MAP AND TABLES DESCRIBING MINERAL RESOURCE POTENTIAL OF
THE BROOKS RANGE, ALASKA

TABLES AND REFERENCE LIST TO ACCOMPANY OPEN-FILE REPORT 78-1-B

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey standards and nomenclature.
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<th>Additional comments</th>
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<th>Estimated number of deposits; percent chance that there are the number predicted or more deposits</th>
<th>Scale and source for the deposit type, see Table 2 for quantitative data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Sandstone coal</td>
<td>--</td>
<td>In Mississippian slate of the Lisburne Hills.</td>
<td>No data</td>
<td>--</td>
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</tr>
<tr>
<td>2.</td>
<td>Bituminous coal</td>
<td>--</td>
<td>Mainly in Lower Cretaceous sedimentary rocks in the northern foothills of the Brooks Range. Some scattered occurrences known in Lower Cretaceous and Tertiary rocks to the west of the Colville River.</td>
<td>Barnes (1977) indicates the total coal resources of northern Alaska as about 510 billion metric tons. Tailleur and Brasel (1976) have also indicated they may be substantially larger, perhaps three times as large. About 90% of the coal-bearing lands lie north of the area of this report.</td>
<td>--</td>
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</tr>
</tbody>
</table>
(a) Cr, asbestos, and Pt-group elements in ultramafic rocks.

(b) Ni and Cu in mafic portions of the ophiolite sequence.

Associated with ultramafic and mafic portions of Jurassic-Permian ophiolite sequences, including dunite, peridotite, gabbro, and basalt.

The ophiolite complexes and surrounding areas have been mapped in reconnaissance only and the existence of these rocks has only recently become known. Some limited industry prospecting for chromite but details of the bodies largely unknown.

A few scattered occurrences of chromite reported in the literature. Commonly known that it occurs widely in the dunite of the ophiolite complexes—as is usual for this rock—but no major concentration known.

Worldwide, most chromite, Pt-group elements, and asbestos occur in rocks similar to those that comprise major portions of these complexes. They also commonly have significant Ni and Cu mineralization. The occurrence of significant deposits in these particular areas is speculative as so little is known of the geology in detail.

Numbers of podiform chromite deposits based on outcrop area and ultramafic rocks and regression model of deposits in California and Oregon. Estimated number of deposits is only for deposits with tonnages comparable to those used in the grade-tonnage model.

50% chance that there are 180 deposits or more.
Cu, Zn, barite deposits

Largely unknown. The major copper prospect, the Omar, may be similar to the deposits at Bornite (area 10), a breccia filling in carbonate rocks. Much of the mineralization is in the Carbonates of the Bird Group.

Deposits apparently restricted to a Jurassic to Mississippian unit of black chert, shale and limestone.

One prospect, the Frost, probably contains 1 million metric tons of barite and may contain 10 million tons.

Unpublished data from the U.S. Bureau of Mines indicate substantial tonnage at the Red Dog prospect but little information as to the vertical extent of the mineralization.

The origin of the deposits has variously been indicated as syngenetic, Mississippi Valley type, volcanogenic and hydrothermal. September 1977 press releases by General Crude Oil Co. and Houston Oil and Minerals Corp. reported that 4 diamond drill holes at a prospect northeast of the Red Dog deposit have intersected from 13 to 30 meters of Pb-Zn-Ag mineralization with ore grades ranging from 1.5 to 8.5% Pb, 5.8 to 25.5% Zn, 3 to 182 grams per metric ton Ag, and up to 0.25% Cd.

Widespread Cu mineralization with occurrences of Zn and barite. Some work by industry, but generally poorly known. One to 10 million metric tons of barite contained in one prospect.

Zn-Pb-barite mineralization known that may be of substantial size. Only surface information available at the best known prospect in the area, the Red Dog. Area is currently highly active. Estimated number of deposits is only for deposits with tonnages comparable to those described in the grade and tonnage column.

50% 50% 100% chance that there are one or more deposits similar grade material and may contain 500 million metric tons.
(a) Stratiform, volcanogenic Zn-Pb-barite deposits.

(b) Widespread geochemical anomalies in Pb, Zn, and locally Ag.

(c) Sedimentary barite.

(a) The Orenchwater deposit which is similar to mineralization in area 5 occurs in a disrupted sequence of Mississippian dark chert, dark shale and silt.

(b) Uncertain. The geochemical anomalies occur in clastic and chemical sedimentary rocks that range in age from Mississippian to Early Cretaceous.

(c) Barite nodules comprise about 10% of portions of the Siksikpuk Formation of Permian age.

No data.

Area has been covered by reconnaissance geology as yet unpublished except at small scale. Detailed studies have been undertaken at the Orenchwater deposit by Nokleberg and Winkler (In press) and most of the area has been covered by geochemical surveys. Few of the geochemical anomalies have as yet been field checked.

The Pb-Ag geochemical anomalies found in 1977 that occur in the Lower Cretaceous sedimentary rocks on the northwestern end of the area were unexpected. The anomalies suggest further work in the extensive Lower Cretaceous terrane along the north side of the Brooks Range, an area previously considered to be of little interest for its mineral resources.

U.S. Bureau of Mines estimates gold potential of about 22.2 million grams.

7. Placer gold

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No data source known.

Total production through 1937 estimated at about 970,000 grams of gold. Cobb, 1973. Gold and silver, U.S. Bureau of Mines, 1971. Area has been known in the area since at least 1909. Area currently active on a small scale.

Placer gold has been known in the area since at least 1909. Area currently active on a small scale.

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U.S. Bureau of Mines estimates gold potential of about 22.2 million grams.
Deposits are associated with Cretaceous monzonite and syenite plutons that intrude Cretaceous rocks. Detailed work on the U-Th deposits by government (Eakins, 1977; Jones and Forbes, 1977; Miller, 1977; Miller and Bunker, 1975; Miller and Elliott, 1977; and Staatz and Mimran, 1976) as well as unpublished work by industry including limited diamond drilling. The Energy Research and Development Administration has recently completed an airborne radiometric and magnetic survey of the area (E.R.D.A., 1975) as well as a geochemical survey of the area as yet unpublished and is currently involved in a follow-up program on the geochemical anomalies.

Most of the prospects consist of disseminated uranium minerals in the intrusive rocks, in vein-type deposits within the intrusives, or in the country rocks, and particularly near dike swarms genetically related to the uraniferous plutons. The plutons have a very high geochemical background of U and Th. For example, samples of the Zane Hills and Selawik Hills plutons contain up to 130 ppm U and 260 ppm Th.

Much current activity and potential for high-grade U-Th deposits in the uraniferous plutons of the Selawik and Zane Hills. As yet exploration is in its infancy although the general area of interest and the geologic controls of the deposits are established. Immense resources of U and Th available if it becomes economic or necessary to mine deposits with an elevated geochemical background of those elements.
Sandstone-type U deposits

A possibly thick Tertiary sedimentary section occurs in the Selawik Basin which is bordered on the north by a belt of uraniumiferous plutons (area 8). Occurrence of Tertiary sedimentary rocks is inferred on the basis of geophysical data and occurrence of uranium in rocks of similar age in other parts of Alaska. Limited exposures of Tertiary sediments along the south side of the Selawik Basin adjacent to the Selawik Hills, Minick No. 1 drilled for petroleum about 30 km south of Kotzebue penetrated 1800 meters of probably Tertiary sediments that included numerous tuffaceous layers and coal bed.

Possibly thick Tertiary host rocks favorable for the occurrence of sandstone-type U deposits adjacent to uraniumiferous plutons. Widely speculated upon as such but no exploration yet.

No uranium mineralization is known to the area. Area covered in various reconnaissance reports but almost entirely mapped as Quaternary units. Drilling will be necessary to test the presence of uranium mineralization. Limited uranium content in this area, only one hole has been drilled and that for petroleum. The Energy Research and Development Administration has recently completed an airborne radiometric survey over much of the area at a spacing of 6 miles between flight lines (E.R.D.A., 1975). A geochronological sampling program was recently conducted in the area but the results have not yet been published.

A long-known mineralized area with deposits of various types. The most significant is the Bornite deposit for the Bornite Cu-Zn deposit has been extensively drilled and explored by a 326 meter shaft. Diamond drilling has continued each summer at the Bornite deposit for the last decade. Several largely unexplored deposits of similar type also occur in the area.

Limited exposure of Tertiary sedimentary units along the south side of the Selawik Basin adjacent to the Selawik Hills, Minick No. 1 drilled for petroleum about 30 km south of Kotzebue penetrated 1800 meters of probably Tertiary sediments that included numerous tuffaceous layers and coal bed.

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The area has produced 1.5 million grams of placer gold from numerous creeks but these are now largely inactive. Production of jade for the lapidary trade will probably continue indefinitely although its value will be relatively minor, probably less than one million dollars per year.
Widespread occurrences of Cu and Pb mineralization with local occurrences of Zn and barite as disseminations and in quartz veins. Uncertain. Mineralization occurs in Devonian and Mississippian clastic and carbonaceous rocks. Reconnaissance geologic map published (Pessel and Brosge, 1977). Area currently under study as part of the AMRAP program in the Ambler River quadrangle and most of the mineral occurrences in the area were found during this program (Hayfield and Tailleur, in preparation). Little detailed work in the area and almost none by industry. Area covered by reconnaissance geochemistry and aeromagnetic surveys as part of the AMRAP program.

Mineral resource potential of the area speculative. Area is poorly known but characterized by a number of prospects, none of themselves, but which in total suggest a metallogenic province with the possibility for one or more large deposits.
Deposits associated with metamorphite piles in a 1200 meter interval of metaclastic-schist, calc-silicate, marble, chlorite schist and quartzite that occurs in a belt of low-grade metamorphic rocks that consist primarily of chlorite-muscovite schist (Smith, Profett, Haduch and Solomian, 1977).

Arctic deposit has reserves of 27-32 million metric tons of material that contains about 0.6% Cu, 5.5% Zn, 51 grams per metric ton Ag, 15% Pb and minor Au.

Reconnaissance geologic mapping has recently been completed of that portion of the area in the Duclair River quadrangle is also being covered in an AMAP series to be published this year. That portion in the Survey Pass quadrangle is being covered in an AMAP project during the summer of 1977. The area has been subject to reconnaissance geologic mapping by government as well as detailed work by industry. Surface evidence of mineralization is subtle and definite proof of mineralization usually can only be substantiated by drilling.

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Surface evidence of mineralization is subtle and definite proof of mineralization usually can only be substantiated by drilling.

Clearly defined belt of volcanogenic Cu-Zn mineralization with Pb, Ag, and Au. One very large deposit known, Arctic, has about 30 million metric tons of reserves of 0.6% Cu, 5.5% Zn, 51 grams per metric ton Ag, 15% Pb and minor Au, and numerous similarly mineralized areas of unknown size and grade that are being actively explored. Excellent possibilities for additional major deposits. Estimated number of deposits is only for deposits with tonnages comparable to those used in the grade-tonnage model.
Stratiform volcanogenic Cu-Zn deposits with Pb, Ag, and Au values.

Inferred as similar to area 13a. No data

Geology known only in reconnaissance for the most part. Limited detailed mapping and industry effort in the area. Portions in the Chandalar and Ambler River quadrangles have been geochemically sampled in reconnaissance as part of the AARAP projects that will be published in early 1978. The only geologic information is based on unpublished reconnaissance mapping by Tailleur including on another map of this series (Grybeck and others, 1977a). Some reconnaissance geochemistry by Pessel (1976) but almost no industry work.

Potential extension of area 12a based on continuity of favorable geologic units. Estimated number of deposits is only for deposits with tonnages comparable to those used in grade-tonnage model.

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Potential extension of area 12a based on continuity of favorable geologic units. Estimated number of deposits is only for deposits with tonnages comparable to those used in grade-tonnage model.

Felsic and intermediate volcanogenic massive sulfide model.

Felsic and intermediate volcanogenic massive sulfide model.
Polymetallic contact meta-morphics or felsic igneous association including occurrences of Pb, Zn, Ag, Cu, Sn, and Mo.

Deposits located in peripheral portions of or in host rocks adjacent to mineralized Cretaceous granite plutons.

No data

Only reconnaissance geology available for much of these areas. Some limited reconnaissance work by industry prior to 1971 but almost no detailed work by industry on the mineralization. The few mineral deposits known were found during reconnaissance work by the Geological Survey.

The occurrence of the polymetallic mineralization associated with the granite plutons is largely defined by the geochemical work. Good to excellent potential for occurrences of deposits of Pb, Zn, Cu, Sn, and Mo and perhaps other elements in the border zones or adjacent to the Cretaceous granite plutons which characterize these areas. Data on the specific location of the mineralization as well as tonnage and grade is almost entirely lacking.

The phosphate beds contain marine phosphate beds that contain resources of U and V occur in a belt across the central and eastern foothills of the northern Brooks Range. The deposits are restricted to the Triassic Shublik Formation and Mississippian Aiapah Limestone. The extent and grade of the deposits rest on limited data at a very few localities. Cathcart and Culbertson (1973) estimate one billion metric tons of rock containing greater than 2% P2O5 and more tonnage at lower grades.
<p>| | | |</p>
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| 15. | (a) Placer gold deposits | (b) Numerous occurrences of ore minerals as disseminations or in quartz veins in Devonian-Silurian carbonates. Production of at least 500,000 grams of placer gold in 5 creeks through 1937. Production relatively minor since then. Reconnaissance geologic mapping completed (Brought and Hofer, 1960). Moderately detailed work in the vicinity of Wild Lake completed by Chipp (1971). Some geochemical exploration. The few identified gold quartz veins in the area probably indicate the source of the placer gold. The placer gold deposits have been known since 1899 and have long been subject to the usual placer prospecting methods which are generally definitive and have not been greatly improved by new technology. Extension of gold placer production into surrounding area is unlikely because of the thoroughness of the past prospecting.
|   |   |   |
| 16. | Placer gold deposits | The gold production from the Wiseman area from 1899 to 1961 was at least 6.5 million grams. Some relatively minor production since 1961. The placers gold deposits as small Cu, Pb, Zn occurrences and placer gold deposits. It is estimated that about as much placer gold remains as has been produced to date. Most of the easily won placers have been mined and relatively little could be mined economically at 1977 prices and mining costs.   |
17. (a) Porphyry Cu deposits.
(b) Stratabound Cu deposits in limited extent at one locality.
(c) Associated with a belt of hypabyssal to mesozonal felsic to intermediate intrusive that extends for about 100 km.
(d) Porphyry Mo deposit
(e) Pb-Zn-Ag deposits in contact metamorphic or hydrothermal veins.
(f) Associated with a belt of hypabyssal to mesozonal felsic to intermediate intrusive that extends for about 100 km.

Reconnaissance geologic mapping completed in 1960 by Dietrich and Raifer (1964); detailed geologic mapping of the Chandalar and Philip Smith Mountains quadrangles near completion. Detailed geological and geochemical mapping by industry in vicinity of much of the known mineralization. Reconnaissance geochemistry completed as part of the ARMAP projects; substantial detailed geochemistry by industry in vicinity of some of the known mineralization. Some drilling on at least one porphyry copper deposit. Moderate level of work by industry for the last decade.

A well-defined belt of mineralization marked by porphyry copper deposits, a porphyry molybdenum deposit, and Pb-Zn-Ag deposits is probably associated with a belt of felsic plutons. No major deposits yet defined but good to excellent possibility that one or more of the known deposits will prove to have substantial reserves. Chances for discovery of additional deposits are good to excellent. No major deposits yet identified but very good possibility that such deposits may be extensions to known occurrences and as previously undiscovered deposits. Estimated number of deposits is only for deposits with tonnages comparable to those used in the grade-tonnage model and only applies to the Chandalar quadrangle (Sawyer, in press).

(a) 90% 50% 10% chance that there are 5 deposits or more

(b) One deposit has been identified; no estimate of possibility of additional deposits.

(a) Porphyry copper model
(b) Porphyry molybdenum model.
(a) Au-quartz veins
(b) Gold placers.

Gold-bearing quartz veins crosscutting phyllite and greenschists. Reserves of at least 885,000 grams of Au at the Mikado mine.

Gold lodes known since at least 1910; detailed work includes geology and geochemistry (Chipp, 1970), as well as over 500 meters of underground work and surface trenching. The area is in the Chandalar quadrangle now being actively worked as a AMRAP project. Currently active and some Au is being mined presently.

About 1.2 million grams of placer gold produced from Little Squaw, Big and Tobin Creek from 1906 into the 1960's (DeYoung, in press).

Over 800,000 grams of lode Au reserves with current activity potential for additional Au reserves in the area of known mineralization north of Squaw Lake. Potential for major extensions to this long-known area doubtful in view of the long history of prospecting in the area.
### 19. Syngenetic or volcanogenic stratiform Zn-Pb-Ag-Cu mineralization in the Hunt Fork Formation.

**Deposits by definition are restricted to the Devonian Hunt Fork Formation which consists largely of black shale.**

| No data |

The Hunt Fork Formation extends in a wide belt for at least 725 km along the backbone of the Brooks Range for its distribution is well established at reconnaissance scale. Recent geologic and geochemical work (Dutro, BrosgA and Marsh, 1977; J.Cathrall, oral commun.) from the Chandalar and Philip Brook Mountains quadrangles indicates scattered occurrences of Zn and Pb mineralization and extensive Pb, Zn, Ag geochemical anomalies. Spotty geochemical anomalies in Pb and Zn also occur to the north in the Mississippian rocks but they have not been field checked and their significance is unclear.

Information largely limited to reconnaissance geologic mapping. No or very little work by industry.

### 20. (a) Volcanogenic Cu-Zn massive sulfide deposits?

**Uncertain**

(b) Syngenetic Zn-Pb deposits?

(c) Au or base-metal veins?

| No data |

Type and age of mineralization may be related to the stratiform Pb-Zn deposits recently discovered in the Selwyn Basin in Canada.

An extensive area of black shale with a few Zn-Pb-Ag occurrences as well as a high background of these metals and local anomalies. Little field work by government or industry on its mineral resource potential.

Little known of the mineralization in these areas. Their potential lies in the scattered occurrences of mineralization and in the general abundance of the lower Paleozoic-Precambrian metamorphic rocks throughout the Brooks Range to contain mineralization. Speculative potential for volcanogenic (?) Zn-Pb or Cu deposits similar to those in the Selwyn Basin and elsewhere in the Yukon Territory, Canada.

Barite deposits apparently restricted to the Permian Echoeka Formation. No data

Reconnaissance geology available for the area but no de­
dtails work on the barite deposits by industry or
government. Reconnaissance geoch­
chemical survey completed for the Philip Smith Mountains quadrangle
(J. Cathrall, in prepara­tion).

The geochemical sampling in the Philip Smith Mountains
quadrangle indicates that the Permian rocks are
associated with strong Ba
anomalies. At least one
possible large occurrence
of barite known in the
Permian rocks in the
Atigun Canyon (Paul
Metz, oral commun.).

Little indication of
barite was reported in
these rocks prior to 1977.

Also note presence of a
layer of nodular barite in
the Siksikpuk Formation of
Permian age in the western
Brooks Range (area 6).

Permian strata along the
north side of the Brooks
Range from at least the
Atigun to Echoeka Rivers
contain occurrences of
barite and persistent
geochemical anomalies
that suggest possibility
of barite deposits.

Little indication of
barite was reported in
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layer of nodular barite in
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Permian strata along the
north side of the Brooks
Range from at least the
Atigun to Echoeka Rivers
contain occurrences of
barite and persistent
geochemical anomalies
that suggest possibility
of barite deposits.

22. Volcanogenic Cu deposits (?)

Most of the relatively few
Cu occurrences occur in the
lower Paleozoic mafic volcanic
rocks. No data

Reconnaissance geology available for all the
area. A reconnaissance
mineral resource assess­
ment report published (Brown and Wilcox, 1979).

Area is part of
the Arctic National
Wildlife Range and has
been closed to prospec­
ting since 1960. Almost
no industry work and
little detailed govern­
ment work. Some scat­
ttered geochemistry.

Scattered Cu occurrences
in lower Paleozoic rocks,
especially the mafic vol­
canics, may be indicative
of significant Cu miner­
alization. Area poorly
known.
Polymetallic contact metamorphic or disseminated Igneous deposits including occurrences of Pb, Zn, Cu, Ag, Sn, U, and Mo.

Deposits are in the periphery of or adjacent to Paleozoic granitic plutons. No data

Reconnaissance geology available for the area. Detailed geologic mapping around the plutons published (Bogle, 1977) but only reconnaissance work in 1937 and 1958. Little emphasis on mineralization in any of the work and little if any exploration by industry. A mineral resource and re­source evaluation report (Bogart, 1979) by Brooks and Reiser, 1979, but based on little new information. Some scattered geochemistry (Brooks, Reiser, and Estlund, 1970).

A representative sample of the Byllak granite contains 50 ppm U (White, 1952) which suggests plutons may be uraniferous.

Scattered mineral occurrences of Pb, Zn, Ag, Cu, Sn, U, and Mo as well as some geochemical sampling indicate the granites are genetically related to the mineralization. Little government work and no industry work directed toward the metallic mineral resources of the area. Data on the specific location of the mineralization, its extent, as well as its tonnage and grade are almost entirely lacking.

Much Quaternary cover over the potential host rocks. Limited amount of data (White, 1952) suggests Byllak granite to the south is urani­ferous.

Geologic speculation suggests sandstone-type U deposits in Tertiary continental strata. Sparse data indicate a poten­tial source in uraniferous granite to the south. No known mineralization in the area.

Sandstone-type U deposits.

Continental Tertiary units on the Arctic Coastal plain. No data

Only reconnaissance geology available for most of the area.

Much Quaternary cover over the potential host rocks. Limited amount of data (White, 1952) suggests Byllak granite to the south is uraniferous.
25. Pb, Zn, Cu, Mo, Bi, and W deposits or geochemical anomalies. In Mississippian-Divonian clastic sequence; may be related to granitic intrusive in area. No data

26. Scattered Ag, Cu, barite, Pb, Zn occurrences or geochemical anomalies. Galena and sphalerite occurrences known in the area but origin enigmatic. A potentially significant area of Pb, Zn, Cu, Mo, W and Sn mineralization largely of unknown origin and extent.

Data restricted to reconnaissance geologic mapping and some scattered geochemical sampling. Galena and sphalerite occurrences known in the area but origin enigmatic. A potentially significant area of Pb, Zn, Cu, Mo, W and Sn mineralization largely of unknown origin and extent.

Data restricted to reconnaissance geologic mapping and very limited geochemical sampling. Little if any work by industry.

Scattered Ag, Cu, Pb, Zn, and barite occurrences in poorly known lower Paleozoic rocks that may be indicative of resources of these materials.
<table>
<thead>
<tr>
<th>Deposit Type</th>
<th>Variable (units)</th>
<th>Number of deposits used</th>
<th>Correlation Coefficients</th>
<th>95 percent of deposits have at least</th>
<th>50 percent of deposits have at least</th>
<th>10 percent of deposits have at least</th>
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<tbody>
<tr>
<td>Porphyry Copper</td>
<td>Tonnage (millions of tons)</td>
<td>41</td>
<td>-0.07 NS</td>
<td>100</td>
<td>100</td>
<td>430</td>
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<tr>
<td></td>
<td>Average copper grade (percent)</td>
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<td>0.0</td>
<td>0.0</td>
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<td>0.000</td>
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<td></td>
<td>Average molybdenum grade (percent Mo)</td>
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<td>0.0</td>
<td>0.000</td>
<td>0.000</td>
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<tr>
<td>Idem Arc</td>
<td>Tonnage (millions of tons)</td>
<td>41</td>
<td>-0.07 NS</td>
<td>100</td>
<td>100</td>
<td>430</td>
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<tr>
<td></td>
<td>Average copper grade (percent)</td>
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<td>0.0</td>
<td>0.000</td>
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<tr>
<td></td>
<td>Average molybdenum grade (percent Mo)</td>
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<td>0.0</td>
<td>0.0</td>
<td>0.000</td>
<td>0.000</td>
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<tr>
<td>Porphyry Copper</td>
<td>Tonnage (millions of tons)</td>
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<td>-0.05 NS</td>
<td>26</td>
<td>26</td>
<td>340</td>
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<td>Average molybdenum grade (percent Mo)</td>
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<td>0.065</td>
<td>0.13</td>
<td>0.026</td>
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<tr>
<td>Fulfitrom Charrite</td>
<td>Tonnage of Cr₂O₃ (tons)</td>
<td>38</td>
<td>-0.46**</td>
<td>24</td>
<td>24</td>
<td>5.5</td>
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<td>Average copper grade (percent)</td>
<td>38</td>
<td>0.86</td>
<td>1.7</td>
<td>3.5</td>
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</tr>
<tr>
<td></td>
<td>Average gold grade locally significant but not determined</td>
<td>38</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Mafic Volcanogenic</td>
<td>Tonnage (millions of tons)</td>
<td>37</td>
<td>-0.13 NS</td>
<td>2.3</td>
<td>2.3</td>
<td>0.0</td>
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<tr>
<td></td>
<td>Average copper grade (percent)</td>
<td>37</td>
<td>1.3</td>
<td>1.3</td>
<td>5.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Average gold grade excluding deposits without reported grades (percent)</td>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Felcic and</td>
<td>Tonnage (millions of tons)</td>
<td>89</td>
<td>-0.41**</td>
<td>1.9</td>
<td>1.9</td>
<td>10.0</td>
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<tr>
<td>Intermediate</td>
<td>Average copper grade (percent)</td>
<td>89</td>
<td>0.54</td>
<td>1.70</td>
<td>5.40</td>
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<tr>
<td>Volcanogenic</td>
<td>Average zinc grade excluding deposits without reported grades (percent)</td>
<td>41</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfide</td>
<td>Average lead grade excluding deposits without reported grades (percent)</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tonnage contained silver excluding deposits without reported silver (tons)</td>
<td>38</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nickel Sulfide</td>
<td>Average nickel grade (percent)</td>
<td>48</td>
<td>-0.03 NS</td>
<td>1.20</td>
<td>1.20</td>
<td>5.90</td>
</tr>
<tr>
<td></td>
<td>Average copper grade (percent)</td>
<td>48</td>
<td>0.32</td>
<td>0.41</td>
<td>1.20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tonnage of contained silver (tons)</td>
<td>48</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mercury</td>
<td>Tonnage of contained mercury (tons)</td>
<td>165</td>
<td>-0.34 NS</td>
<td>0.63</td>
<td>0.63</td>
<td>17</td>
</tr>
<tr>
<td>Raven</td>
<td>Tonnage of contained gold (tons)</td>
<td>89</td>
<td>-0.36 NS</td>
<td>0.61</td>
<td>0.61</td>
<td>1.10</td>
</tr>
<tr>
<td>Tungsten</td>
<td>Tonnage (millions of tons)</td>
<td>31</td>
<td>-0.36 NS</td>
<td>0.61</td>
<td>0.61</td>
<td>1.10</td>
</tr>
</tbody>
</table>
before the reports cited above.

especially germane to the assessment of the mineral resources of the area. The references cited there are usually not given in this publication unless there is a specific reason to do so.

The following three references summarize the voluminous literature on the geology and mineral resources of the area. Also included are references to works published before the reports cited above.

BIBLIOGRAPHY


