MINERAL OCCURRENCES OF THE AMBLER RIVER QUADRANGLE Compiled by C. F. Mayfield and Donald Grybeck

disseminated

Small malachite stained quartz vein U.S. Geol. Survey

Less than 1 m wide vein in limestone; U.S. Geol. Survey

visible chalcopyrite and malachite; field station rock sample has 10 ppm Ag. 76Ek361A

30 m long rusty zone having quartz U.S. Geol. Survey

Copper minerals at contact between Brooks, 1914

Minor amounts of galena, fluorite, U.S. Bur. Mines and malachite in granite near unpublished data

Boulangerite (Pb<sub>5</sub>Sb<sub>4</sub>S<sub>11</sub>) in reddish U.S. Geol. Survey

Veinlets of tremolite asbestos in Anderson, 1947

Asbestos veinlets and Cu staining Alaska Div. of

Unstated number (1-2?) of claims Alaska Div. of

staked 1968-1970; assessment work Geol. and Geophys.

Mineralized quartz vein containing Brosge and others,

body containing nephrite jade, and small amounts of chrysotile 1947, p. 16

Small amounts of garnierite or a Anderson, 1945, related mineral inultramafic rocks. p. 24

Selected zones in creek gravels Reed, 1931, p. 12-contain from 1.2-5.9 g (.04-.19oz) 16; Fritts, 1970,

of Au per cubic meter; minor p. 54-55

Geol. and Geophys.

in Fe-rich black phyllite; phyllite field station anomalously high in Ag, Ba, Mo, and 76Ek394

V; zone extends along strike for at

contact zone over a distance of geochemically anomalous in Pb and

Small amount of quartz rubble

Asbestos in serpentinite;

reports "jade cutting".

malachite, azurite, and galena

gem quality nephrite mined; minor

Creek has been prospected but

without significant production.

production of nephrite from

chalcopyrite and malachite in

containing ilmenite; host rocks are felsic orthogneiss and

MAP NAME(S) NO. (if known)

LOCATION

T.29N.,R.1W.

T.26N.,R.1W.

T.25N.,R.2W.

T.24N.,R.3E.

Cu,(Ag)

Pb,Sb

T.21N.,R.3E. Cu,Pb

T.21N.,R.5E.

14 Jade Mountain T.21N.,R.4E.

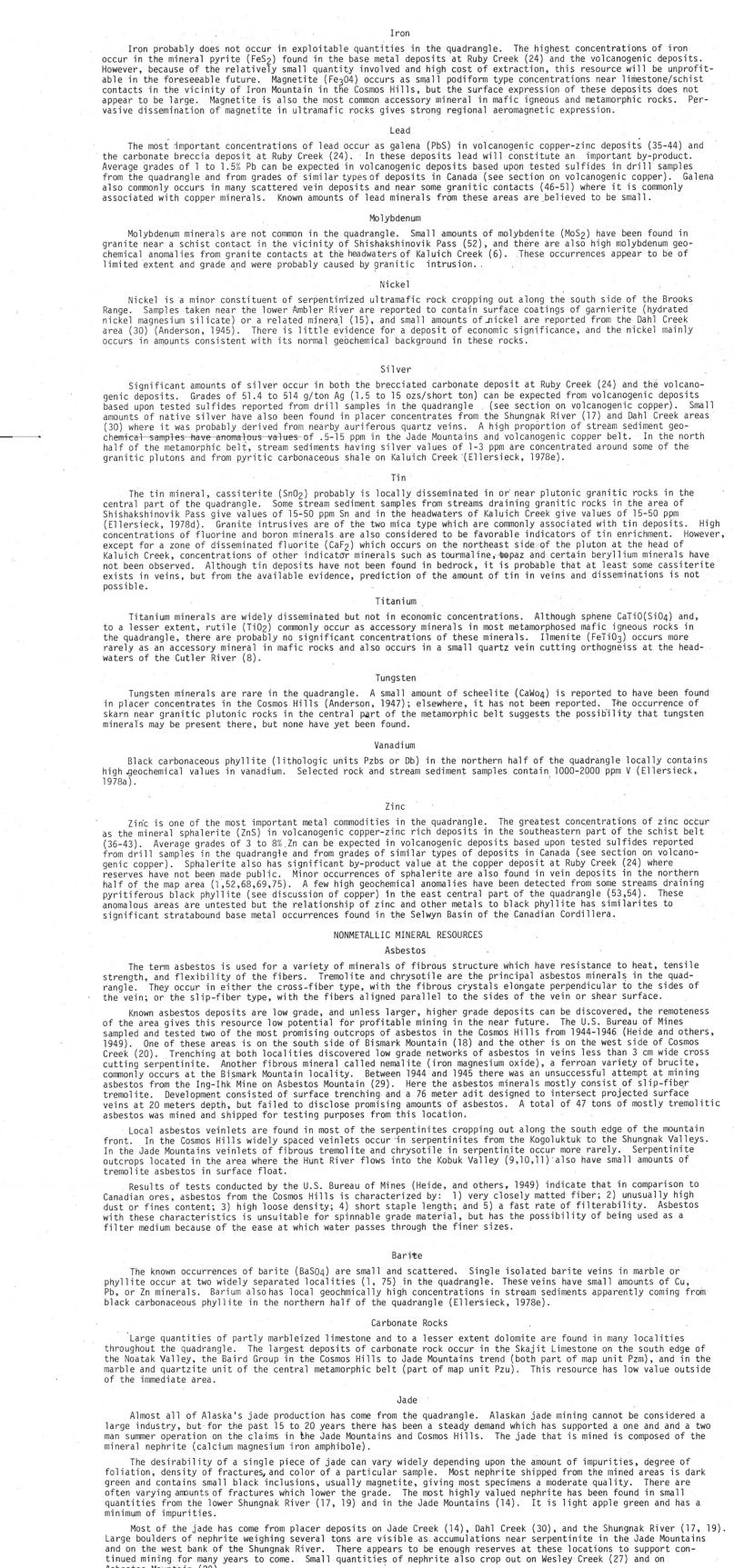
16 Agnes Creek T.21N.,R.6E.

17 Bismark Creek T.19N.,R.7E.

(lower Shungnak River)

Nephrite jade, Residual

FOLIO OF THE AMBLER RIVER QUADRANGLE, ALASKA MAYFIELD - GRYBECK MINERAL OCCURRENCES AND RESOURCES MAP



Sand, Gravel, and Rock Talus

ENERGY RESOURCES

Geothermal Energy

Cretaceous granitic plutonic rocks in the quadrangle contain some radioactive minerals, but their potential is

Small amounts of radioactivity have also been detected in the copper deposit at Ruby Creek (24). The unidentified radioactive material consists of tiny particles in carbonate breccia and sometimes irregular stringers parallel to bedding in micaceous rocks (Runnels, 1963).

Finely disseminated black minerals U.S. Geol. Survey

Malachite in quartz vein cutting U.S. Geol. Survey

Malachite stain on small piece of U.S. Geol. Survey

Copper mineralization over an area U.S. Bur. Mines, of about 25 x 30 m consisting of unpublished data

Small limonite rich gossan has 1800 U.S. Geol. Survey

ppm Cu and 5 ppm Ag at limestone - field station

Malachite in small quartz vein cut- U.S. Geol. Survey

azurite along fractured surfaces field station

Malachite stains from fractured U.S. Geol. Survey

Anomalously high geochemistry from U.S. Geol. Survey

Sphalerite, galena, and malachite in small quartzite outcrop; nearby black pyritic phyllite has 1000 76Trl45A, B

Prominent rusty colored hills of U.S. Bur. Mines,

soil sample near two small quartz field station veins cutting Fe stained zone in carbonate; contains 420 ppm Zn and

Gold probably derived from glacial Smith, 1913, deposits upstream; little production. p. 141-142; Cobb

Malachite, azurite and chalcopy-

malachite and chalcopyrite in

quartz veins and fractures cutting

contact with carbonate; 100 ppm

Cd in sample.

ppm V and 70 ppm Mo.

an area of about 4 km².

Malachite in conglomerate.

Malachite in conglomerate.

shear zone less than 1 m wide in limestone; barite, malachite,

brecciated dolomite; pyrite,

chalcopyrite and malachite in

Malachite in quartz float; Fe stained soil approximately 5 x

in 2 meter thick granitic dike cut-ting calc-schist; contains 200 ppm 76Md257 Cu, 200 ppm Pb, 2000 ppm Zn and

uncertain. Matsko and Freeman (1963) report finding a radioactive anomaly from an airplane survey over the granitic gneissic rocks cropping out in the lower Kogoluktuk Valley, but a ground traverse indicated the radioactive minerals were probably disseminated throughout the rock in low concentrations. A sample of quartzite talus containing meta-

torbernite (copper uranyl phosphate hydrate) was found near a granite contact in the Ulaneak Creek drainage (80)

(Cu),(Pb),(Zn), Disseminated

Cu,Pb,Zn,(Mo), Vein and

Coating

Disseminated and coating

Coating

resource of these commodities to support local construction needs.

may prove to be useful to the local inhabitants of the area.

centrations to support a soapstone carving industry run by local native artists.

INTRODUCTION

This section is intended to provide the reader with a list of the potentially important mineral commodities in the Ambler River quadrangle and to describe how each commodity occurs, where it occurs, and if possible, its resource

The term mineral "deposit" is used in this report to indicate a resource with enough potential to encourage exploration. The term mineral "occurrence" is used to indicate a source of minerals of unknown potential or small size.

The Ambler River quadrangle has had a limited history of mineral resource exploitation. The first prospecting in the area was done by the gold seekers at the turn of the century. Gold was located in placer deposits in the Cosmos Hills and mined intermittently for the next 50 to 60 years. This is the principal commodity that has been mined from the area although these deposits are not a large resource in comparison to many other gold districts in Alaska. During the prospecting activity brought on by the gold rush, other commodities such as asbestos, jade, and numerous base metal occurrences were reported. Several asbestos deposits were evaluated and a few tons were mined for testing purposes at

the Ing-Ihk Mine when shortages developed near the end of World War II. Most of Alaska's jade has come from deposits located within the quadrangle. These deposits have continued to support small scale mining operations for the last 25 to

30 years. There has been a great amount of interest in the exploration of copper since the discovery of large high grade brecciated carbonate deposits at Ruby Creek (24) in 1958 and the volcanogenic deposit at Arctic Camp (42) in 1965. Subsequently there have been additional encouraging discoveries of volcanogenic deposits which are not fully explored. Mining of these deposits has not yet begun, but preliminary reserve estimates at the largest known deposit, Arctic Camp, are approximately 30 million metric tons of +10 percent combined Cu, Zn, Pb, Ag.

METALLIC MINERAL RESOURCES

Small podiform concentrations of chromite are likely to be found in serpentinized ultramafic rocks along the

southern edge of the Brooks Range, but there is thus far little indication of large high grade deposits. Chromium is found in stream sediment geochemical samples from streams draining ultramafic rocks along the southeast side of the

of serpentinite outcrops upstream. Rapid rock analysis of the Cr and Fe content from two samples collected at Dahl

placers on Dahl Creek (30) where some specimens of Chromite reach .3 m in diameter and are probably from the weathering

Copper is the most important resource in the quadrangle. It is found in six types of occurrences: 1) volcanogenic sulfide deposits; 2) sulfide deposits in carbonate breccia zones; 3) untested geochemical anomalies from pyritic black phyllites; 4) occurrences associated with serpentinized ultramafic rocks; 5) veins, shear zones, and fracture coatings

Stratabound copper deposits closely associated with felsic schist have the greatest economic potential. The felsic

schists are believed to be derived from rhyolitic domes and volcanoclastic piles that have been regionally metamorphosed in the Cretaceous (Wiltse, 1975; Sichermann and others, 1976; Smith and others, 1977). Little detailed information is

available about the size and grade of most of the deposits, but from what is publicly known, copper and zinc are the most important metal commodities. There are also recoverable amounts of lead and silver. At the largest known deposit

at Arctic Camp (42), sulfides occur as both high grade disseminations and massive layers parallel to the metamorphic

foliation, which is also considered to be parallel to original bedding (Wiltse, 1975). Zones of sulfide minerals are sometimes found en echelon on different foliation planes which are mostly thought to be the product of numerous depositional cycles, but may sometimes be caused by shear fractures and isoclinal folds. The most abundant sulfides are

The deposits occur in a belt 5 to 10 km wide following the regional strike of the foliation extending from Cross Creek east 110 km to the Reed River in the Survey Pass quadrangle. Further to the west the country rocks consist of

absence of felsic schist. Although no volcanogenic deposits have been identified west of Cross Creek, this area seems worthy of future detailed exploration. East of Cross Creek, within the zone of known felsic schist, the potential

The base metal resources of the volcanogenic deposits in the Brooks Range are difficult to precisely assess,

because this province has been only partly explored and most deposits are undeveloped. However, a rough approximation of the total Cu, Zn, Pb, Ag volcanogenic resources in the quadrangle can be made by estimating the number, grade, and tonnage of the deposits based upon available exploration data from private companies, favorable host rocks, and geo-

There are 9 known volcanogenic deposits (36-45) in the quadrangle. One of the deposits has published reserves and the other 8 are of unknown size and grade. It is likely that there are more deposits yet to be discovered. Using Cu, Zn, Pb, and Ag stream sediment geochemical anomalies (Ellersieck, 1978b,c,e) from streams draining areas of favorable.

geology with no known deposits, a subjective probability for the number of as yet undiscovered deposits at or near the

90% chance that there are 7 or more undiscovered deposits

50% chance that there are 10 or more undiscovered deposits

10% chance that there are 12 or more undiscovered deposits

In arriving at the probability estimates, it is assumed that a geochemical anomaly or group of anomalies located in

a favorable geologic setting can be used to indicate the likelihood of'a deposit upstream. Multiple metal anomalies or particularly high anomalies from a sample site were judged to give a better chance of a deposit upstream than smalle anomalies or single metal anomalies. It is suspected that the estimated numbers of undiscovered deposits may be too

hort tons) of 4% Cu, 5.5% Zn, 1% Pb, and 51.4 g/ton Ag (1.5 oz/short ton) (Sichermann and others, 1976). Reported

grades from drill samples at the Smucker prospect (36) have indicated 3.8% Zn, 1.2-1.6% Pb, and from 69 to 514 g/ton Ag (2 to 15 ozs/short ton); copper values have not been reported (Petroleum Information, 1978). The average grade of 67 phanerozoic Canadian volcanogenic deposits is approximately 1.2% Cu, 3.4% Zn, 1% Pb (Sangster, 1977). Using the

, Zn, Pb. The Canadian study further suggests that there is a tendency toward an inverse relationship between the

A rough estimate of the tonnage of deposits of unknown size can be also made using the data compiled from Canadian volcanogenic deposits of phanerozoic age (Sangster, 1977). It is suspected that most occurrences which are too small

A significant stratabound sulfide deposit in carbonate breccia is located on Ruby Creek (24) in the Cosmos Hills.

The deposit is both structurally and stratigraphically controlled in a host rock of Devonian dolomite and limestone interlayered with calcareous phyllite. Sulfide minerals fill open spaces and occur as replacement bodies in brecciated

do not show alteration. The most important ore metal is copper; however, zinc, lead, silver, and gold also exist in

rocks in the Cosmos Hills. The similarity of metals at Ruby Creek (24) and the Arctic deposit (42) also suggests a

may also have been responsible for the concentration of metals at Ruby Creek.

copper and zinc may be finely disseminated within the carbonaceous phyllite.

size of the anomalous areas and the apparent stratabound nature of the occurrences.

Occurrences associated with serpentinized ultramafic rock

troy oz.) of gold with the lower figure probably being more accurate.

may be present in some of the streams draining the south side of the Baird Mountains

solutions of igneous or metamorphic origin.

Disseminations at granitic contacts

ignificant quantities. The most common sulfide minerals are pyrite, chalcopyrite, bornite, and spalerite. Known

carbonate rocks. Mineralized bodies generally have their greatest dimension parallel to bedding. Wall rocks typically

The origin of the Ruby Creek deposit is speculative. Sulfur isotope studies by Runnels (1964) suggest that it is of magmatic hydrothermal origin. He thought that the copper may have come from nearby mafic intrusive rocks. Fritts (1970) believed the deposit is allochthonous and related to the solutions responsible for serpentinization of mafic

possible similar origin. Magmatic hydrothermal solutions from granitic plutonic rocks underlying the Cosmos Hills dome

Since the origin of the Ruby Creek deposit is not clearly understood, it is difficult to predict the likelihood

that other similar deposits will be found in the quadrangle. Areas with outcrops of similar lithology and age are

regarded as being the most favorable terrane for this type of deposit. Mapped units having these characteristics include the Baird Group and Skajit Limestone (mapped as unit Pzm) which crop out on the south side and in the northern

Stratabound pyrite zones occurring in black carbonaceous phyllite along the eastern edge of the quadrangle in places contain moderately high geochemical anomalies in both copper and zinc. At the headwaters of the Igning and

Kogoluktuk River valleys some stream gravels are stained red from iron oxides, and the adjacent phyllite contains

abundant thin pyritic lenses less than 2 cm thick parallel to foliation. Geochemical stream sediment anomalies of up to 290 ppm copper and 1100 ppm zinc come from some of these areas (Ellersieck, 1978b,c). No copper or zinc minerals

The rock unit in which these anomalies occur consists of black siliceous phyllite, black calcareous schist, and

crust composed of dolomite, epsomite (hydrated magnesium sulfate) and hexahydrite (hydrated magnesium zinc iron sulfate)

anomalies from stratabound pyrite zones can be traced along strike for a distance of more than 3 km west of the Igning

losely prospected. This stratigraphic zone may have potential for sizeable base metal deposits because of the large

exposed slopes where leaching and reprecipitation by ground water action commonly develops a white surficial precipita

Because of the carbonaceous appearance and stratigraphic extent of the host rocks, the sulfur is probably of sedimen-

River (54) and over several kilometers at the head of the Kogoluktuk River (53). These æreas probably have not beer

Small amounts of copper occur as both stains on fracture surfaces and as disseminated chalcopyrite in mafic igneous rock near serpentinite outcrops west of the Hunt River (10, 11). The copper occurrences are thought to be

Veins, shear zones, and fracture coatings containing copper minerals are found in many areas, throughout the

Small amounts of disseminated copper minerals occur near the contacts of a granitic pluton at the head of Kaluich

Historically gold has been the most important commodity produced from the quadrangle. Placer gold was first dis-

productive streams in the Cosmos Hills. Intermittent mining activity continued from 1915 to 1961. There were three important producing streams: the Shungnak River (17, 19), Dahl Creek (30), and California Creek (34). Small operations

with minor production were located on Lynx and Riley Creeks. Other streams with reported low grade finds and insig-nificant production are Bismark Creek (17), Cosmos Creek (20), Wesley Creek (27), Ruby Creek (24), Jay Creek (23),

Pearl Creek (32), and Canyon Creek (31). Total production figures are not available, but isolated estimates (Brooks, 1907, Smith, 1913, and Fritts, 1970) indicate the region has probably produced between 460 and 1200 kg (15,000-40,000).

Gold placer potential in the Cosmos Hills is considered to be low. Most of the gold comes from stream gravels older than the last glacial stage. Pay streaks of rough coarse gold are commonly buried by many feet of barren gravel and are considered to be on or near the source. Placer streams are small and narrow. As a result, they lack large quantities of untested promising gravel. It is unlikely that gold produced in the future from the Cosmos Hills will

At Midas Creek the gold is sparse, in fine particles, and well worn. The bedrock of upper Midas Creek does not appea

to be auriferous, and gold may have come from glacial gravel derived from the Noatak Valley. It is doubtful that this creek has any significant production or potential. Little is known about the placer gold occurrence on Agnes Creek except that the work done was more in the nature of prospecting than mining. The country rock from the vicinity of Agnes Creek is lithologically similar to that in the Cosmos Hills, and for this reason other small occurrences of gold

Midas Creek (63) and Agnes Creek (16) are two other streams outside the Cosmos Hills where gold has been reported

covered on the lower Shungnak River in 1898. For the next 16 years there was steady activity on some of the most

Creek (6). Copper is found with galena, sphalerite, and fluorite. Small skarn zones are also common at many granitic

contacts throughout the central part of the quadrangle, but their copper content appears to be negligible.

quadrangle. Mineralized veins and shear zones are usually less than 1 m thick and less than a few meters in strike length. Copper occurrences are also present at many places near the contact of the Skajit Limestone and overlying Kekiktuk Conglomerate. The significance of this stratigraphic horizon for possible mineral deposits is not known, but the known mineral occurrences appear to be small. Vein type occurrences are probably formed from hydrothermal

related to the emplacement of serpentinite and probably do not represent an exploitable resource.

have been found in outcrop, but the geochemical anomalies and the textures of pyrite in the host rock suggest that

dark gray limestone. One distinctive characteristic of the calcareous part of this unit is best seen on steep well

tary origin. Sulfide mineral occurrences are not as widespread as sulfate minerals; however, sporadic geochemical

to be of economic interest are not included in the Canadian data, which may make the following tonnage estimates

95% chance a deposit will be greater than 200,000 metric tons

55% chance a deposit will be greater than 1,000,000 metric tons

12% chance a deposit will be greater than 10,000,000 metric tons

<2% chance a deposit will be greater than 100,000,000 metric tons

data above, it seems likely that the grade of the Brooks Range volcanogenic deposits falls between 6 to 10% combine

grade of Cu and Pb, a direct relationship between the grade of Zn and Pb, and no relationship between the grade of

low, because the stream sediment geochemical samples do not quite cover all the areas of favorable geology, and single

The only volcanogenic deposit which has received detailed exploration and with tonnage and grade figures that have een made public is the Arctic deposit (42). It is estimated to have 27 to 32 million metric tons (30 to 35 million

Jade Mountains (Ellersieck, 1978f). Small amounts of chromite have also been found in concentrates from the gold

in metasediments; and 6) disseminations at granitic contacts.

for future discoveries of large high grade base metal deposits is considered high.

samples occasionally fail to give indication of deposits that are known to exist upstream.

pyrite, sphalerite, and chalcopyrite.

Zn and Cu in this type of deposit.

reserves have not been made public.

Black pyritic phyllite type

EXPLANATION FOR MINERAL RESOURCE MAP

Stratabound pyrite deposits in black siliceous phyllite or semischist having base metal

Minerals associated with serpentinized ultramafic rocks occurring in podform masses, veins, contact deposits, or disseminations

Minerals occurring in contact metamorphic aureoles at or near granite contacts in

Chemical or mineral symbols at numbered locations indicate principal commodities of interest.

FAVORABLE MINERAL RESOURCE AREAS

Favorable terrane with highest potential for discovery of new deposits or additional reserves.

Linear belt of pelitic and graphitic schists
Mineralogy similar to other volcanogenic deposits found throughout the world

Same linear belt of pelitic and graphitic schists as map area Al except for an

Favorable terrane with highest potential for discovery of new deposits or additional reserves.

Outcrops containing rocks of similar lithology and age as host rocks of known mineral

Stratabound pyrite deposits in black siliceous phyllite having Zn-Cu geochemical anomalies

Favorable terrane with highest potential for discovery of new deposits or additional reserves.

Letter symbols identify terrane favorable for a corresponding mineral deposit type. Numbers

areas are generalized and may enclose small areas that are unfavorable for discovery of the

following letter symbols identify potential of terrane (l=highest potential). Delineated

EXPLANATION FOR GENERALIZED GEOLOGIC MAP

CORRELATION OF MAP UNITS

SURFICIAL DEPOSITS

OF UNCERTAIN AGE

DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS

SEDIMENTARY AND METASEDIMENTARY ROCKS

LOWER PART OF ENDICOTT GROUP (DEVONIAN)-MAINLY SLATE AND SANDSTONE

DARK CALCAREOUS SCHIST, LIMESTONE, AND SILICEOUS PHYLLITE (DEVONIAN)

METASEDIMENTARY ROCKS OF UNCERTAIN AGE

IGNEOUS AND META-IGNEOUS ROCKS

Pzcq chloritic quartzite and schist (paleozoic)-locally includes feldspathic orthogneiss

ZU UNDIFFERENTIATED METAMORPHIC ROCKS (PALEOZOIC) - INCLUDES MARBLE, QUARTZITE, CALC-SCHIST, AND LESSER QUARTZ-MICA SCHIST

INTERMEDIATE META-IGNEOUS ROCKS (MESOZOIC AND/OR PALEOZOIC) MAY BE PLUTONIC AND (OR) VOLCANIC, MOSTLY GRANODIORITE OR QUARTZ DIORITE IN COMPOSITION

QUARTZ CONGLOMERATE, SANDSTONE, AND MUDSTONE (CRETACEOUS)

IGNEOUS PEBBLE-COBBLE CONGLOMERATE (CRETACEOUS)

MzPzpw PHYLLITE AND MAFIC VOLCANIC WACKE (MESOZOIC OR PALEOZOIC)

uqm GRAY PHYLLITE AND QUARTZ-MICA SCHIST (PALEOZOIC AND OLDER(?))

BASALT, DIABASE, AND GREENSTONE (MESOZOIC AND/OR PALEOZOIC)

FELSIC SCHIST (MESOZOIC AND/OR PALEOZOIC) MAY BE, IN PART, VOLCANIC

Qu UNCONSOLIDATED SURFICIAL DEPOSITS (QUATERNARY)

zm LIMESTONE AND MARBLE (DEVONIAN AND OLDER)

Zbs GRAPHITIC PHYLLITE AND SCHIST (PALEOZOIC)

gr META-GRANITIC PLUTONIC ROCKS (CRETACEOUS)

LITHOLOGIC CONTACT; dashed where uncertain

ULTRAMAFIC ROCKS AND SERPENTINITE (JURASSIC)

Qu >QUATERNARY

s >PALEOZOIC

uqm | PALEOZOIC AND OLDER (?)

LISBURNE GROUP AND UPPER PART OF ENDICOTT GROUP (MISSISSIPPIAN)—INCLUDES KAYAK SHALE AND KEKIKTUK CONGLOMERATE

META-IGNEOUS ROCKS

Kgr CRETACEOUS

Visible chromite, jade, or asbestos minerals in outcrop or stream float

Stratabound and lenticular character of sulfide mineral concentrations

Favorable terrane with lower potential for discovery of new deposits.

lose spacial association of sulfides with felsic schist (rhyolite to dacite composition)

Types of mineral deposits and occurrences

Stratabound volcanogenic sulfide deposits

Placer deposits, mainly gold and jade

Coal occurrences

Stratabound sulfide deposits in carbonate breccia zones

Minerals occurring in veins or along shear zones and fractures

Stratabound volcanogenic Cu-Zn-Pb sulfide deposits

Base metal stream sediment geochemical anomalies

Stratigraphic horizon similar to map area Al

Known mineral deposits or mineral occurrences

Stratabound Cu-Zn sulfide deposits in carbonate breccia

. Stream sediment, soil, or rock geochemical anomalies

Favorable terrane with lower potential for discovery of new deposits.

Favorable terrane with highest potential for discovery of new deposits.

Favorable terrane with lower potential for discovery of new deposits.

(Criteria used to define area)

hin pyrite layers parallel bedding

High sulfate content of host phyllite

High sulfate content of phyllite (C2,C4

Serpentinite or ultramafic host rock

\*Footnote to resource map area symbols

High carbon content of phyllite (C2,C3,C4, C5)

Podform chromite, asbestos vein, and contact jade deposits

Anomalous stream sediment or pan concentrate samples

Favorable terrane with lower potential for discovery of new deposits.

High carbon content of host phyllite

(Criteria used to define area)

Zn geochemical anomalies (C2) High pyrite content of phyllite (C3)

Aeromagnetic anomalies

specific deposit type shown.

CRETACEOUS

M -MISSISSIPPIAN

| DEVONIAN

Unconformity

Unconformity

Stream gravels stained red from iron oxides

Base metal stream sediment geochemical anomalies

. Dolomite breccia

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A., 1975, Geology of the Arctic Camp prospect, Ambler River quadrangle, Alaska: Alaska Division of Geological and Geophysical Surveys Open-file Report 60, 4lp. there are large quantities of broken fragmental rocks found locally on talus slopes. As a result, there is a large A small occurrence of soapstone is located in serpentinized ultramafic rock west of the lower Hunt River (11). There are also talc veins in serpentinite at Asbestos Mountain (29), and north of Stout Mountain in the Cosmos Hills. Prospecting of these occurrences and other serpentinite bodies might result in the discovery of large enough con-Cretaceous clastic rocks bordering the south side of the Brooks Range locally contain small isolated coal beds.

Smith (1913) and Barnes (1967) report that small lense(s?) of bituminous coal occur in outcrops along the lower Ambler River (79). Coal in stream gravel has also been found on the lower Kogoluktuk and Hunt Rivers, but the source has not been located. These occurrences probably do not comprise a large economically exploitable resource; however, they The potential for significant exploitable geothermal power is considered to be low. An unconfirmed small sulfurious hot spring was reported to be located at the headwaters of the Kogoluktuk River (written communication Lewis

Pb, Zn C 5	MOATAK  MoATAK  Marketapu  Market	O Pam California A Constitution of the Constit	68 Cu, Pb, Zn 69	70 Cu,Pb,Zn,Mo OPb,Zn 71 \( \text{Cu,A9} \) B1 72 \( \text{Cu} \)	64Ocu 633 Au
30Cu,Aq	B2 Pzm Pzbs C3 Cu, Ag, Mozbs  C4 Pzm Pzbs Pzbs	Fam.	75 Ocu, Pb, Znj borrite cu 76	B2    60   60   60   60   60   60   60   6	Cu Ocu Ocu Ocu Ocu Ocu Ocu Ocu Ocu Ocu Oc
A2	Pb.Cortluprife  B.2  OPb,Sb	Pzbs J Pzbs Pzbs Pzbs Pzbs Pzbs Pzbs Pzbs Pzbs	Oclaims	68 Ocu, Pb, Zn  B 2  48 Ocu, Pb Cu	570cu  C1  C1  C2  C47  C47  C47  C47  C46  C46  CPb  C45  Clajims  C1
D1  Octor, asbestos  Oc	Gu, Pb  B2  Joden as Destos  La Signatura de la Companya de la Com	A2  D2 Ccoal  Ni 16 Au	35 Ocu 36 Ocu, Zn, Pb, 37 Vcu, Zn, Pb, Ag, Au 38 Cu	and the state of t	ins  200  2330  2330  240  240  250  250  250  250  250  25
Qu 1000 PEET 30' RZE	Onion Portage  Ambler  Another  Another	Ccoal  River  Mountain  Pillak  Lake  R 6 E.	B1 23 24 Au 25 Ocu 22 24 Accu 25 OFe 25 OFe 25 OFe 25 OFe 26 OPb 27 Au 3 Seesios 26 OPb 27 Au 4	A 2 Lorm  32  Au  28  Au  29  Cosbestos, jade, value  30  Au, Ni, Au  30  Sobestos, jade  33  Au  Au  Au  Au  Au  Au  Au  Au  Au	Cu, Zn  A1  Cu, Zn  Cu
This report is preliminary and has not been edited or reviewed for conformity with Geological Survey standards and nomenclature.	5 0 5 5 0 5 CC	SCALE 1:250 000  10 15  10 15 20 25  ONTOUR INTERVAL <b>200</b> FEET DATUM IS MEAN SEA LEVEL	25 MILES  KILOMETERS	LOCATION INDEX	ACKNOWLEDGMENTS
			ALASKA  68°  OUADRANGLE LOCATION	159° 156°  159° 156°  MISHEGUK HOWARD KILLIK t t t t t t t t t t t t t t t t t t t	tudy of the geology and mineral resources of the Ambler angle is a cooperative effort between the U.S. Geological en Alaska Division of Geological and Geophysical Survey hanks are given to Irv Tailleur of the U.S. Geological king available his unpublished records and firsthand keology of the mineral occurrences in the Ambler River one following geologists have contributed to the compilation of mineral occurrences by making available their not aimples: from the U.S. Geological Survey - W. P. Brosge and I. L. Tailleur, and from the Alaska Division of Geolophysical Surveys - G. R. Eakins, C. E. Fritts, R. E. H. Pessel, and M. A. Wiltse. The following companies covided information and helpful discussion: the Anacor ompany, Bear Creek Mining Company, Noranda Exploration, and Inc. D. A. Singer and W. D. Menzie assisted with elasted to estimates of undiscovered volcanogenic delasted

Vein and residual

Cu,Zn,Pb,(Ag), Breccia filling

Placer and vein M

T.19N.,R.7E.

T.19N.,R.8E.

22 Pardners Hill T.19N.,R.8E. Cu,Pb,Zn, (Au),(Ag)

T.19N.,R.9E.

T.19N.,R.9E.

T.19N.,R.8E.

27 Wesley Creek T.18N.,R.9E. Au

28 Riley Creek T.19N.,R.9E. Au

23 Jay Creek

19 Shungnak River T.19N.,R.7E.

samples: from the U.S. Geological Survey - W. P. Brosgè, W. W. Patton, and I. L. Tailleur, and from the Alaska Division of Geological and Geophysical Surveys - G. R. Eakins, C. E. Fritts, R. E. Garland, G. H. Pessel, and M. A. Wiltse. The following companies graciously provided information and helpful discussion: the Anaconda Mining Company, Bear Creek Mining Company, Noranda Exploration, Inc., and WGM Inc. D. A. Singer and W. D. Menzie assisted with the statistics related to estimates of undiscovered volcanogenic deposits.					LITHOLOGIC CONTACT; dashed where uncertain  HIGH ANGLE FAULT; dashed where uncertain, dotted where concealed  THRUST FAULT; dotted where concealed					Little if any mining of lode gold has taken place. The ridge between Dahl and Riley Creeks has low grade disseminated gold in small milky quartz veins within phyllitic schist, and these have yielded insignificant amounts of gold (Smith and Eakin, 1911; Smith, 1913; Reed, 1931; Fritts, 1970). Reports of coarse angular gold come from most producing streams in the Cosmos Hills, and it is likely that the source is within nearby quartz veins; however, there has been little or no attempt at mining them.  The resource potential for gold in the quadrangle probably depends most upon its concentration in volcanogenic deposits and the carbonate breccia deposit at Ruby Creek (24). Although the concentration of gold appears to be low, its presence in these base metal ores could have significant by-product value.									
Serpentinized ultramafic body containing veins and veinlets of cross-and slip-fiber crysotile asbestos; local magnesite veinlets; small test shipment made during World War II but no production; nephrite occurs near some serpentinite contacts.	ets of p. 18-20; He tile and others,	ide	29 Ing-Ihk Mine (Asbestos Mountain)	T.19N.,R.9E.	Asbestos, (nephrite jade), (quartz),(talc)	Vein	М	Serpentinized ultramafic body contains veinlets of cross- and slip-fiber tremolite and chrysotile asbestos; 33.1 tons of tremolite	p. 47; Heide and	43 Diane Creek	T.20N.,R.12E.	. Cu,Zn	Massive and disseminated in la [volcanogenic]	<u>P</u> yers	Weakly disseminated chalcopyrite, bornite, sphalerite, and pyrrhotite in calcareous schist and calc-silicat rocks mainly as float.	Private industry	58	T.25N.,R.10E.	(Cu),(Pb),(Zn), (Zr)
	uring							and about .9 tons of chrysotile shipped during World War II; small occurrences of soapstone and talc are common; small amount of optical	p. 11-13; Fritts, 1970, p. 55-56	44 Que Creek	T.20N.,R.12E.	Cu	Massive and disseminated in la Volcanogenic	<u>P</u> yers	Disseminated malachite in muscovite- quartz schist for at least 275 meters along strike.	Private industry	59	T.25N.,R.10E.	Cu
Intermittent gold placer mi 1898 to 1940; may have prod much as 311 kg (10,000 oz)	duced as 131-132; Ree of Au; 1931, p. 12-	16;			. (	,		quartz crystals shipped in 1943 from vicinity.	" Smith, 1913,	45	T.22 & 23N., R.10 & 11E.	?	?	<u>P</u> ,	83 lode claims staked in 3 blocks 1974.	Alaska Div. of Geol. and Geophys. Surveys Kardex File	60	T.25N.,R.10E.	Cu
concentrates mainly magnetite with rare nuggets of copper and silver; low grade asbestos occurs in green- stone and serpentinite along river;	ite with Fritts, 1970 silver; p. 54-55 in green- ng river;	,	30 Dahl Creek	T.18N.,R.9E.	Au,(asbestos), (Ni),(jade),(Cr), (Ag)	Placer,	М	Consists of an upstream deposit of coarse gold and a lower deposit of fine gold; upper deposit lies on or near its source; total production is the largest in the district, but	p. 125-129; Reed, 1931, p. 18-22; n Anderson, 1947,	46	T.23N.,R.11E.	Pb	Vein	0	Galena, pyrite and magnetite in float of quartz vien.	Alaska Div. of Geol. and Geophys. Surveys field	61	T.25N.,R.10E.	Cu
gravels also contain nephri boulders weathered from wes								probably less than 622 kg (20,000 o	z) 1970, p. 55-56							station 72Z1			
of valley.  Sheared serpentinite with l tremolite and chrysotile as	low-grade Reed, 1931, sbestos 16-17; Ander		31 Canyon Creek	T.19N.,R.10E.	Au	Placer	P	Several prospect pits sunk in 1932 but minor production if any.		47	T.23 & 24N., R.11E.	Cu,Pb,(Au)	Vein	<u>P</u>	Numerous small quartz veins and veinlets with chalcopyrite and galena in quartzose rocks in contact aureole of granite; 46	Private industry	62	T.26N.,R.11E.	Cu
veinlets; gold in creek pla but no production; minor no jade in creek gravels.	acer 1945, p. 20-	-21;	32 Pearl Creek	T.20N.,R.9E. (approximate location)	Au	Placer	Р	Minor production in 1933; location uncertain.	Smith, 1934, p. 53	48	T.23N.,R.10E.	Cu	Vein	0	lode claims staked 1974.  Bornite, chalcopyrite, cuprite, and pyrite in 6 m thick quartz	Alaska Div. of Geol. and Geophys.	63 Midas Creek	T.28N.,R.12E.	Au
Malachite and azurite in qu veins cutting carbonate roo numerous lode claims staked	cks; field static	on aska	33 Lynx Creek	T.18N.,R.10E.	Au	Placer	М	Small scale placer operation on stream gravels; mined intermittentl from 1912 to 1940; no production records kept.	Reed, 1931, y p. 27-28; Fritts, 1970, p. 57	49	T.23N.,R.10E.	Cu,Pb,(Au)	Vein	<u>P</u>	vein in limestone on ridge saddle near granite contact.  Numerous small quartz veins and	Surveys field station 72B48 Private industry	64 Ningyoyak Creek	T.29N.,R.11E.	Cu
1960.	Geophys. Sur Kardex File	rveys	34 California Creek	T.18N.,R.10E.	Au	Placer	М	Placer operations began in 1918 and continued steadily into the 1930's; gold is coarse and probably	Reed, 1931, p. 27- 28; Fritts, 1970,				•		veinlets with chalcopyrite and galena in quartzose rocks in contact aureole of granite; 20 lode claims staked 1974.		65	T.29N.,R.8E.	Cu,(Ag)
Chalcopyrite and bornite in of dolomitic limestone above slate and schist; minor ga selected sulfide samples co	ve dark 1911, p. 300 alena; Smith, 1913 contain p. 149-150;	0-303; Fritts,						near its source; production figures not known but probably between 155. kg and 622 kg (5,000-20,000 oz).		50 Shishakshinovik Pass	T.24N.,R.11E.	Cu,Pb,(Ag), (Au)	Vein?	0	Selected specimens containing copper minerals assay 9.81 percent Cu, 27.73 percent Pb,	Smith, 1913, p. 150	66	T.29N.,R.8E.	Cu
up to 1.37 g/ton Au (.04 o 47.9 g/ton Ag (1.4 oz/ton)	). Sichermann, and Fikkan,	Russell	35	T.22N.,R.8E.	Cu	Coating	0	Malachite staining on discontinuous lense of marble.	s U.S. Geol. Survey field station 72Tr9.2	51	T.23N.,R.11E.	Cu,Pb,(Au)	Vein	Р	and some Au and Ag.  Numerous small quartz veins and veinlets with chalcopyrite and	Private industry	67	T.29N.,R.8E.	Cu
A little gold recovered in	n 1931. Reed, 1931, p. 18, 31; I 1970, p. 58	Fritts,	36 Smucker	T.22N.,R.8E.	Zn,Pb,Ag,Cu	Massive and disseminated in layers [volcanogenic]	<u>P</u> .	Abundant malachite, disseminated pyrite, chalcopyrite, and sphaleri in chlorite and graphitic muscovit	e-						galena in quartzose rocks in contact aureole of granite; 24 lode claims staked 1974.		68	T.28N.,R.8E.	Cu,Pb,Zn, (Cd)
Deposit predominantly Cu a but Pb, Ag and Au also fou significant quantities; mi zone within a 760 m thick carbonate sequence consist	und in p. 147-148; ineralized Matzko and Devonian 1963; Runne	Freeman, ls,						quartz schist; drill samples 820 m apart indicate layered sulfide zon 3 to 9 m thick, assaying 100 to 255 g/ton Ag (3 to 15 oz/ton), 2-8 Zn, and 1-1.6% Pb.	e(s?)	52	T.23N.,R.12E.	Pb,Zn,Ag,Mo	Vein?	0	Minor galena, sphalerite, and molybdenite in granite near its contact zone; high geochemical anomalies in Pb, Zn, and Mo; float boulder has 2 percent Pb, 1.6 percer	U.S. Bur. Mines, unpublished data	69	T.28N.,R.9E.	(Zn),(Pb)
dolomite, limestone, phylli calcareous phyllite; commo minerals are pyrite, chalc	on ore Sichermann,		37 Sleet Creek	T.22N.,R.8E.	Cu,Zn	Massive and disseminated in layers[volcanogenic]	P	Malachite staining in muscovite- quartz schist.	Private industry	e lee					Zn, and more than 102.8 g/ton Ag (3 oz/ton).				
bornite, and lesser, tenna tetrahedrite, sphalerite, a selected samples reach .02 but the U content of the o	antite- Fikkan, 197 and galena; 2%, eU		38	T.22N.,R.8E.	Cu,(Zn)	Massive and disseminated in layers [volcanogenic]	0	Malachite stain in small marble outcrop in saddle; high Cu and Zn stream sediment anomally.	U.S. Geol. Survey field station 55Trl05	53	T.24N.,R.12E.	(Zn),(Cu)	Disseminated	0	Pyritic black phyllite; some samples from area have >100 ppm Cu and >1000 ppm Zn; zone extends to both sides		70	T.28N.,R.9E.	Cu,Pb,Zn,(Mo), (V)
apparently negligible; cur grade and tonnage figures available but they are app	rrent not		39 Horse Creek	T.22N.,R.10E.	Cu,Zn,Pb	Massive and disseminated in layers [volcanogenic]	P	Details and reserves not published but deposit similar to Arctic deposit (Map no. 42).	Sichermann, Russell, and Fikkan, 1976	54	T.25N.,R.13E.	(Cu),(Zn)	Disseminated	0	of creek.  Thin pyritic layers parallel foliation in black phyllite;	Ellerseick, 1978a	71 Kav	T.28N.,R.9E.	Cu,Ag
Magnetite masses up to 220 occur as float near contac limestone and schist.		,	40 Sunshine Creek	T.21N.,R.10E.	Cu,Zn,Pb	Massive and disseminated in layers [volcanogenic]	Р	Details and reserves not published but deposit similar to Arctic deposit (Map no. 42).	Sichermann, Russell, and Fikkan, 1976						pyritic zone extends 4 km to the south; richest stream sediment sample contains 290 ppm Cu and 450 ppm Zn.				
Small amounts of galena in vein and brecciated dolom		13;	41 Dead Creek	T.21N.,R.11E.	Cu,Zn,Pb	Massive and disseminated in layers [volcanogenic]	Р	Details and reserves not published but deposit similar to Arctic deposit (Map no. 42).	Sichermann, Russell, and Fikkan, 1976	55	T.25N.,R.12E.	Cu	Vein?	0	Sparse massive sulfide samples containing chalcopyrite and malachite weathering from	U.S. Geol. Survey 76Md266	72	T.27N.,R.9E.	Cu
Low grade deposits of gold in creek gravel; minor pro	d found Reed, 1931, oduction. p. 17		42 Arctic	T.21N.,R.11E.	Cu,Zn,Pb,Ag, (Au)	Massive and disseminated in layers [volcanogenic]	Р	Polymetallic, stratabound volcano- genic deposit within a suite of low- to medium-grade igneous and	Sichermann, Russell, and	56	T.26N.,R.11E.	Cu	Coating	0	dolomite near contact with quartzite.  Malachite staining at contact of conglowerate and marble	U.S. Geol. Survey field station	73	T.27N.,R.8E.	Cu
Area mined was a high, ste dry tributary of Riley Cr placer was 200 m long and	reek; 1930, p. 33	36;						pelitic schists; pyrite, chalcopy and sphalerite comprise 20-90% of a number of sulfur-rich horizons .3 to over 18 m thick that form a	Smith and others, 1977	57	T.25N.,R.11E.	Cu	Vein	0	Malachite, azurite, and pyrite	76Tr143  Alaska Div. of Geol. and Geophys.	74	T.28N.,R.8E.	Cu
than 10 m wide; low grade occurs in quartz veins cu schist on hillside above   minor production from pla	e gold p. 22-24, 3 utting Fritts, 197 placer; p. 58; Cobb	30; 70,						triangular shaped mineralized zone about 1030 x 730 m in plan and abo 90 m thick. Deposit drilled and estimated to contain 27-32 million (30-35 million short toos) of pool	out						in quartz vein.	Surveys field station 72B62	75	T.26N.,R.7E.	Cu,Pb,Zn, barite

 O - Mineral occurrence (no development) P - Prospect, inactive since 1970

T.25N.,R.8E.

T.23N.,R.11E.

Cu, U

P - Prospect, active since 1970 M - Mine with recorded production. All inactive with the exception

of the jade cutting operations on Dahl Creek and Jade Mountain (Map nos. 30 & 14). The metric system is used for description of all weights and measures

with the exception of those in parentheses which are given in troy ounces and short tons.

References - "Alaska Div. of Geol. and Geophys. Surveys Kardex File" refers to the claim file of active and inactive claims maintained by the state survey.

> Background information for this folio is published as U.S. Geological Survey Circular 793, available free of charge from the U.S. Geological Survey, Reston, Va. 22092.

chalcopyrite in small pods and

? Six lode(?) claims staked 1968. Alaska Div. of

sample, 365 ppm Cu and 625 ppm Zn.

Metatorbernite (Copper Urany)

Anomalously high stream sediment Private industry

Phosphate Hydrate) in quartzite field station talus from south side of cirque 72Tr25.1

conglomerate below large flat

(30-35 million short tons) of rock

g/ton Ag (1.5 oz/ton), and a small amount of Au.