai Greenstone throughout the Tangle subterrane (map. Nos. 1-6, 14-18, 21-25, 27-29, 32-34, 35, 39, 75, 88-97, table 2). These deposits consist of disseminated and local small masses of chalcopyrite, bornite, malachite, and azurite. Samples contain as much as 130,000 ppm Cu, 300 ppm Ag, and 3.2 ppm Au. As in the Slana River subterrane, these deposits are located either in or near quartz veins or in areas of epidote-chlorite-actinolite-quartz alteration of the Nikolai Greenstone, gabbro, or diabase. These deposits are classified as copper-silver quartz vein deposit types. As in the Slana River subterrane, the mineralization probably formed during low-grade regional metamorphism of the Wrangellia terrane that occurred during accretion in the mid-Cretaceous (Nokleberg and others, 1984, 1985).

Two minor mineral occurrences in the Tangle subterrane consist of pyrite in sheared serpentinized olivine cumulate with 3,200 ppm Cu (map No. 86, table 2) and samples with sphalerite in limey argillite interbedded with metabasalt with 810 ppm Zn and 5 ppm Ag (map No. 69, table 2). Insufficient data preclude classification.

MACLAREN AND CLEARWATER TERRANES AND TERRANE OF ULTRAMAFIC AND ASSOCIATED ROCKS

Sparse lode mineral occurrences in the Maclaren Glacier metamorphic belt of the Maclaren terrane consist of (1) one small area of bornite and malachite in meta-andesite with a grab sample containing 24,000 ppm Cu and 5 ppm Ag (map No. 13, table 2), (2) three small areas of pyrite-bearing phyllite (map Nos. 9, 20, 43, table 2) with samples containing as much as 1,800 ppm Zn and 15 ppm Ag, and (3) pyrite in schist with 1,000 ppm Zn (map No. 10, table 2). One small area of malachite in amphibolite gneiss occurs in the East Susitna batholith of the Maclaren terrane (map No. 19, table 2). Insufficient data precludes classification of these deposits.

Two minor deposits (one mineral occurrence and one prospect) in the Clearwater terrane in the western part of the quadrangle consist of (1) pyrite in iron-stained phyllite samples containing as much as 2,300 ppm Cu (map No. 7, table 2) and (2) pyrite, galena, sphalerite, and malachite in iron-stained metarhyolite containing as much as 94,000 ppm Pb, 7,900 ppm Zn, 2,700 ppm Cu, and 50 ppm Ag (map No. 8, table 6). The mineral occurrence may be classified as a polymetallic vein deposit type; the prospect is classified as a possible polymetallic vein deposit type.

Minor lode mineral occurrences in the terrane of ultramafic and associated rocks in the eastern part of the quadrangle consist of (1) disseminated pyrite, pyrrhotite, and chalcopyrite in iron-stained hornblende-plagioclase gneiss (map No. 124, table 2) and (2) disseminated chromite in alpine peridotite (map No. 144, table 2). The latter mineral occurrence is classified as a podiform chromite deposit type.

LODE MINERAL DEPOSITS AND OCCURRENCES RELATED TO LATE MESOZOIC OR TERTIARY INTRUSIVE ROCKS SOUTH OF THE DENALI FAULT

Sparse lode mineral occurrences related to late Mesozoic intrusive rocks are present south of the Denali fault (table 2). The major lode occurrences are related to late Mesozoic or early Tertiary granitic rocks in the Maclaren Glacier metamorphic belt of the Maclaren terrane in the western part of the quadrangle. Lode occurrences consist of pyrite, chalcopyrite, and molybdenite that is either in quartz veins in granite or is disseminated in metatuff adjacent to granite (map Nos. 11, 12, table 2). Samples contain as much as 2,500 ppm Mo. These deposits are classified as possible porphyry copper-molybdenum deposit types or perhaps polymetallic vein deposit types.

Lode mineral occurrences and deposits related to late Mesozoic or early Tertiary granitic rocks in the Slana River subterrane of the Wrangellia terrane consist of two types. The first type comprises ten small to moderate-size deposits (eight mineral occurrences and two prospects)(map Nos. 31, 104, 116, 117, 123, 126, 127, 129, 130, 134, table 2) consisting of fresh to altered quartz diorite, granodiorite, and granite or dikes and quartz veins adjacent to granitic rocks. The deposits contain chalcopyrite, sphalerite, pyrite, or galena. Samples contain as much as 25,000 ppm Cu, 35 ppm Ag, 4.4 ppm Au, and 250 ppm Pb. These deposits are classified as possible porphyry copper-molybdenum deposit types or possibly related polymetallic vein deposit types.

The second type is represented by two deposits. The Zackly skarn mineral deposit (map No. 26, table 2) consists of garnet-epidote skarn in marble containing malachite and gold, with grab samples containing as much as 66,000 ppm Cu, 35 ppm Ag, and 4.4 ppm Au. An unnamed prospect contains chalcopyrite, pyrite, sphalerite, magnetite, gold, and copper minerals in diopside-epidote skarn with grab samples containing as much as 25,000 ppm Cu, 30 ppm Ag, 55,000 ppm Zn, and 3.7 ppm Au (map No. 36, table 2). These deposits are classified as copper-lead-zinc (Au) skarn deposit types. The Zackly deposit has been extensively explored and drilled in recent years.

PLACER DEPOSITS

North of the Denali fault, three small gold placer occurrences are located in the Jarvis Creek Glacier subterrane (map Nos. 1-3, table 3). In all three areas, small amounts of gold occur in alluvial gravels of streams draining areas of extensive glacial deposits and metasedimentary schists and quartz veins of the Jarvis Creek Glacier subterrane.

South of the Denali fault, eighteen small to medium-sized gold placer deposits (three mineral occurrences, one mineral deposit and 14 mines) are distributed in the Slana River subterrane of the Wrangellia terrane (map Nos. 1-4,6-19, table 3), and one mine is located in the Tangle subterrane (map No. 5, table 3). Several gold placer mines occur in the Broxson Gulch, Rainy Creek, Eureka Creek, and Delta River areas (map Nos. 1, 4-6, 13-16, table 3). Known grades contain up to 13 colors per pan (Yeend, 1981b). Most of these placers are located in gravels down-drainage from Tertiary sedimentary rocks or older glacial deposits. A lesser number of placers are present in alluvial gravels downstream from upper Paleozoic island-arc rocks. The largest of these deposits is the Broxson Gulch placer deposit (map No. 1), which consists of gravels eroded from upper Paleozoic island-arc rocks and from a fault-bounded unit of Tertiary sedimentary rocks (Rose, 1965; Yeend, 1981b).

The major gold placers in the southern part of the quadrangle occur in the Slate Creek-Chistochina area (map Nos. 4-6, 8-12, table 3). This area has been a major gold producer since discovery of gold in the area before the turn of the century. These placer deposits have been studied by Mendenhall (1903, 1905), Moffit (1912, 1944, 1954), Chapin (1919), and Rose (1967). As of 1967, the total gold production from this general area is between 3 and 3.5 million dollars (Rose, 1967). The major gold placers in this area are the Quartz Creek, Slate Creek, Ruby Gulch, Limestone Creek, and Big Four deposits (Yeend, 1981b). Known grades range from 1 to 14 colors per pan (Yeend, 1981a, b). Platinum is locally mined at the Big Four and Slate Creek deposits; no source is known for the platinum.

The sources of gold for the Slate Creek-Chistochina area appear to be a Tertiary(?) conglomerate (locally referred to as "Round Wash") (Yeend, 1980, 1981a, b). Gold in the placer deposits is similar to that in the conglomerate, and there is also a lack of quartz veins or other obvious sources for the placer gold in underlying bedrock. Also, boulders in the conglomerate are similar to boulders in the placer gravels, and no placer deposits are located in areas away from the conglomerate.

The Tertiary(?) conglomerate consists of a coarse conglomerate with boulders as large as 30 cm; chlorite schist, gabbro, granodiorite, metadiabase, metagabbro, and amphibolite make up most of the clasts in the unit. The matrix is commonly coarse-grained with abundant quartz. The overall color of the unit is maroon to green, and the boulders are well rounded. Several pans of material from the unit produced a concentrate with 10 gold fragments. Studies of these clasts in the Tertiary sedimentary rocks in this area indicate that their source was neither in the local area south of the Denali fault nor from immediately across the Denali fault. The source of the clasts has been apparently offset by movement along the Denali fault (this study; Stout, 1976; Yeend, 1980, 1981a, b).

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EXPLANATION OF TABLES

MAP NUMBER, LATITUDE, LONGITUDE, NAME, COMMODITY, AND DEVELOPMENT

Map number refers to a specific deposit on the map of metalliferous lode and placer deposits, and serves to link the map and tables. Lode mineral occurrences, deposits, prospects, and mines are numbered and described separately for the areas north (table 1) and south (table 2) of the Denali fault. Placer mineral occurrences, deposits, and mines are numbered and described separately (table 3). In a few cases, groups of deposits are listed under a single map number. The latitude and longitude are the most precise location of the center of the mineral deposit or occurrence, usually to within five seconds of latitude and longitude. Name(s) of deposits are derived from published sources or general usage. Most mineral occurrences are unnamed. Listed under commodities are the major metal(s) present in chemical analyses of rock samples from the various areas. Metals are shown by standard chemical symbol. Development indicates whether the area is a mineral occurrence, deposit, prospect, or mine.

MAXIMUM METAL CONCENTRATION, GENERAL DESCRIPTION, AND REFERENCES

Under maximum metal concentration are listed the highest reported concentrations of metals, determined by emission spectrographic or atomic absorption analysis, for rock samples from mineral occurrences, deposits, prospects, and mines. Most of the analyses are from Zehner and others (1985). A few of the analyses are from the cited previous studies. Under general description is a short summary of the geology, petrology, and mineralogy of each area and a description of the type of sample. In addition to references, the last column of the tables gives location numbers from previous studies and compilations. The sample numbers for this study are also listed in the references column so that the reader can refer to the complete chemical analyses listed in Zehner and others (1985).

Abbreviations used in tables

Abbreviations	Explanation
Unit Explanation	
cm	centimeter
km	kilometer
m	meter
mm	millimeter
ppm	parts per million
Mineral, rock, and miscellaneous abbreviations	
azur	azurite
brn	bornite
chalc	chalocite
chrys	chrysocola
cp	chalcopyrite
cr	chromite
E	east
gal	galena
hem	hematite
mal	malachite
marc	marcasite
mo	molybdenite
NE	northeast
NW	northwest
pent	pentlandite
py	pyrite
pyrr	pyrrhotite
SE	southeast
sph	sphalerite
W	west

Table 1.--Metalliferous lode mineral occurrences, deposits, and prospects, north of the Denali Fault in the Mount Hayes Quadrangle, eastern Alaska Range, Alaska

Map number. Latitude N. Longitude W.	Name (if known). Commodities Development	Mineral deposit type. Geologic host unit in ppm	Maximum metal concentration,	General description	References, sample numbers
1 63°47'40" 146°57'14"	----- Au Occurrence	Porphyry Cu-Mo(?). Granodiorite, Jarvis Creek Glacier subterrane	Au, 0.10	Grab sample of chloritized schistose granodiorite.	This study, 80IL005B
2 63°48'22" 146°32'22"	----- Mo Prospect	Porphyry Cu-Mo. Granodiorite, Jarvis Creek Glacier subterrane	Mo, 70; Ag, 5	Grab samples with py and mo(?) in iron-stained shear zone in granodiorite near, and at contact with quartz schist.	This study, 80IL003B-E
3 63°48'12" 146°31'27"	Ptarmigan Creek. Mo Deposit	Porphyry Cu-Mo or Cu. Granodiorite, Jarvis Creek Glacier subterrane	Mo, 50; Au, 0.10	Grab samples with mo(?) in quartz veins up to 10 cm thick oriented subparallel to shear zones in granodiorite. Intense iron staining and silicification in granodiorite near quartz veins.	This study, 80IL004A, D; Smith, 1942; MacKevett and Holloway, 1977, loc. 1
4 63°43'44" 146°46'40"	----- Pb Occurrence	Polymetallic vein(?). Jarvis Creek Glacier subterrane	Pb, 250	Grab sample contains py in quartz-white mica-chlorite schist. Quartz veins intrude schist nearby.	This study, 80NK010B
5 63°42'48" 146°44'27"	Miyaoka. Zn, Cu, Au Occurrence	Kuroko massive sulfide. Jarvis Creek Glacier subterrane	Zn, 5,000; Cu, 4,300 Pb, 170; Sn, 50 Au, 0.20; Co, 500	Grab samples contain py, pyrr, and minor cp, sph and gal in lenses of massive sulfides and in veins in complexly deformed greenstones, chlorite schists and calc schists. Mineralized rock outcrops intermittently along a N-NW strike for more than 2 km.	This study, 81IL144E, B; 82IL047A; 80IL018B, H; 80IL020A, C, F; 80IL022B; 81IL142G, H, L, O
6 63°41'24" 146°39'30"	Hayes Glacier W. Pb, Zn, Ag, Au Occurrence	Kuroko massive sulfide. Jarvis Creek Glacier subterrane	Pb, 7,200; Zn, 6,900 Ag, 5; As, 5,000 Sn, 100; Au, 0.20, Cu, 1,100	Grab samples contain py, gal, sph and minor cp in discontinous massive sulfide lenses in quartz-chlorite-white mica schist.	This study, 82IL053B, C; 82IL060B
7 63°41'13" 146°33'21"	Hayes Glacier E. Cu, Zn, Ag Occurrence	Kuroko massive sulfide. Jarvis Creek Glacier subterrane	Cu, 9,200; Zn, 2,150 Pb, 600; Ag, 10	Grab samples contain py, pyrr, sph and gal in chlorite-epidote-carbonate schist.	This study, 82IL064B
8 63°35'59" 146°14'48"	Roberts No. 1. Zn, Cu Occurrence	Kuroko massive sulfide. Jarvis Creek Glacier subterrane	Zn, 23,000; Pb, 320, Cu, 2,600; Sn, 70	Grab samples contain py, pyrr, sph, cpy and gal in massive sulfide lense in quartz-chlorite-carbonate schist.	This study, 82IL044A, B

Table 1.--Metalliferous lode mineral occurrences, deposits, and prospects, north of the Denali Fault in the Mount Hayes Quadrangle, eastern Alaska Range, Alaska --Continued

Map number. Latitude N. Longitude W.	Name (if known). *Commodities* Development	Mineral deposit type. *Geologic host unit* in ppm	Maximum metal concentration,	General description	References, sample numbers
9 $63^{o}35'46''$ $146^{o}13'32''$	Roberts No. 2. Pb, Ag, Zn Occurrence	Kuroko massive sulfide. Jarvis Creek Glacier subterrane	Pb, 2,500; Zn, 2,000 Ag, 50; Cu, 2,500 Sn, 30	Grab samples contain py, prr, sph, gal, and cp in massive sulfide lenses in quartz-chlorite-white mica schist.	This study, 81NK226D, E, G
10 $63^{o}36'46''$ $146^{o}10'42''$	----- Cu, Ag, Au Prospect	Polymetallic vein(?). Metagabbro, Jarvis Creek Glacier subterrane	Cu, 55,000; Ag, 7 Au, 0.10	Grab sample with cp and mal in metagabbro with sparse quartz veins. Metagabbro crops out intermittently around hill through glacial till. Largest outcrop about 500 by 1000 m.	This study, 80ZN013A
11 $63^{o}31'25''$ $145^{o}49'35''$	Gunnysack Creek. Au Occurrence	Polymetallic vein(?). Jarvis Creek Glacier subterrane	-----	Py in iron-stained quartz vein up to 6 m thick cutting quartz-white mica-calcite schist.	Moffit, 1942; MacKevett and Holloway, 1977, loc. 2
12 $63^{o}30'30''$ $145^{o}49'55''$	Black Rapids. Sb Occurrence	----- Jarvis Creek Glacier subterrane	-----	Stibnite in pyritic quartz vein up to 24 cm thick cutting quartz-white mica-calcite schist.	Moffit, 1954 ; Ebbley and Wright, 1948; MacKevett and Holloway, 1977, loc. 3
13 $63^{o}42'00''$ $145^{o}27'00''$	----- Occurrence	Polymetallic vein(?). Jarvis Creek Glacier subterrane	-----	Gal in quartz stringers cutting quartz-white mica-garnet schist.	Moffit, 1942; Cobb, 1979, fig. 3, loc. 5
14 $63^{o}35'00''$ $145^{o}21'58''$	----- Sn Occurrence	Porphyry Sn(?). Granite, Jarvis Creek Glacier subterrane	Sn, 30	Grab sample contains py in iron stained granite dike possibly intruded along thrust fault.	This study, 81NK011B
15 $63^{o}35'32''$ $145^{o}14'20''$	----- Sn Occurrence	Porphyry Sn(?). Rhyolite porphyry, Jarvis Creek Glacier subterrane	Sn, 30	Grab sample contains py in iron stained rhyolite porphyry intruding quartz-biotite-white mica schist.	This study, 80AF058B
16 $63^{o}37'29''$ $145^{o}12'14''$	----- Sn Occurrence	Polymetallic vein(?). Jarvis Creek Glacier subterrane	Sn, 300	Float sample with py bands in quartz-epidote-garnet schist.	This study, 81IL008A

Table 1.--Metalliferous lode mineral occurrences, deposits, and prospects, north of the Denali Fault in the Mount Hayes Quadrangle, eastern Alaska Range, Alaska --Continued

Map number. Latitude N. Longitude W.	Name (if known). Commodities Development	Mineral deposit type. Geologic host unit in ppm	Maximum metal concentration,	General description	References, sample numbers
17 63°27'20" 145°21'40"	----- Pb Occurrence	Polymetallic vein(?). Jarvis Creek Glacier subterrane	Pb, 260	Grab sample contains py in white mica-chlorite schist.	This study, 81NK015A
18 63°22'04" 145°32'27"	----- Pb Occurrence	Polymetallic vein(?). Jarvis Creek Glacier subterrane	Pb, 310; Ag, 5	Grab sample contains py in quartz vein intruding biotite-chlorite-white mica schist.	This study, 79NK235B
19 63°46'30" 144°29'41"	----- Sn Occurrence	Polymetallic vein(?). Lake George subterrane	Sn, 30	Grab sample contains pyrr in shear zone in silicified, iron-stained quartz-chlorite-actinolite schist.	This study, 81IL086B
20 63°40'10" 144°05'42"	----- Pb, Ag Occurrence	Porphyry Cu-Mo(?). Schistose granite, Macomb subterrane	Pb, 130; Ag, 7	Grab sample contains py in autobrecciated, iron stained quartz vein in schistose granite.	This study, 81RM002A
21 63°39'11" 144°03'39"	----- Pb, Ag Occurrence	Porphyry Cu-Mo(?). Schistose granite, Macomb terrane	Pb, 110; Ag, 3	Composite chip sample with gal(?) in quartz vein in schistose chlorite granite.	This study, 81ZN001B
22 63°29'38" 144°43'01"	----- Au Occurrence	Polymetallic vein(?). Macomb subterrane	Au, 3.2	Grab sample of pyritic, iron stained quartz-biotite schist near schistose granodiorite dike.	This study, 81ZN037B
23 63°31'12" 144°32'36"	----- Au Occurrence	Porphyry Cu-Mo(?). Granite, Macomb subterrane	Au, 0.25	Grab sample of white mica-chlorite schistose granite.	This study, 81IL026A
24 63°26'32" 144°38'05"	----- Sn Occurrence	Porphyry Sn(?). Lamprophyre, Jarvis Creek Glacier subterrane	Sn, 50	Grab sample contains pyrr in calcite-quartz plagioclase lamprophyre intruding quartz-plagioclase-chlorite schist.	This study, 81IL052B
25 63°23'22" 144°34'26"	----- Sn Occurrence	Polymetallic vein(?). Jarvis Creek Glacier subterrane	Sn, 30	Grab sample contains pyrr in hornblende schist.	This study, 81IL112C

Table 1.--Metalliferous lode mineral occurrences, deposits, and prospects, north of the Denali Fault in the Mount Hayes Quadrangle, eastern Alaska Range, Alaska --Continued

Map number. Latitude N. Longitude W.	Name (if known). Commodities Development	Mineral deposit type. Geologic host unit in ppm	Maximum metal concentration,	General description	References, sample numbers
26 63°27'22" 144°24'22"	----- Au, Sn Occurrence	Porphyry Cu-Mo(?) or porphyry Sn. Aplite dike, Macomb terrane	Au, 2.8; Sn, 70	Grab sample contains py in iron stained aplite dike intruding quartz-biotite-white mica-garnet schist.	This study, 81RM024A
	Name (if known).	Mineral deposit type.	Maximum metal	General description	References, sample
27 63°19'27" 144°24'08"	----- Pb, As, Ag, Au; Occurrence	Kuroko massive sulfide. Jarvis Creek Glacier subterrane	Pb, 14,000; Ag, 100 As, 2,000; Sb, 3,000 Au, 6.0; Mo, 30 Sn, 300	Grab sample contains py in gossan float in area of massive sulfides associated with metavolcanic rocks.	This study, 81NK236D
28 63°29'42" 144°16'05"	----- Cr Occurrence	Podiform chromite(?). Pyroxene gabbro, Macomb subterrane	Cr, >5,000	Grab sample contains disseminated cr in coarse-grained olivine-pyroxene cumulate.	This study, 81IL074A, B
29 63°20'54" 144°13'27"	----- Pb Occurrence	Polymetallic vein(?). Mafic dike, Jarvis Creek Glacier subterrane	Pb, 360	Grab sample of highly sheared and altered quartz carbonate white mica schist near mafic dike	This study, 81SB037A
30 63°16'31" 144°16'23"	Delta district. Cu, Zn, Pb, Au Deposit	Kuroko massive sulfide. Jarvis Creek Glacier subterrane	Cu, 13,000; Ag, 30 Zn, 110,000; Pb, 3,000; Au, 0.85 As, 1,500; Sn, 70	Grab samples contain cp, py, pyrr and minor gal and sph in massive sulphide lens in meta-andesite and metaandesitic graywacke. Massive sulfide lenses outcrop intermittently along W-NW strike for approximately 2 km.	This study, 80IL028A, 81IL134A
31 63°16'04" 144°14'05"	Delta district. Zn, Au Deposit	Kuroko massive sulfide. Jarvis Creek Glacier subterrane	Zn, 1,100; Au, 1.2	Grab samples contain py and pyrr in quartz rich massive sulfide lens in quartz-carbonate-chlorite schist interbedded with iron stained meta-andesite and metadacite. Iron stained zone is approximately 80 m wide and 400 m long.	This study, 81IL161K
32 63°15'32" 144°14'20"	Delta district. Pb, Zn, Ag, Au Deposit	Kuroko massive sulfide. Jarvis Creek Glacier subterrane	Pb, 12,000; Ag, 150 Zn, 6,200; Cu, 2,200 Sn, 100; Au, 1.9	Grab sample contains py, cp, gal and sph in massive sulfide lenses in iron stained meta-andesite and metagraywacke. Iron stained zone is approximately 50 m by 80 m.	This study, 81IL162A

Table 1.--Metalliferous lode mineral occurrences, deposits, and prospects, north of the Denali Fault in the Mount Hayes Quadrangle, eastern Alaska Range, Alaska --Continued

Map number. Latitude N. Longitude W.	Name (if known). Commodities Development	Mineral deposit type. Geologic host unit in ppm	Maximum metal concentration,	General description	References, sample numbers
33 63°14'22" 144°08'25"	Delta district. Cu, Ag Occurrence	Kuroko massive sulfide. Jarvis Creek Glacier subterrane	Cu, 110,000; Ag, 70 Pb, 700; Zn, 1,600 Sn, 50; Mo, 50	Grab sample contains py, cp, mal and brn(?) in iron stained quartz-chlorite schist and locally in crosscutting quartz veins. Gabbro dikes locally intrude area.	This study, 81NK184A, B, C, 81IL173A
34 63°16'14" 144°06'03"	Delta district. Zn, Pb, Ag, Cu Prospect	Kuroko massive sulfide. Jarvis Creek Glacier subterrane	Zn, 30,000; Ag, 100 Pb, 6,500; Cu, 6,900 Sn, 50	Grab sample contains sph, gal, cp and py in boulder of massive sulfides in area of metavolcanic rocks.	This study, 81RM040A
35 63°14'57" 144°05'21"	Delta district. Pb, Ag, Zn Deposit	Kuroko massive sulfide. Jarvis Creek Glacier subterrane	Pb, 15,000; Ag, 300 Zn, 26,000; Mo, 50 Sb, 2,000; As, 5,000 Sn, 150	Grab samples contain py, gal and sph in 4 m thick massive sulfide lens in quartz-chlorite schist.	This study, 83IL079A-E
36 63°15'53" 144°02'18"	Delta district. Cu, Ag, Zn, Au Deposit	Kuroko massive sulfide. Jarvis Creek Glacier subterrane	Cu, 10,000; Ag, 200 Zn, 21,000; Sn, 300 Pb, 6,400; Sb, 1,500 Au, 1.6; As, 10,000	Grab samples contain py, cp, gal and py in massive sulfide lens in quartz-white mica schist and metagabbro.	This study, 81IL126A, B, C, E, F, 81IL140A
37 63°11'25" 144°06'22"	Delta district. Cu, Pb, Ag Deposit	Kuroko massive sulfide. Jarvis Creek Glacier subterrane	Cu, 6,400; Pb, 160 Ag, 10	Grab sample contains py and cp in quartz-white mica calcite schist near contact with greenstone.	This study, 81IL171A
38 63°09'22 144°02'00"	Delta district. Pb, Zn Deposit	Kuroko massive sulfide. Jarvis Creek Glacier subterrane	Pb, 2,000; Zn, 560	Grab samples contain py in quartz-chlorite schist and crosscutting quartz veins.	This study, 81NK248A, B

Table 2.--Metalliferous lode mineral occurrences, deposits, prospects, and mines, south of the Denali Fault in the Mount Hayes Quadrangle, eastern Alaska Range, Alaska

Map number. Latitude N. Longitude W.	Name (if known). Commodities Development	Mineral deposit type. Geologic host unit in ppm	Maximum metal concentration,	General description	References, sample numbers
1 63°08'55" 146°59'40"	----- Cu Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	-----	Secondary copper minerals in veinlets, vesicles and joints along shear zones in metabasalt.	Smith and others, 1975; Cobb, 1979, loc. 1, fig. 4
2 63°08'02" 146°59'32"	----- Cu Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	-----	Secondary copper minerals in veinlets, vesicles and joints along shear zones in metabasalt.	Smith and others, 1975; Cobb, 1979, loc. 2, fig. 4
3 63°10'33" 146°55'45"	----- Cu Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	-----	Secondary copper minerals in veinlets, vesicles and joints along shear zones in metabasalt.	Smith and others, 1975; Cobb, 1979, loc. 4, fig. 4
4 63°10'05" 146°55'40"	----- Cu; Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	-----	Secondary copper minerals in veinlets, vesicles and joints along shear zones in metabasalt.	Smith and others, 1975; Cobb, 1979, loc. 5, fig. 4
5 63°10'12" 146°54'00"	----- Cu Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	-----	Secondary copper minerals in veinlets, vesicles and joints along shear zones in metabasalt.	Smith and others, 1975; Cobb, 1979, loc. 6, fig. 4
6 63°08'40" 146°52'50"	----- Cu Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	-----	Secondary copper minerals in veinlets, vesicles and joints along shear zones in metabasalt.	Smith and others, 1975; Cobb, 1979, loc. 3, fig. 4
7 63°11'50" 146°55'38"	----- Cu Occurrence	----- Muscovite schist, Clearwater terrane	Cu, 2,300	Grab sample contains py in iron stained quartz-mica schist near thrust fault. Zone of staining is up to 5 m thick.	This study, 82SB023B
8 63°12'30" 145°53'25"	----- Pb, Zn, Ag Prospect	Polymetallic vein(?). Muscovite schist, Clearwater terrane	Pb, 94,000; Ag, 47; Zn, 7,900; Mo, 15; Cu, 2,700	Grab sample contains py, gal, mal and sph(?) in iron stained metarhyolite near thrust fault.	This study, 82NK017C
9 63°13'31" 146°57'23"	----- Ag Occurrence	----- Phyllite, East Susitna batholith	Ag, 15	Grab sample contains py in biotite-chlorite-garnet pyhllite near thrust fault.	This study, 79ZN063A

Table 2.-- Metalliferous lode mineral occurrences, deposits, prospects, and mines, south of the Denali Fault in the Mount Hayes Quadrangle, eastern Alaska Range, Alaska --Continued

Map number. Latitude N. Longitude W.	Name (if known). Commodities Development	Mineral deposit type. Geologic host unit in ppm	Maximum metal concentration,	General description	References, sample numbers
10 63°13'57" 146°56'37"	----- Zn Occurrence	----- Schist and amphibolite, Maclaren metamorphic belt	Zn, 1,000	Grab sample contains py in white mica-garnet schist near thrust fault.	This study, 79NK086A
11 63°15'00" 146°50'05"	----- Mo Occurrence	Porphyry Cu-Mo(?). Metaandesite, Maclaren metamorphic belt	Mo, 300	Grab sample contains py and mo in quartz veins up to 1 cm wide and disseminated in meta-andesite tuff near granite.	This study, 79IL052B
12 63°15'00" 146°49'30"	----- Mo, Cu Occurrence	Porphyry Cu-Mo. Granite, Maclaren terrane	Mo, 2,500	Grab sample with py, mo, and cp in altered muscovite-chlorite granite.	This study, 79IL053A; Kaufman, 1964, loc 12; MacKevett and Holloway, 1977, loc. 4
13 63°14'28" 146°50'00"	----- Cu, Ag Occurrence	----- Metaandesite, Maclaren metamorphic belt	Cu, 24,000; Ag, 5	Grab samples with bm and mal along fractures in highly weathered metaandesite. Disseminated py in Fe-carbonate veinlets.	This study, 79IL032B, D
14 63°14'15" 146°50'10"	----- Cu Prospect	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	-----	Secondary copper minerals in highly altered and fractured metabasalt near fault zone.	Smith and others, 1975; MacKevett and Holloway, 1977, loc. 5
15 63°12'54" 146°49'09"	----- Cu, Ag, Au Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	Cu, 24,000; Ag, 15 Au, 0.10	Float sample with bm, chalc and mal in quartz-epidote vein along 3-m-wide fault zone in metabasalt.	This study, 79IL031A; Smith and others, 1975; Cobb, 1979, loc. 8, fig. 4
16 63°13'25" 146°47'55"	----- Cu Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	-----	Secondary copper minerals in veinlets, vesicles and joints along shear zones in metabasalt.	Smith and others, 1975; Cobb, 1979, loc. 11, fig. 4
17 63°12'52" 146°47'50"	----- Cu Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	-----	Secondary copper minerals in veinlets, vesicles and joints along shear zones in metabasalt.	Smith and others, 1973; Cobb, 1979, loc. 9, fig. 4

Table 2.--Metalliferous lode mineral occurrences, deposits, prospects, and mines, south of the Denali Fault in the Mount Hayes Quadrangle, eastern Alaska Range, Alaska.--Continued

Map number. Latitude N. Longitude W.	Name (if known). Commodities Development	Mineral deposit type. Geologic host unit in ppm	Maximum metal concentration,	General description	References, sample numbers
18 63°10'50" 146°45'15"	----- Cu Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	-----	Secondary copper minerals in veinlets, vesicles and joints along shear zones in metabasalt.	Smith and others, 1975; Cobb, 1979, loc. 7, fig. 4
19 63°21'35" 146°50'30"	----- Cu Occurrence	----- Schist and amphibolite, Maclaren metamorphic belt	-----	Mal in fractured amphibolite gneiss.	Smith and others, 1975; Cobb, 1979, loc. 14, fig. 4
20 63°19'06" 146°46'53"	----- Ag Occurrence	----- Phyllite, Maclaren metamorphic belt	Ag, 7; Mo, 50	Grab sample contains py in white mica phyllite.	This study, 79ZN041A
21 63°16'12" 146°44'45"	----- Cu Prospect	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	-----	Bm, cp, mal and azur along widely seperated fractures up to a few centimeters wide in metabasalt. Fractures occur over a width of about 30 meters.	Kaufman, 1964, loc. 13; Saunders, 1961, p. 39; MacKevett and Holloway, 1977, loc. 9
22 63°14'27" 146°43'50"	----- Cu Prospect	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	-----	Cu in metabasalt.	Saunders, 1961, p. 38; MacKevett and Holloway, 1977, loc. 8
23 63°14'30" 146°43'00"	----- Cu Prospect	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	-----	Secondary copper minerals in vesicles, veinlets and joints along shear zones in metabasalt.	Smith and others, 1975; Cobb, 1979, loc. 17, fig. 4
24 63°14'45" 146°41'55"	----- Cu Prospect	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	-----	Secondary copper minerals in vesicles, veinlets and joints along shear zones in metabasalt.	Smith and others, 1975
25 63°13'35" 146°42'40"	----- Cu Prospect	Cu-Ag quartz vein Nikolai Greenstone, Tangle subterrane	-----	Cp in stringers in metabasalt.	Kaufman, 1964, loc. 11; MacKevett and Holloway, 1977, loc. 7

Table 2.--Metalliferous lode mineral occurrences, deposits, prospects, and mines, south of the Denali Fault in the Mount Hayes Quadrangle, eastern Alaska Range, Alaska --Continued

Map number. Latitude N. Longitude W.	Name (if known). Commodities Development	Mineral deposit type. Geologic host unit in ppm	Maximum metal concentration,	General description	References, sample numbers
26 63°12'54" 146°41'48"	Zackly. Cu, Ag, Au Deposit	Cu-Pb-Zn skarn. Upper Triassic tuff and sedimentary rocks, Tangle subterrane	Cu, 66,000; Ag, 35 Au, 4.4; Mo, 30	Irregular and discontinuous skarn pods and lenses in marble near and next to quartz diorite. Mineralized zone several meters wide and several hundred meters long strikng west and dipping vertically. Sparse py, mal, and gold in garnet-epidote skarn.	This study, 82NK097B-E
27 63°12'50" 146°41'20"	----- Cu Prospect	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	-----	Secondary copper minerals in vescicles, veinlets and joints along shear zones in metabasalt.	Smith and others, 1975; Cobb, 1979, loc. 19, fig. 4
28 63°15'49" 146°40'25"	----- Ag, Au Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	Ag, 5; Au, 0.10	Grab sample contained py in quartz-epidote vein in metabasalt.	This study, 79ZN057B
29 63°16'13" 146°37'20"	----- Cu Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	Cu, 15,000	Cu in pods and fractures in metabasalt.	Kaufman, 1964, loc. 15; Chapman and Saunders, 1954; Cobb, 1979, loc. 20, fig. 4
30 63°18'24" 146°37'32"	----- Cu Occurrence	Porphyry Cu. Slana Spur Formation, Slana River subterrane.	Cu, 3,000 Co, 1,000	Grab sample contains py and cp in metamorphosed calcareous chert adjacent to metadacite porphyry.	This study, 79CH040A
31 63°18'18" 146°35'48"	----- Ag Occurrence	Porphyry Cu-Mo. Diorite porphyry, Slana River subterrane	Ag, 5; Mo, 50	Grab sample contains py in altered diorite porphyry.	This study, 79NK179A
32 63°17'25" 146°34'20"	----- Cu Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	-----	Cp and bm in fractures and disseminated in metabasalt.	Kaufman, 1964, loc. 18; Cobb, 1979, loc. 24, fig. 4

Table 2.-- Metalliferous lode mineral occurrences, deposits, prospects, and mines, south of the Denali Fault in the Mount Hayes Quadrangle, eastern Alaska Range, Alaska --Continued

Map number. Latitude N. Longitude W.	Name (if known). Commodities Development	Mineral deposit type. Geologic host unit in ppm	Maximum metal concentration,	General description	References, sample numbers
33 63°17'00" 146°33'04"	Kathleen Margaret. Cu, Ag, Au Mine	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	Cu, 130,000; Ag, 300 Au, 3.2; Sn, 700	Grab samples with cp, brn, and mal in NE-NW striking quartz veins up to 3 m wide and traceable along strike for up to 140 m. Local massive sulfides in quartz veins. Disseminated sulfides in wall rocks. Veins localized in shear zones in metabasalt.	This study, 79IL036-38; Kaufman, 1964, loc. 17; Chapman and Saunders, 1954
34 63°14'30" 146°32'17"	----- Cu, Ag Prospect	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	Cu, 17,000; Ag, 5	Grab sample with cp and br in quartz-epidote vein in metabasalt.	This study, 79IL042; Kaufman, 1964, loc. 16; MacKevett and Holloway, 1977, loc. 11
35 63°15'45" 146°29'09"	----- Cu Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	Cu, 15,000	Grab sample contains azur and mal in quartz in veins in metabasalt.	This study, 79RM028C
36 63°18'03" 146°29'06"	----- Cu, Ag, Zn, Au Prospect	Cu-Pb-Zn skarn. Upper Paleozoic tuff, argillite, limestone, Tangle subterrane	Cu, 25,000; Ag, 30 Zn, 55,000; Au, 3.7	Grab sample with cp, sph, gold, magnetite, and secondary copper minerals in skarn. Skarn crops out intermittently over distance of about 1 km. Skarn adjacent to weathered gabbro containing cp and py.	This study, 79IL054A, 82IL008C; Rose, 1966a, loc. 7, fig. 3; MacKevett and Holloway, 1977, loc. 14
37 63°19'01" 146°25'27"	----- Cr Occurrence	Podiform chromite. Olivine cumulate, Slana River subterrane	Cr, >5,000	Grab sample contains disseminated cr in serpentinized olivine cumulate inclusion in metagabbro.	This study, 79NK242B
38 63°19'24" 146°22'54"	----- Cr Occurrence	Podiform chromite. Olivine cumulate, Slana River subterrane	Cr, >5,000	Grab sample contains disseminated cr in serpentinized, olivine cumulate inclusion in metagranodiorite.	This study, 79NK051D
39 63°13'55" 145°24'25"	----- Cu Prospect	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	-----	Cp and brn pods in quartz veins up to 4 m wide in metabasalt.	Stout, 1976; Cobb, 1979, loc. 29, fig. 4

Table 2.--Metalliferous lode mineral occurrences, deposits, prospects, and mines, south of the Denali Fault in the Mount Hayes Quadrangle, eastern Alaska Range, Alaska--Continued

Map number. Latitude N. Longitude W.	Name (if known). Commodities Development	Mineral deposit type. Geologic host unit in ppm	Maximum metal concentration,	General description	References, sample numbers
40 63°16'39" 146°16'50"	----- Cr Occurrence	Podiform chromite. Olivine cumulate, Tangle subterrane	Cr, >5,000	Grab sample contains disseminated cr in olivine-pyroxene cumulate.	This study, 79ZN070A
41 63°19'10" 146°15'30"	----- Cr Occurrence	Podiform chromite. Olivine cumulate, Slana River subterrane	-----	Disseminated cr in dunite.	Rose, 1966a, loc. 6, fig. 3; MacKevett and Holloway, 1977, loc. 15
42 63°18'56" 146°11'32"	----- Cu, Ag Occurrence	Porphyry Cu(?). Slana Spur Formation, Slana River subterrane	Cu, 38,000; Ag, 50 Au, 0.10	Grab samples with cp, bm, and mal in highly altered chlorite-epidote shear zone in meta-andesite porphyry. Altered zone about a few meters long.	This study, 79IL047A, B; Rose, 1966a, loc. 5, fig. 3; MacKevett and Holloway, 1977, loc. 16
43 63°19'08" 146°10'06"	----- Zn Occurrence	----- Phyllite, Maclaren terrane	Zn, 1,800; Co, 500; Y, 700	Grab samples with py in limonite-cemented breccia in black phyllite. Limonite zone up to 3 m wide.	This study, 79IL049-51
44 63°18'11" 146°11'37"	----- Au Occurrence	Porphyry Cu. Dacite stocks and sills, Slana River subterrane	Au, 0.10	Grab sample contains py in metadacite porphyry.	This study, 79NK037A
45 63°15'19" 146°12'55"	----- Cr Occurrence	Podiform chromite. Olivine cumulate, Tangle subterrane	Cr, >5,000	Grab sample contains disseminated cr in serpentinized olivine cumulate.	This study, 79ZN031A
46 63°20'40" 146°5'09"	----- Cr Occurrence	Podiform chromite. Olivine cumulate, Slana River subterrane	Cr, >5,000	Grab sample contains disseminated cr in olivine cumulate.	This study, 79NK009A
47 63°20'42" 146°5'00"	----- Co Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Slana River subterrane	Co, 500	Float sample with cp, py, and pyrr in veins in in metabasalt.	This study, 79IL029A; Rose, 1965, loc. 19, fig. 2; MacKevett and Holloway, 1977, loc. 18

Table 2.--Metalliferous lode mineral occurrences, deposits, prospects, and mines, south of the Denali Fault in the Mount Hayes Quadrangle, eastern Alaska Range, Alaska--Continued

Map number. Latitude N. Longitude W.	Name (if known). Commodities Development	Mineral deposit type. Geologic host unit in ppm	Maximum metal concentration,	General description	References, sample numbers
48 63°20'52" 146°04'07"	----- Ag, Au; Occurrence	Gabbroic Ni-Cu. Gabbro, Slana River subterrane	Ag, 3; Au, 0.10; Ni, 1,500	Grab sample contains py in highly sheared, shattered and stained lens of gabbro, 3 m wide and several 100's of meters long, in metabasalt.	This study, 79NK008A
49 63°21'05" 146°03'38"	----- Au Occurrence	Porphyry Cu. Dacite stocks and sills, Slana River subterrane	Au, 0.10	Grab sample with py in dacite porphyry that occurs in fault bounded lens a few tens of meters by several hundred meters.	This study, 79NK006B
50 63°21'00" 146°02'40"	----- Cu, Co Occurrence	Gabbroic Ni-Cu(?). Olivine cumulate, Slana River subterrane	Cu, 20,000; Co, 1,000; Ni, 2,000	Grab samples with cp and py in massive pyrr sulfide lenses in sheared, serpentinized olivine cumulate. Two to six sulfide lenses; largest is 1 by 2 m. Lenses strike west to to northwest on steep south-facing hillside.	This study, 79IL030A-D; Rose, 1965, loc. 18, fig. 2; MacKevett and Holloway, 1977, loc. 19
51 63°19'14" 146°03'54"	----- Cr Occurrence	Podiform chromite. Olivine cumulate, Slana River subterrane	Cr, >5,000	Grab sample contains disseminated cr in olivine cumulate.	This study, 79CH010B, D
52 63°19'14" 146°03'54"	----- Au Occurrence	Cu-Ag quartz vein(?). Diabase dike, Slana River subterrane	Au, 0.15	Grab sample with mal along fractures in meta-diabase dike intruding olivine cumulate.	This study, 79CH010C
53 63°19'07" 146°03'36"	----- Cr, Sn Occurrence	Podiform chromite. Olivine cumulate, Slana River subterrane	Cr, >5,000; Sn, 50	Grab sample contains disseminated cr in sheared, brecciated olivine cumulate. Sheared zone crops out for at least 15 m along strike.	This study, 79CH009A
54 63°19'24" 146°03'36"	----- Ag, Au Occurrence	----- Slana Spur Formation, Slana River subterrane	Ag, 150; Au, 2.3 Mo, 30	Grab sample of highly sheared and silicified metavolcanic graywacke.	This study, 79IL027E
55 63°18'21" 146°04'36"	Green Wonder. Cu, Ag, Zn Prospect	Polymetallic vein. Slana Spur Formation, Slana River subterrane	Cu, 7,200; Ag, 7 V, 3000; Zn Ni; Cr	Grab sample with disseminated cp in 20 m wide diabase dike intruding metaandesite. Rose (1965) reports sph and uvarovite in garnet-quartz-diopside rock.	This study, 79IL020C; Rose, 1965, loc. 13, fig. 2; MacKevett and Holloway, 1977, loc. 20

Table 2.--Metalliferous lode mineral occurrences, deposits, prospects, and mines, south of the Denali Fault in the Mount Hayes Quadrangle, eastern Alaska Range, Alaska --Continued

Map number. Latitude N. Longitude W.	Name (if known). Commodities Development	Mineral deposit type. Geologic host unit in ppm	Maximum metal concentration,	General description	References, sample numbers
56 63°17'44" 146°03'53"	----- Cr Occurrence	Podiform chromite. Olivine cumulate, Slana River subterrane	Cr, >5,000	Grab sample contains disseminated cr in olivine cumulate.	This study, 79CH018A
57 63°19'10" 146°02'00"	----- Cu, Ag, Au Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Slana River subterrane	Cu, 7,500; Ag, 36 Au, 2.8 trace: Pb, Zn	Chip samples contain cp in NE trending mineralized zone about a meter wide in metabasalt.	Rose, 1965, loc. 15, fig. 2; MacKevett and Holloway, 1977, loc. 21
58 63°20'06" 146°00'13"	----- Cu, Zn, Ag, Au Occurrence	Cu-Pb-Zn skarn. Slana Spur Formation, Slana River subterrane	Cu, 56,000; Zn, 720 Ag, 300; Au, 1.2	Grab sample contains cp and py in skarn near gabbro dike. Skarn zones up to 1 m thick and 2 m long are developed in lenses parallel to bedding and as seams parallel to gabbro dikes.	This study, 79NK225C; Rose, 1965, loc. 16, fig, 2; MacKevett and Holloway, 1977, loc. 22
59 63°20'45" 145°56'55"	----- Cu Occurrence	Porphyry Cu. Dacite stock, Slana River subterrane	-----	Cp and secondary copper minerals in sheared zone 2 m wide by 3 m long in pyritized dacite porphyry.	Rose, 1965, loc. 17, fig. 2; MacKevett and Holloway, 1977, loc. 26
60 63°19'05" 145°59'26"	----- Cu, Pb, Ag, Au Prospect	Cu-Ag quartz vein. Nikolai(?) Greenstone, Slana River subterrane	Cu, 22,000; Pb, 120 Ag, 50; Au, 6.5	Grab sample with cp, bm, and mal in and next to fractures in metaandesite tuff. Sulfides occur imeters across.n NE-trending fractures in zones up to onemeters across.	This study, 79IL017A, B; Rose, 1965, loc. 6, fig. 2; Cobb, 1979, loc. 2, fig. 5
61 63°18'52" 145°59'06"	Eastern Star. Cu, Au Prospect	Porphyry Cu-Mo. Dacite, Slana River subterrane	Cu, 60,000; Au, 0.6	Grab sample with cp and py along fractures in shear zones and disseminated in propylitically-altered diorite next to shear zones. Shear zones strike northeast and a meter wide by several meters long.	This study, 79IL012A-D; Rose, 1965, loc. 5, fig. 2; MacKevett and Holloway, 1977, loc. 23
62 63°19'15" 145°57'54"	----- Cu, Ag, Au, Co Occurrence	Cu-Pb-Zn skarn. Gabbro, Slana River subterrane	Cu, 6,000; Ag, 3 Au, 0.15, Co, 2,000	Grab sample with cp, py, and bm in massive sulfide bands up to one meter wide by several meters long striking northwest in garnet skarn. Gabbro crops out a few meters away across talus. Other sulfide bands crop out 50 m upslope in similar setting.	This study, 79IL018A, 79IL019A-E; Rose, 1965, loc. 4, fig. 2

Table 2.--Metalliferous lode mineral occurrences, deposits, prospects, and mines, south of the Denali Fault in the Mount Hayes Quadrangle, eastern Alaska Range, Alaska --Continued

Map number. Latitude N. Longitude W.	Name (if known). Commodities Development	Mineral deposit type. Geologic host unit	Maximum metal concentration, in ppm	General description	References, sample numbers
63 63°17'50" 146°00'30"	----- Cu Occurrence	Cu-Pb-Zn skarn. Slana Spur Formation, Slana River subterrane	-----	Cp, py, pyrr and marc in skarn.	Rose, 1965, loc. 10, fig. 2; Cobb, 1979, loc. 43, fig. 4
64 63°18'10" 149 59'55"	----- Ni, Ag, Cu Occurrence	Gabbroic Ni-Cu(?). Slana Spur Formation, Slana River subterrane	Ni, 5,000; Ag, 10 Cu, 3,700	Grab sample contains cp, py, marc, pent(?), in lens 1 m wide by 3 m long in metabasalt or gabbro	Rose, 1965, loc. 8, fig. 2; MacKevett and Holloway, 1977, loc. 24
65 63°17'50" 145°59'19"	----- Cr Occurrence	Podiform chromite. Olivine-pyroxene cumulate, Slana River subterrane	Cr, >5,000	Grab sample contains disseminated cr in olivine-pyroxene cumulate.	This study, 79NK027A
66 63°18'13" 145°58'35"	----- Cr Occurrence	Podiform chromite(?). Gabbro intruding Slana Spur formation, Slana River subterrane	Cr, >5,000	Grab sample with disseminated cr in silicified zone 2 m wide by 3 m long in gabbro.	This study, 79IL014B
67 63°18'13" 145°58'35"	----- Cu, Ag Occurrence	Cu-Pb-Zn skarn. Slana Spur Formation, Slana River subterrane	Cu, 4,200; Ag, 12.5	Grab sample from skarn a few meters wide in cherty limestone.	Rose, 1965, loc. 7, fig. 2
68 63°17'35" 145°57'05"	----- Cu Occurrence	Cu-Pb-Zn skarn. Gabbro dike intruding Nikolai Greenstone, Slana River subterrane	-----	Py and secondary copper minerals in skarn adjacent to gabbro dike.	Rose, 1965, loc. 9, fig. 2; MacKevett and Holloway, 1977, loc. 25
69 63°13'10" 146°08'55"	----- Zn, Ag Occurrence	----- Paleozoic argillite, Tangle subterrane	Zn, 810; Ag, 5	Grab samples contain sph(?) in limey argillite interbedded with metabasalt.	This study, 79NW129A, 130B
70 63°14'03" 146°03'15"	----- Cr Occurrence	Podiform chromite. Olivine cumulate, Tangle subterrane	Cr, >5,000	Grab sample contains disseminated cr in serpentinized olivine cumulate.	This study, 79ZN026A

Table 2.-- Metalliferous lode mineral occurrences, deposits, prospects, and mines, south of the Denali Fault in the Mount Hayes Quadrangle, eastern Alaska Range, Alaska --Continued

Map number. Latitude N. Longitude W.	Name (if known). Commodities Development	Mineral deposit type. Geologic host unit in ppm	Maximum metal concentration,	General description	References, sample numbers
71 63°13'48" 146°01'57"	----- Cr Occurrence	Podiform chromite. Olivine cumulate, Tangle subterrane	Cr, >5,000	Composite chip sample contains disseminated cr in olivine cumulate.	This study, 79ZN024B
72 63°13'12" 145°56'53"	----- Cr Occurrence	Podiform chromite. Olivine cumulate, Tangle subterrane	Cr, >5,000	Grab sample contains disseminated cr in serpentinized olivine cumulate.	This study, 79ZN022A
73 63°12'58" 145°56'22"	----- Cr Occurrence	Podiform chromite. Olivine cumulate, Tangle subterrane	Cr, >5,000	Grab sample contains disseminated cr in serpentinized olivine cumulate.	This study, 79ZN012A
74 63°13'04" 145°55'41"	----- Cr Occurrence	Podiform chromite. Olivine cumulate, Tangle subterrane	Cr, >5,000	Grab sample contains disseminated cr in serpentinized olivine cumulate.	This study, 79ZN009A
75 63°09'50" 145°59'50"	----- Cu Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	-----	Cp, brn, and mal in pods in quartz veins in metabasalt.	Stout, 1976; Cobb, 1979; loc. 9, fig. 5
76 63°19'45" 145°53'50"	----- Cr, Co Occurrence	Podiform chromite. Olivine cumulate, Slana River subterrane	Cr, >5,000; Co, 500	Grab sample contains disseminated cr in olivine cumulate.	This study, 79NK022A
77 63°19'24" 145°54'29"	----- Cr, Co Occurrence	Podiform chromite. Olivine cumulate, Slana River subterrane	Cr, >5,000; Co, 500	Grab sample contains disseminated cr in olivine cumulate.	This study, 79NK023A
78 63°19'28" 145°53'57"	----- Cr, Co Occurrence	Podiform chromite. Olivine cumulate, Slana River subterrane	Cr, >5,000; Co, 500	Grab sample contains disseminated cr in olivine cumulate.	This study, 79NK021A
79 63°18'47" 145°54'55"	----- Cr; Occurrence	Podiform chromite. Olivine cumulate, Slana River subterrane	Cr, >5,000	Grab sample contains disseminated cr in olivine cumulate.	This study, 79CH019A

Table 2.--Metalliferous lode mineral occurrences, deposits, prospects, and mines, south of the Denali Fault in the Mount Hayes Quadrangle, eastern Alaska Range, Alaska.--Continued

Map number. Latitude N. Longitude W.	Name (if known). Commodities Development	Mineral deposit type. Geologic host unit	Maximum metal concentration, in ppm	General description	References, sample numbers
80 63°16'35" 145°52'05"	----- Cu Occurrence	Cu-Pb-Zn skarn. Eagle Creek Formation, Slana River subterrane	-----	Cp and pyrr in skarn near gabbro.	Brooks, 1918; Cobb, 1979, loc. 8, fig. 5
81 63°18'26" 145°49'42"	----- Cr Occurrence	Podiform chromite. Olivine cumulate, Slana River subterrane	Cr, >5,000	Grab sample contains disseminated cr in olivine cumulate.	This study, 79HZ006A
82 63°18'45" 145°49'46"	----- Cr Occurrence	Podiform chromite. Olivine cumulate, Slana River subterrane	Cr, >5,000	Grab sample contains disseminated cr in serpentinized olivine cumulate.	This study, 79HZ005A
83 63°19'47" 145°49'29"	----- Mo Occurrence	----- Slana Spur Formation, Slana River subterrane	Mo, 50	Grab sample contains mo in iron-stained metadacite tuff.	This study, 79NK065B
84 63°20'25" 145°46'43"	----- Cu, Ni Prospect	Gabbroic Ni-Cu(?). Gabbro and olivine-pyroxene cumulate, Slana River subterrane	Cu, 2,000; Ag, 5; Cr, >5,000; Ni, 2,000	Grab samples with py, pyrr, and cp in, and replacing mafic silicates in coarse-grained ultramafic rock within sheared metavolcanic rocks. Mineralized zone a few meters wide.	This study, 79IL092C-E
85 63°20'24" 145°46'34"	Bee Mining. Ni, Cu, Ag, Au Prospect	Cu-Ag quartz vein. Gabbro, Slana River subterrane	Ni, 20,000; Cu, 6,000; Ag, 5 Au, 1.5	Grab samples with py and pyrr in massive sulfide lense and as disseminations in quartz-epidote altered gabbro, about 10 m wide by 20 m long.	This study, 79IL091B; Rose, 1965, loc. 3, fig. 2; MacKevett and Holloway, 1977, loc. 28
86 63°06'50" 145°45'18"	----- Cu Occurrence	----- Olivine-pyroxene cumulate, Tangle subterrane	Cu, 3,200	Grab sample contains py in sheared, serpentinized and iron stained olivine cumulate near gabbro.	This study, 78NK158B
87 63°05'58" 145°44'36"	----- Cr Occurrence	Podiform chromite. Olivine-pyroxene cumulate, Tangle subterrane	Cr, >5,000	Grab sample contains disseminated cr in olivine-pyroxene cumulate near gabbro.	This study, 78NK156A

Table 2.-- Metalliferous lode mineral occurrences, deposits, prospects, and mines, south of the Denali Fault in the Mount Hayes Quadrangle, eastern Alaska Range, Alaska --Continued

Map number. Latitude N. Longitude W.	Name (if known). Commodities Development	Mineral deposit type. Geologic host unit in ppm	Maximum metal concentration,	General description	References, sample numbers
88 63°05'20" 145°39'30"	----- Cu Prospect	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	-----	Brn in 1 cm wide quartz veins in metabasalt.	Rose and Saunders, 1965, loc. 9, fig. 7; Cobb, 1979, loc. 31, fig. 5
89 63°05'27" 145°37'35"	----- Cu, Ag Prospect	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	Cu, 20,000; Ag, 20	Grab samples with bm, cp, azur, and mal in small, generally discontinous quartz-epidote veins in highly fractured metabasalt. Veins strike SE. Outcrop about 20 m by 6 m.	This study, 79IL023C, 78AL011B; Rose and Saunders, 1965, loc. 10 fig. 7
90 63°05'05" 145°37'40"	----- Cu Prospect	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	-----	Brn, chrys and mal occur in an area 6 m long by 1 m wide in metabasalt.	Rose and Saunders, 1965, loc. 8, fig. 7; MacKevett and Holloway, 1977, loc. 37
91 63°04'25" 145°38'20"	----- Cu Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	-----	Brn, chalc, mal and chrys in veinlets 1 cm wide and traceable along strike for approximately 30 m in metabasalt.	Rose and Saunders, 1965, loc. 7, fig. 7; Cobb, 1979, loc. 33, fig. 5
92 63°03'10" 145°35'05"	----- Cu Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	-----	Chrys in pods 0.5 m wide by 1 m long in metabasalt.	Rose and Saunders, 1965, loc. 6, fig. 7; MacKevett and Holloway, 1977, loc. 39
93 63°02'15" 145°33'45"	----- Cu Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	Cu, 69,000	Chip samples across a zone 3 m wide contain chalc and chrys in highly fractured metabasalt. Zone of mineralization is approximately 3 to 5 m wide by 5 m long.	Rose and Saunders, 1965, loc. 3, fig. 7
94 63°02'14" 145°33'44"	----- Cu, Ag Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	Cu, 44,000; Ag, 20	Grab sample with bm and mal in quartz-epidote pod in sheared metabasalt pillows.	This study, 79IL059A; Rose and Saunders, 1965, loc. 2, fig. 7; MacKevett and Holloway, 1977, loc.40

Table 2.--Metalliferous lode mineral occurrences, deposits, prospects, and mines, south of the Denali Fault in the Mount Hayes Quadrangle, eastern Alaska Range, Alaska --Continued

Map number. Latitude N. Longitude W.	Name (if known). Commodities Development	Mineral deposit type. Geologic host unit in ppm	Maximum metal concentration,	General description	References, sample numbers
95 63°02'10" 145°32'30"	----- Cu Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	-----	Brn and cp in quartz-epidote vein 0.5 cm long in metabasalt.	Rose and Saunders, 1965, loc. 1, fig. 7; Cobb, 1979, loc. 37, fig. 5
96 63°01'18" 145°32'58"	----- Cu Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	-----	Py, cp and brn in quartz-epidote vein and pods up to 20 cm long by 10 cm wide in limonitic metabasalt. Limonite zone in basalt is approximately 75 m long by 10 m wide.	Rose and Saunders, 1965, loc. 5, fig. 7; MacKevett and Holloway, 1977, loc. 41
97 63°00'26" 145°33'48"	----- Cu, Ag Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Tangle subterrane	Cu, 26,000; Ag, 20	Composite chip sample across 2 m zone contains mal and azur in amygdules in metabasalt.	This study, 78NK157A
98 63°21'21" 145°41'12"	----- Pb, Ag, Cu, Ni Occurrence	----- Slana Spur Formation, Slana River subterrane	Pb, 240; Ag, 15	Composite chip samples contain py in iron stained metaandesite.	This study, 78NK134A
99 63°21'21" 145°42'00"	----- Cr Occurrence	Podiform chromite. Ultramafic rock, Slana River subterrane	Cr, >5,000; Ni, >5,000	Serpentinite derived from ultramafic rock. Highly sheared, local gabbro dikes.	This study, 79IL008B; MacKevett and Holloway, 1977, loc. 35
100 63°21'00" 145°42'06"	----- Ag Occurrence	Porphyry Cu. Dacite stock, Slana River subterrane	Ag, 5; Mo, 50	Composite chip samples contain py in iron stained metadacite porphyry.	This study, 78NK136B, D; Hanson, 1963, loc. 1, pl. 5; Cobb, 1979, loc. 15, fig. 5
101 63°20'52" 145°42'12"	----- Cu, Ag, Au Prospect	Cu-Ag quartz vein. Slana Spur Formation, Slana River subterrane	Cu, 4,800; Pb, 400 Ag, 30; Au, 1.9 Mo, 100; Sb, 300	Composite grab samples with cp, brn, and mal in quartz veins in metamorphosed and silicificed volcanic breccia and basalt. Veins strike northeast with and are about one cm to a meter wide. Disseminated py in adjacent wall rocks.	This study 78NK137B, D 79IL024B; Hanson, 1963, pl. 5; Cobb, 1979, loc. 16, fig. 5
102 63°20'30" 145°42'38"	----- Zn Occurrence	Porphyry Cu. Dacite dike, Slana River subterrane	Zn, 1,000	Grab sample with disseminated py in 2 m wide metadacite dike intruding metavolcanic volcanic graywacke.	This study, 79IL058A; Hanson, 1963, loc. 2, pl. 5; Cobb, 1979, loc. 17, fig. 5

Table 2.--Metalliferous lode mineral occurrences, deposits, prospects, and mines, south of the Denali Fault in the Mount Hayes Quadrangle, eastern Alaska Range, Alaska --Continued

Map number. Latitude N. Longitude W.	Name (if known). Commodities Development	Mineral deposit type. Geologic host unit in ppm	Maximum metal concentration,	General description	References, sample numbers
103 63°19'48" 145°43'32"	----- Cu, Pb, Zn, Ag Occurrence	Cu-Ag quartz vein. Slana Spur Formation, Slana River subterrane	Cu, 5,600; Pb, 180 Zn, 4,200; Ag, 10 As, 5,000;	Grab sample contains cp, mal and azur in 2 cm wide quartz vein in metadacite.	This study, 78AI003C; Hanson, 1963, loc. 3, pl. 5; Cobb, 1979, loc. 18, fig. 5
104 63°21'07" 145°39'23"	----- Cu, Ag, Ni Occurrence	Porphyry Cu-Mo(?). Diorite, Slana River subterrane	Cu, 16,000; Ag, 7 Co, 700; Ni, >5,000	Grab sample with py, pyrr, cp, and pent in massive sulfide lens 0.5 m by 1 m, and in disseminations in diorite at contact with serpentinized dunite.	This study, 79IL081A; Rose, 1965, loc. 2, fig. 4; Cobb, 1979, loc. 14, fig. 5
105 63°20'34" 145°40'32"	----- Ag Occurrence	Porphyry Cu. Dacite stock, Slana River subterrane	Ag, 5	Composite chip sample contains py in iron stained metadacite porphyry.	This study, 78NK189A
106 63°19'45" 145°40'55"	----- Cu, Pb Prospect	Porphyry Cu. Dacite stock, Slana River subterrane	Cu, 100,000 Pb, 5,000 trace: Au	Cp, py, secondary copper minerals and gal(?) in quartz veins and as disseminations in metatuff near dacite intrusion.	Hanson, 1963, loc. 4, pl. 5; Cobb, 1979, loc. 19, fig. 5
107 63°19'26" 145°39'39"	----- ----- Occurrence	Porphyry Cu(?). Metadacite dike or stock, Slana River subterrane	-----	Py disseminated and along fractures in metadacite.	Hanson, 1963, pl. 5
108 63°19'15" 145°40'30"	----- Cu, Ag Occurrence	Porphyry Cu. Slana Spur Formation, Slana River subterrane	Cu, 39,000; Ag, 44	Cp and gal in small subparallel veins up to 12 cm wide in tuffaceous sedimentary rocks near dacitic intrusion.	Hanson, 1963, loc. 5, pl. 5; MacKevett and Holloway, 1977, loc. 30
109 63°18'42" 145°38'00"	----- Zn, Pb Occurrence	Porphyry Cu. Dacite porphyry Slana River subterrane	Zn, 700; Pb, 300	Composite chip sample contains py in iron stained metadacite porphyry.	This study, 78NK186A
110 63°17'54" 145°40'05"	----- Cu, Ag Occurrence	Cu-Ag quartz vein. Slana Spur Formation, Slana River subterrane	Cu, 10,000; Ag, 20	Composite chip sample contains cp, bm, mal and azur in quartz veins along joints in meta-andesite agglomerate.	This study, 78NK130B

Table 2.--Metalliferous lode mineral occurrences, deposits, prospects, and mines, south of the Denali Fault in the Mount Hayes Quadrangle, eastern Alaska Range, Alaska --Continued

Map number. Latitude N. Longitude W.	Name (if known). Commodities Development	Mineral deposit type. Geologic host unit in ppm	Maximum metal concentration,	General description	References, sample numbers
111 63°17'20" 145°38'10"	----- Cu, Pb, Ag, Au Occurrence	Cu-Ag quartz vein. Slana Spur Formation, Slana River subterrane	Cu, 8,000; Pb, 3,000 trace: Ag, Au	Cp and gal(?) in quartz veins up to 2 cm thick in dacitic lapilli tuff.	Hanson, 1963, loc. 6, pl. 5; Cobb, 1979, loc. 21, fig. 5
112 63°17'18" 145°37'30"	----- Cu Occurrence	Porphyry Cu. Dacite stock, Slana River subterrane	-----	Cp in quartz veins up to 2 m thick along thrust fault in dacitic intrusion.	Hanson, 1963, loc. 7, pl. 5; Cobb, 1979, loc. 22, fig. 5
113 63°17'15" 145°37'05"	----- Cu, Pb, Ag, Au Occurrence	Cu-Ag quartz vein. Tetelna Volcanics, Slana River subterrane	Cu, 4,000; Pb, 6,000 trace: Ag, Au	Cp, gal and py in quartz veins up to 1 m wide in andesitic to dacitic flow breccias.	Hanson, 1963, loc. 8, pl. 5; Cobb, 1979, loc. 23, fig. 5
114 63°16'48" 145°37'10"	----- Cu Occurrence	Polymetalic vein(?). Slana Spur Formation, Slana River subterrane	-----	Cp and py disseminated in dacitic tuff.	Hanson, 1963, pl. 5; MacKevett and Holloway, 1977, loc. 31
115 63°16'30" 145°37'00"	----- Cu Occurrence	Polymetallic vein(?). Slana Spur Formation. Slana River subterrane	-----	Cp and py in quartz veins up to 0.5 m wide in dacitic tuff.	Hanson, 1963, loc. 9, pl. 5; Cobb, 1979, loc. 24, fig. 5
116 63°19'44" 145°35'40"	----- Cu, Ag, Au Occurrence	Porphyry Cu-Mo. Quartz diorite, Slana River subterrane	Cu, 12,000; Ag, 30 Au, 0.10	Grab sample with cp and py in quartz veins in fractures in silicified quartz diorite. Silicified zone is about 7 m by 15 m.	This study, 79IL083A; Hanson, 1963, pl. 5
117 63°17'28" 145°34'00"	----- Cu, Pb Prospect	Porphyry Cu-Mo. Granodiorite, Slana River subterrane	-----	Cp, gal and py disseminated in silicified granodiorite.	Hanson, 1963, loc. 12, pl. 5; MacKevett and Holloway, 1977, loc. 34
118 63°17'14" 145°33'59"	----- Ag, Cu Prospect	Cu-Ag quartz vein. Slana Spur Formation, Slana River subterrane	Ag, 3; Cu, Pb	Grab sample of iron-stained metaandesite. Cp and gal in quartz veins up to 12 cm wide in highly altered metaandesite intruded by quartz diorite.	This study, 79IL075F Hanson, 1963, loc. 13, pl. 5; Cobb, 1979, loc. 27, fig. 5

Table 2.-- Metalliferous lode mineral occurrences, deposits, prospects, and mines, south of the Denali Fault in the Mount Hayes Quadrangle, eastern Alaska Range, Alaska --Continued

Map number. Latitude N. Longitude W.	Name (if known). Commodities Development	Mineral deposit type. Geologic host unit in ppm	Maximum metal concentration,	General description	References, sample numbers
119 63°16'50" 145°34'10"	----- Cu, Pb Prospect	Cu-Ag quartz vein. Slana Spur Formation, Slana River subterrane	Cu, 5,000; Pb, 5,000	Cp, gal and py in small quartz veins in metadacite tuff.	Hanson, 1963, loc. 12, pl. 5; MacKevett and Holloway, 1977, loc. 33
120 63°16'17" 145°35'05"	----- Cu, Pb, Ag Occurrence	Cu-Ag quartz vein(?). Slana Spur Formation, Slana River subterrane	Cu, 4,000; Pb, 2,600 Ag, 44; Au, trace	Cp and gal in small quartz veins intruded along fault in limestone.	Hanson, 1963, loc. 10, pl. 5; Cobb, 1979, loc. 25, fig. 5
121 63°16'00" 145°34'20"	----- Cu Prospect	Cu-Ag quartz vein(?). Slana Spur Formation, Slana River subterrane	-----	Cp in quartz veins up to 20 cm wide intruded along thrust fault in metaandesite tuff.	Hanson, 1963, loc. 11, pl. 5; MacKevett and Holloway, 1977, loc. 32
128 63°11'00" 144°56'36"	----- Ag Occurrence	----- Tetelna Volcanics, Slana River subterrane	Ag, 5	Grab sample of metadacite with malachite and azurite staining.	This study, 79NW082A; Rose, 1967, loc. 10, fig. 1
129 63°11'42" 144°54'48"	----- Cu Occurrence	Porphyry Cu-Mo(?). Granite, Slana River subterrane	Cu, 2,200	Grab sample contains azur in pegmatite dike in granite pluton.	This study, 79NW080F
130 63°12'35" 144°54'30"	----- Au, W Occurrence	Porphyry Cu-Mo(?). Granite, Slana River Subterrane	Au, 1.2; W, 100 Traces: Cu, Ag	Grab sample with pyritic argillite near granite. Pyrite zone is about 250 by 500 m.	This study, 79IL068A; Rose, 1967, loc. 14, fig. 1; Cobb, 1979; loc. 5, fig. 6
131 63°12'57" 144°53'24"	----- Ag Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Slana River subterrane	Ag, 5.6; Au, 0.06	Grab sample of pyritic metabasalt.	Rose, 1967, loc. 15, fig. 1; MacKevett and Holloway, 1977, loc. 56
132 63°12'57" 144°52'52"	----- Mo, Ag Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Slana River subterrane	Mo, 10; Ag, 5.5; trace: Cu, Ni, Au	Grab sample with py, pyrr, and trace of cp in metabasalt.	This study, 79[illegible]57C; Rose, 1967, loc. 16, fig. 1; Cobb, 1979,

Table 2.-- Metalliferous lode mineral occurrences, deposits, prospects, and mines, south of the Denali Fault in the Mount Hayes Quadrangle, eastern Alaska Range, Alaska --Continued

Map number. Latitude N. Longitude W.	Name (if known). Commodities Development	Mineral deposit type. Geologic host unit in ppm	Maximum metal concentration,	General description	References, sample numbers
133 63°12'25" 144°52'15"	----- Au, Ag Occurrence	----- Eagle Creek Formation, Slana River subterrane	Au, 0.06; trace Ag	Grab sample of highly stained pyritic argillite.	Rose, 1967, locs. 17-18, fig. 1; Cobb, 1979, loc. 8, fig. 6
134 63°11'45" 144°52'30"	----- Cu, Ag; Occurrence	Porphyry Cu-Mo(?). Granite, Slana River subterrane	Cu, 2,000; Ag, 3.75	Grab sample contains Cu, and Ag in pyritized zone approximately 15 m in diameter at contact between peridotite and granite.	Rose, 1967, loc. 20, fig. 1; MacKevett and Holloway, 1977, loc. 47
135 63°10'50" 144°49'50"	----- Cu Occurrence	Cu-Ag quartz vein(?). Gabbro, Slana River subterrane	-----	Cp and secondary copper minerals in vein in gabbro.	Rose, 1967, loc. 23, fig. 1; MacKevett and Holloway, 1977, loc. 49 1977, loc. 49
136 63°10'05" 144°52'00"	----- Ag Occurrence	Porphyry Cu. Metadacite stock, Slana River subterrane	Ag, 3.75	Grab sample contains py in metadacite.	Rose, 1967, loc. 24, fig. 1; MacKevett and Holloway, 1977, loc. 48
137 63°09'19" 144°51'22"	----- Cu, Ag Occurrence	Cu-Ag quartz vein. Tetelna Volcanics, Slana River subterrane	Cu, 14,000; Ag, 15	Grab samples with disseminated cp and py in metaandesite. Mineralized zone about 3 m wide and 10 m long.	This study, 79IL071D, F Rose, 1967, loc. 27, fig. 1; MacKevett and Holloway, 1977, loc. 50
138 63°07'23" 144°54'10"	----- Cu, Ag Occurrence	Porphyry Cu. Dacite stock, Slana River subterrane	Cu, 11,400; Ag, 50	Grab sample contains py, cp, mal and azur in dacite porphyry at contact with dacite agglomerate.	This study, 79RM034A
139 63°08'21" 144°48'44"	Northland Mines. Cu Prospect	Cu-Pb-Zn skarn. Slana Spur(?) Formation, Slana River subterrane	Cu, 15,000; Ag, 7; W, 100	Grab sample with cp in massive hem in veins in skarn in limestone. Veins up to one m thick. Mineralized zone area forms dip slope about 90 m long and 25 m wide.	This study, 79IL073C; Rose, 1967, loc. 31, fig. 1
140 63°08'45" 144°48'00"	----- Cu, Zn, Ag, Au Deposit	Porphyry Cu(?). Dacite porphyry, Slana River subterranc	Cu, 20,000; Zn, 530; Ag, 70; Au, 2.0 As, 1,500; Sn, 30	Grab sample of massive sulfide with py, cp, bm, mal, and azur in metadacite porphyry near gabbro.	This study, 79RM038B

Table 2.-- Metalliferous lode mineral occurrences, deposits, prospects, and mines, south of the Denali Fault in the Mount Hayes Quadrangle, eastern Alaska Range, Alaska --Continued

Map number. Latitude N. Longitude W.	Name (if known). Commodities Development	Mineral deposit type. Geologic host unit in ppm	Maximum metal concentration,	General description	References, sample numbers
141 63°10'40" 144°45'50"	----- Ag Occurrence	----- Eagle Creek Formation, Slana River subterrane	Ag, 3.75	Grab sample of pyritic argillite.	Rose, 1967, loc. 22, fig. 1; Cobb, 1979, loc. 23, fig. 6
142 63°06'31" 144°43'58"	----- Cu, Ag, Au Occurrence	Cu-Ag quartz vein. Tetelna Volcanics, Slana River subterrane	Cu, 6,400; Ag, 15 Au, 0.20	Grab sample contains mal in stained metaandesite porphyry.	This study, 79HZ020C
143 63°04'50" 144°21'48"	----- Cu, Au Occurrence	Cu-Ag quartz vein. Nikolai Greenstone, Slana River subterrane	Cu, 2,600; Au, 1.4	Grab sample with cp and pyrr in massive sulfide lens in amygdaloidal metabasalt near gabbro.	This study, 79IL063E; Richter, 1967, loc. 5, fig. 2; MacKevett and Holloway, 1977, loc. 52
144 63°04'40" 144°17'05"	----- Cr Occurrence	Podiform chromite. Dunite, terrane of ultramafic and associated rocks	-----	Disseminated and seam cr in dunite.	Richter 1967, loc. 6, fig. 2; MacKevett and Holloway, 1977, loc 53
145 63°01'08" 144°15'30"	Alteration Creek. Cu, Ag Occurrence	Cu-Ag quartz vein. Tetelna Volcanics, Slana River subterrane	Cu, 1,500; Ag, 16.8;	Cp and secondary copper minerals in thin quartz veins in pyritized, silicified and locally brecciated basalt.	Richter, 1967, loc. 2, fig. 2; MacKevett and Holloway, 1977, loc. 54

Table 3.--Placer mineral occurrences, deposits, and mines, Mount Hayes Quadrangle, eastern Alaska Range, Alaska

Map number Latitude N. Longitude W.	Name (if known). Commodity, Development	Average gold concentration, in dollars/yd or colors/pan	General description	References
			NORTH OF THE DENALI FAULT	
1 63°41'43" 145°48'05"	Ober Creek. Au Occurrence	-----	Small amounts of gold found in alluvial gravels of stream draining area of extensive glacial deposits andmetasedimentary schists and quartz veins of the Jarvis Creek Glacier subterrane.	Wedow and others, 1954, p. 18; MacKevett and Holloway, 1977, loc. 55
2 63°42'09" 145°33'54"	McCumber Creek. Au Occurrence	-----	Small amounts of gold found in alluvial gravels of stream draining area of extensive glacial deposits and metasedimentary schists and quartz veins of the Jarvis Creek Glacier subterrane.	Moffit, 1942, p. 143-144; MacKevett and Holloway, 1977, loc. 56
3 63°41'49" 145°32'00"	Morning Star. Au Occurrence	-----	Small amounts of gold found in alluvial gravels of stream draining area of extensive glacial deposits and metasedimentary schists and quartz veins of the Jarvis Creek Glacier subterrane.	Smith, 1933, p. 34; MacKevett and Holloway, 1977, loc. 57
			SOUTH OF THE DENALI FAULT	
1 63°19'40" 146°05'12"	Broxson Gulch. Au Mine	16 dollars/yd, 13 colors/pan	Gold found in alluvial gravels of small creek entering east fork of Broxson Gulch and which drains small fault bounded wedge of Tertiary conglomerate	Rose, 1965, p. 35; MacKevett and Holloway, 1977, loc. 58; Yeend, 1980
2 63°18'50" 146°03'10"	Specimen Creek. Au Occurrence	-----	Gold found in upper part of creek. Bedrock is pyritizedmetabasalt.	Rose, 1965, p. 35; MacKevett and Holloway, 1977, loc. 59
3 63°17'40" 145°57'40"	W. Fork Rainy Creek. Au Deposit	-----	Gold in aluvial gravels probably derived from older glacial deposits.	Rose, 1965, p. 34; MacKevett and Holloway, 1977, loc. 60

Table 3.--Placer mineral occurrences, deposits, and mines, Mount Hayes Quadrangle, eastern Alaska Range, Alaska --Continued

Map number Latitude N. Longitude W.	Name (if known). Commodity, Development	Average gold concentration, in dollars/yd or colors/pan	General description	References
			SOUTH OF THE DENALI FAULT	
4 63°17'15" 145°52'30"	Rainy Creek. Au Mine	-----	Gold in alluvial gravels probably derived from older glacial deposits.	Rose, 1965, p. 34; MacKevett and Holloway, 1977, loc. 61
5 63°12'06" 145°48'50"	Delta River. Au Mine	-----	Small amounts of fine gold in alluvial gravels of Delta River.	Moffit, 1912, p.65; MacKevett and Holloway, 1977, loc. 62
6 63°20'32" 145°43'45"	Yukon Corporation. Au Mine	-----	-----	Wedow and others, 1954, p. 18 MacKevett and Holloway, 1977, loc. 63
7 63°10'58" 144°51'35"	Chistochina Glacier. Au, Pt Occurrence	-----	Gold found in extensive recent glacial deposits of the Chistochina Glacier.	Rose, 1967, p. 25-26; MacKevett and Holloway, 1977, loc. 64
8 63°11'10" 144°49'05"	Big Four. Au, Pt Mine	1 color/pan	Fine, smooth gold found in alluvial gravels of stream draining area of Tertiary conglomerate.	Rose, 1967, p. 25-26; MacKevett and Holloway, 1977, loc. 66; Yeend, 1980
9 63°10'05" 144°49'30"	Slate Creek. Au, Pt. Mine	1 color/pan	Mostly fine, smooth gold found in channel and bench gravels of Slate Creek and Miller Gulch; the richest ground being the intersection of the two. Large amounts of Tertiary conglomerate cap hill to the north of Slate Creek where the main drainage is Miller Gulch. Possible economic reserves of gold may also be present in burried channel of ancestral Slate Creek.	Moffit, 1954, p. 191-193; Rose, 1967, p. 23-25; MacKevett and Holloway, 1977, loc. 65; Yeend, 1980
10 63°09'40" 144°45'50"	Ruby Gulch. Au Mine	-----	Small amounts of gold recovered from alluvial gravels of creek draining area of Tertiary conglomerate.	Rose, 1967, p. 26; Moffit, 1954, p. 191-192; Cobb, 1979, loc. 24, fig. 6

Table 3.--Placer mineral occurrences, deposits, and mines, Mount Hayes Quadrangle, eastern Alaska Range, Alaska.--Continued

Map number Latitude N. Longitude W.	Name (if known). Commodity, Development	Average gold concentration, in dollars/yd or colors/pan	General description	References
			SOUTH OF THE DENALI FAULT	
11 63°09'25" 144°45'05"	Quartz Creek. Au Mine	14.22 dollars/yd, 14 colors/pan	Fine smooth gold found in alluvial gravels of creek draining area of Tertiary conglomerate.	Moffit, 1954, p. 191-192; Rose, 1967, p. 26; Yeend, 1980
12 63°08'25" 144°43'00"	-----	-----	Small amounts of gold recovered from alluvial gravels of creek draining area of Tertiary congolmerate.	MacKevett and Holloway, 1977, oc. 77; U.S.B.M., 1973
13 63°07'50" 144°39'10"	Limestone Creek. Au Mine	-----	Fine smooth gold produced from alluvial gravels of small streams flowing SE and E into Middle Fork of the Chistochina River. Streams drain a large bench composed of unconsolidated glacial deposits and a small area of older conglomerate	Moffit, 1944, p. 29; MacKevett and Holloway, 1977, loc. 29; Cobb, 1979, locs. 27-27, fig. 6
14 63°08'07" 144°38'28"	Kraemer. Au Mine	-----	Same as No. 13	Same as No. 13
15 63°08'30" 144°37'00"	Bedrock. Au Mine	-----	Same as No. 13	Same as No. 13
16 63°04'15" 144°48'40"	Chisna. Au Mine	-----	Gold found in alluvial gravels derived from older glacial deposits.	Moffit, 1944, p. 29-31; MacKevett and Holloway, 1977, loc. 70
17 63°02'25" 144°56'10"	Dempsy. Au Mine	-----	Fine gold found in alluvial gravels derived from older glacial deposits.	Moffit, 1912, p. 77; MacKevettand Holloway, 1977, loc. 69

Table 3.--Placer mineral occurrences, deposits, and mines, Mount Hayes Quadrangle, eastern Alaska Range, Alaska --Continued

Map number Latitude N. Longitude W.	Name (if known). Commodity, Development	Average gold concentration, in dollars/yd or colors/pan	General description	References
			SOUTH OF THE DENALI FAULT	
18 63°00'45" 144°26'10"	Eagle Creek. Au Mine	-----	Gold found in alluvial gravels derived from older glacial deposits.	Moffit, 1944, p. 40-42; MacKevett and Holloway, 1977, loc. 71
19 63°00'35" 144°11'45"	----- Au Occurrence	-----	Rough gold produced from alluvial gravels. Bedrock in area is metabasalt and metadiorite.	Richter, 1967, p. 16; MacKevett and Holloway, 1977, loc. 72

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