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METALLIFEROUS AND SELECTED NONMETALLIFEROUS MINERAL RESOURCE POTENTIAL IN THE BIG DELTA QUADRANGLE, ALASKA

By

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Introduction

This report is an assessment of the metalliferous mineral potential of the Big Delta quadrangle, Alaska, by tract and by type of deposit, and a discussion of the occurrence of selected nonmetallic resources. The assessment is based on investigations of the geology, geochemistry, geophysics, and telegeology of the area.

Geologic investigations included regional scale (1:250,000) reconnaissance geologic mapping (Weber and others, 1978), age dating of selected igneous rocks (Wilson, 1976), and chemical analysis of mineralized and unmineralized rocks (Foster and others, 1978). Geochemical investigations included analysis of the minus 80 mesh fraction of stream sediments, analysis of the nonmagnetic heavy mineral concentrates of stream sediments, analysis of the oxide residue of stream sediments, and analysis of the ash of willow leaves and twigs (O'Leary and others, 1978; Hessin and others, 1978a-j). Geophysical investigations consisted of an airborne aeromagnetic survey of the quadrangle (Alaska Div. Geophys. Surveys, 1975) and an interpretation of the aeromagnetic data (Griscom, 1978). Telegeologic investigations consisted of an interpretation of Landsat imagery of the quadrangle (Albert and Steele, 1978).

Acknowledgments

The preparation of this report was facilitated by the efforts of a number of people. Discussions with G. D. Eberlein and D. A. Singer particularly aided in the preparation of the report, as did the technical assistance of Dan Mosier, Steve Luthy, and Diana Nelson.

Methodology

The report follows the general methodology of the AMRAP program (Singer, 1975), which consists of delineation of tracts as permissive for the occurrence of mineral deposits by type, estimation of relevant characteristics, such as tonnage and average grade of deposits of each type, and estimation of the number of deposits by type likely to occur within delineated tracts.

As with other AMRAP studies, the methodology has been adjusted to be consonant with the amount and type of information available. In the Big Delta quadrangle, very little detailed geologic, geochemical, and geophysical work, of the type necessary to establish the presence or absence of significant mineralization, has been undertaken by industry or government. Thus, some modifications of each step in the methodology have been necessary. For two delineated tracts, it is not possible to unequivocally identify which of several deposit types may occur within the area. For several deposit types, no grade and tonnage models are available. Available information has not warranted estimation of the number of deposits which occur in delineated areas. For vein deposits, no areas have been delineated because the quadrangle has a low and relatively uniformly distributed potential for such deposits. Construction materials, fuels, and nonmetals have been considered as commodities rather than as deposit types.

Components of the report

The report consists of six major components:

1. A map (plate 1) showing the location of prospects and mines, occurrence of sulfides and tracts delineated as permissive for the occurrence of deposits by type.

2. A table (1) describing prospects and mines.

3. A table (2) describing sulfide occurrences.

4. A table (3) which describes geologic, geochemical, and geophysical characteristics of tracts delineated as permissive for the occurrence of mineral deposits, and which discusses deposit types and commodities that may occur within the Big Delta quadrangle but for which no tracts were delineated.

5. A table (4) presenting for several metals the amounts considered to be geochemically anomalous in assessing the quadrangle's mineral potential.

6. A table (5) presenting models of the tonnages and average grades of some types of deposits considered permissive for occurrence in the Big Delta quadrangle.

Each of these components are described in more detail.

The map is presented on a 1:250,000-scale generalized geologic and topographic base. The location of lode prospects and mines is shown by a square, and placer mines and prospects are shown by a rod-shaped symbol. In some cases a group or groups of claims have been represented by a symbol located near the center, as best known, of the claims. Each symbol, either lode or placer, is identified by a large Arabic numeral which keys the location to a description in table 1. The location of sulfide occurrences is shown by a dot. Each dot has an associated small Arabic numeral which keys the location to a description in table 2. Tracts considered permissive for the occurrence of particular deposit types are delineated by a solid or dashed line on the map. A dashed line indicates greater uncertainty in the location of a boundary of a delineated tract than for a boundary shown by solid line. Each tract is indicated by a Roman numeral which keys the tract to a description (table 3).

Table 1 summarizes information available through November 1978 on prospects and mines for metallic minerals. This table has been slightly modified from a portion of the table which accompanys Open-File Map 77-168D (Eberlein and others, 1977). It contains nine columns which are explained below.

Column 1, map number--Refers to a location given by number and symbol on the map. Most locations were determined from data compiled by the U.S. Bureau of Mines (1978) and from data from the Mining Kardex File of the Mining Information Office Division of Geological and Geophysical Surveys, Department of Natural Resources, College, Alaska. On many creeks and in some other areas, one location number is given for all of the claims, prospects, or mines in that area and may represent many claims, prospects, and mines belonging to several different people or companies.

Column 2, names--Names of prospects, mines, or mining areas are listed alphabetically. Most locations are named for creeks, and the many names of individual claims are not given. However, in a few cases, the area is designated by names of claims or mines.

Column 3, location--Township and range is given for all listed mines and prospects. However, some locations, particularly of old claims and prospects, are not accurately known and are so indicated by a query.

Column 4, development category--A mine is defined as a mineral deposit with recorded production:

M--mine with known activity since 1970

m--mine with no known activity since 1970

(?)--production not certain but probable

A prospect is defined as a deposit or (potential) possible deposit that has been staked or been subject to exploratory work, but has no known production:

P--prospect with known or probable activity since 1970

p--prospect with no known activity since 1970

In some cases a deposit indicated by m or M may presently be a prospect.

Column 5, resources--The main metallic commodity is indicated in this column by the conventional chemical symbol. Byproducts produced in minor amounts, potential byproducts, and possibly significant minor constituents are similarly indicated parenthetically.

Column 6, form--Physical configuration of the deposit.

Column 7, type--Because available information is limited, only two categories are given, placer and hydrothermal. Hydrothermal is used in its broadest sense and, as more information becomes available, the classification of some of these deposits can be refined. A query indicates that classification as hydrothermal is particularly uncertain because of inadequate information.

Column 8, brief description--A brief summary of the available information on the geology and mineralogy of the deposits is given in this column. Where possible, information on history, development, production, and resources is included.

Column 9, principal references--References considered to be most informative about the individual deposits are cited in abbreviated form. A more complete reference is given in the reference list at the end of this report. Much information was gleaned from the Mining Kardex File (59) of the Mining Information Office, Division of Geological and Geophysical Surveys, Department of Natural Resources, College, Alaska, and because this information was examined for each deposit and data included where considered informative, this source is understood and not cited. Where no other reference is given, this is the source of information.

English units of measure are retained for this table in order to quote the source material more easily and correctly.

Table 2 gives the location and available information of localities where sulfides or indications of sulfides were observed in rocks during the fieldwork. The distribution as shown by this table and map is not necessarily indicative of the true density and distribution of sulfide minerals in the rocks because the density of observations is extremely variable. For instance, a relatively small number of helicopter landings and traverses were made in the western part of the quadrangle because of the dense vegetation cover. Also fewer rocks are exposed in that part of the quadrangle because of an extensive and thick cover of loess. The table has eight columns and column six has ten parts.

Column 1, map number--This number refers to the set of smallest numbers on the map (plate 1) of this report, and the number indicates the location where a rock containing sulfides was observed.

Column 2, field number --This number refers to the locality as indicated in the original field notes, on field maps, and in geochemical data.

Column 3, location of township and range--Any map number can easily be located on the map by reference to township and range.

Column 4, sulfide mineralogy--A mineral name is given where sulfide minerals were identified megascopically or described in the field. A query following a mineral name indicates uncertain identification. A query standing alone indicates that the sulfide minerals were not identified in the field. If the space is blank, sulfide minerals were not definitely seen, but there were other indications of their possible presence, such as iron oxide stain.

Column 5, rock description-The name of the host rock or adjectives describing the rock in which sulfide minerals were seen is given.

Column 6, chemical data--The results of six-step semiquantitative spectrographic analyses for silver, arsenic, copper, molybdenum, lead, antimony, tin, tungsten, and zinc are given in parts per million. Gold as determined by the atomic absorption method is also given in parts per million. More complete analytical data for these rocks are available in Foster and others (1978).

If no data are given in this column for a rock, the rock was not analyzed.

Column 7, occurrence--Most of the sulfides recorded occur as small grains finely disseminated (D) throughout the rock. In a few cases, more massive sulfide occurrences were found in veins (V).

Column 8, remarks--Supplemental information recorded in field notes and additional results from spectrographic analysis which might be applicable in determining the significance and meaning of the sulfide occurrence are presented.

Table 3 describes each delineated tract outlined on the accompanying map (plate 1). Each area is identified by a Roman numeral. First, the types of deposits which may occur within the area are presented; then, the evidence used to delineate the tract and to identify permissive deposit types is presented. The evidence is presented under six general headings: known mineralization, rock types and structural features, observed sulfides, anomalous geochemical elements, aeromagnetic interpretation, and alteration.

Under known mineralization, the presence of any mines or prospects within the delineated area is discussed. Because the majority of mines and prospects in Big Delta quadrangle are either gold veins or gold placers, known mineralization was of limited use in delineating most areas for most deposit types.

Under rock types and structural features, those geologic features relevant to possible mineralization are presented. Often the rock types will include types which are not represented as separate units on the geologic map.

The discussion of observed sulfides is limited to noting the presence of sulfides and mention of particular significant occurrences. More detailed information about observed sulfides is available in table 2.

For each of the four geochemical media used in Big Delta, elements which reach anomalous levels within a delineated tract, are presented under anomalous geochemical elements. Six elements have been considered for each medium: Cu, Pb, Zn, Mo, Sn, and W. The metals were determined by six-step semiquantitative spectrographic analysis; in addition, the stream-sediment samples were analyzed by atomic absorption for Cu, Pb, and Zn. A table presents the frequency with which the metals reach anomalous levels within the delineated tract. Metals determined by atomic absorption are indicated by a subscript "AA." Anomalies were defined roughly as the upper five percent of the values of each element (see table 4). For a few tracts, supplemental elements with relatively high values are mentioned.

Under aeromagnetic interpretation, features from the interpreted aeromagnetic map of Big Delta (Griscom, 1978) that may be relevant to possible mineralization are discussed.

The final heading for each delineated area discusses alteration (excluding weathering) observed in the delineated area.

Table 4 presents for each geochemical medium the levels of each element that are considered anomalous in the discussions of table 3. As was previously stated, anomalous values were defined roughly as the upper five percent of the values of each element. It is difficult to interpret such values in isolation; fortunately, geochemical data are available for the portion of the Tanacross quadrangle lying in the Yukon Tanana Upland. These data help to place the

Big Delta geochemical data in perspective. Figure 1 through 8 present histograms for four elements, Cu, Pb, Zn, and Mo, from two media, namely, stream sediments and oxide leach for samples from the Big Delta (Hessin and others, 1978a-j) and from the Yukon-Tanana Upland portion of the Tanacross quadrangle (Curtin and others, 1976a-c; Curtin, Day, Carten, and others, 1976).

Though no statistical tests have been performed on the data, examination of the figures suggests two conclusions. Firstly, samples from both areas contain similar amounts of copper and molybdenum (figs. 1, 2, 7, 8). Secondly, samples from Big Delta seem to contain more lead and zinc than do those from the Yukon-Tanana Upland parts of Tanacross (figs. 3, 4, 5, 6). This is especially marked for zinc in stream-sediment samples. Part, but probably not all, of this effect is due to the presence of different associations of rocks; zinc is present in especially high amounts in the north-central portion of Big Delta. The zinc may well be associated with a sequence of rocks for which Tanacross has no similar units.

Table 5 presents statistical models of tonnage and average grade for three deposit types (felsic and intermediate volcanogenic sulfide, mafic volcanogenic sulfide, and porphyry copper), which may occur within the Big Delta quadrangle. These models, which are based on information from well-explored deposits, consist of probabilistic estimates of grades and tonnages of each deposit type, together with the correlations of grades and tonnage. Such models provide an indication of the relative resource abundance that can be expected if, indeed, such deposit types are present.

For some deposit types which occur or may occur in the Big Delta quadrangle, it has not been possible to construct grade and tonnage models. These include placer gold, various types of vein and lead-zinc deposits.

The latter occur throughout the northern Cordillera in clastic sedimentary rocks, carbonates, and their metamorphic equivalents, which range from Precambrian to at least Devonian in age (Thompson and Panteleyev, 1976). Data were collected on the tonnage and average grades of lead, zinc, and silver for 24 of these deposits, which occur in diverse geologic settings and, therefore, may be expected to be heterogeneous in their grades and tonnages. Indeed, plots of the variables indicate the deposits probably represent more than one population; this is especially evident when silver grade is plotted against the other variables. Thus a model of the grades and tonnages of such lead-zinc deposits cannot be constructed.

The tracts delineated as permissive for the occurrence of lead-zinc deposits contain diverse geologic settings similar to those in which many of the 24 deposits mentioned above occur. Thus while no grade and tonnage model can be constructed, some statistics based on the 24 deposits may be useful for demonstrating the variability of such deposits. Of the 24 deposits:

1. 90 percent have greater than 45,000 tonnes, and 90 percent have less than 57 million tonnes;

2. 90 percent have average zinc grades of greater than 2.8 percent, and 90 percent have average zinc grades of 10 percent or less;

3. 90 percent have average lead grades of greater than 0.9 percent, and 90 percent have average lead grades of less than 11.3 percent.

4. 90 percent have an average silver content of greater than 0.8 ppm, and 90 percent have average silver contents of less than 228 ppm.

Conclusions

The geology, geochemistry, geophysics, and past mining and prospecting history indicate that the Big Delta quadrangle has a number of areas permissive for the occurrence of metalliferous mineral deposits. Most of these delineated areas or tracts are in the eastern part of the quadrangle. Parts of the western part of the quadrangle may also have some potential, but their delineation has not been possible because geologic relationships are obscured by the heavy cover of vegetation and thick surficial deposits.

Both gold placer and lode deposits are known to occur in the Big Delta quadrangle. Reported placer production has been about 3,310 kg of gold and 440 kg of silver, mainly from the Richardson district (tract VIII) and the Caribou Creek area (tract VII). Lode deposits have produced about 1 kg of gold and 0.7 kg of silver, all from the Black Mountain area (tract II). Because the quadrangle has been extensively prospected for gold, there is little likelihood that many new placer deposits remain in new areas. However, additional placer gold may remain in ground that was considered uneconomic at lower prices. The quadrangle has a low and relatively uniform potential for the occurrence of additional small gold-bearing quartz veins.

The geology of the quadrangle is also permissive for the occurrence of several additional deposit types. Three delineated tracts (I, II, III) are permissive for the occurrence of porphyry copper deposits. The nearest known porphyry copper deposits are in the Tanacross quadrangle (180 km to the east), and these deposits appear to be lower in tonnage and grade than porphyry deposits in British Columbia and the conterminous western United States.

Three tracts (IV, V, VI) were delineated as permissive for the occurrence of two types of volcanogenic sulfide and (or) lead-zinc deposits associated with sedimentary rocks, or their metamorphic equivalents. One of these tracts (IV) has been delineated for the occurrence of felsic and intermediate volcanogenic sulfide deposits and (or) lead-zinc deposits associated with metasedimentary rocks. A second tract (VI) has been delineated for the occurrence of mafic volcanogenic sulfide deposits. Finally, a third tract (V) has been delineated for the occurrence of lead-zinc deposits associated with metasedimentary rocks. Not enough information is available to establish the presence or absence of such deposits. However, in Canada these types of deposits are known in similar geologic settings. Grade and tonnage models built on well-explored deposits indicate that both types of volcanogenic deposits can be of significant tonnage and grade. While no grade-tonnage model of lead-zinc deposits associated with sedimentary rocks could be constructed, some statistics are presented to demonstrate the variability of grades and tonnages of such deposits which occur in clastic sedimentary rocks, carbonates, and their metamorphic equivalents in the northern Cordillera.

The quadrangle is also permissive for vein deposits other than gold. Antimony and bismuth veins are known. Metals, such as tin and tungsten, are present in stream-sediment samples and heavy-mineral concentrate samples and may be derived from veins. Metal-bearing veins appear to be broadly distributed throughout the quadrangle, but promising areas with concentrations of veins, other than tracts I and II and prospect number 41 (table 1), are not known.

Areas with strongly anomalous stream-sediment samples and high concentrates of sulfides and other strong indications of mineralization have not been found in the Big Delta quadrangle, but permissive geology, the occurrence of minor amounts of sulfides, and spatially concentrated, low-level stream-sediment geochemical anomalies are considered useful pathfinders and deserve consideration in the search for sulfide deposits.

There has been little exploration for uranium in the quadrangle; some adjacent quadrangles seem to have a greater potential for containing significant amounts of uranium. Material, such as sand, gravel, and riprap, occur in sufficient quantity to meet local construction needs. The potential for significant deposits of such commodities as coal and methane is considered low.

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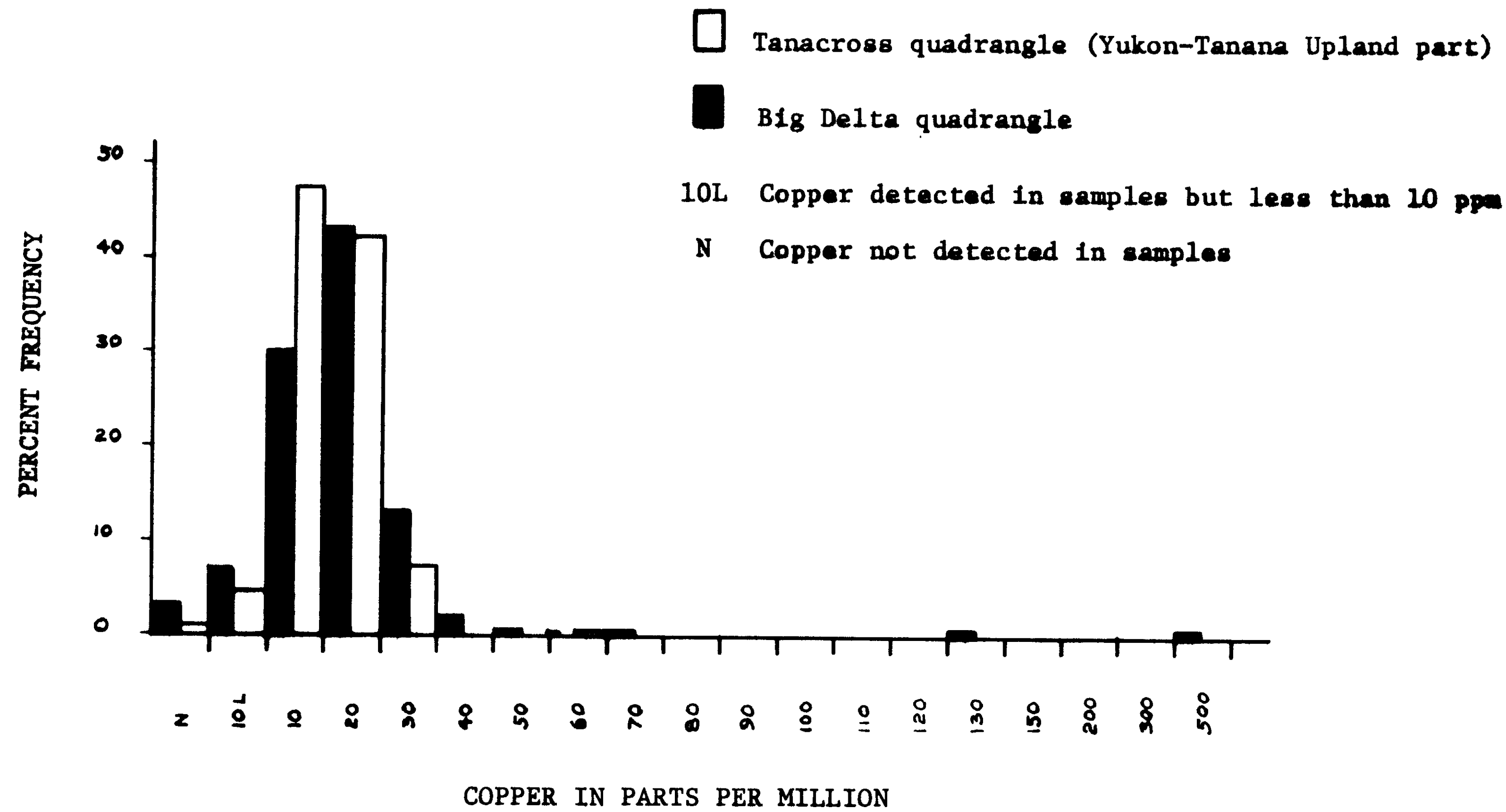

Figure 1.--Histograms comparing amounts of copper, determined by the atomic absorption method, in stream-sediment samples from the Big Delta quadrangle and the Yukon-Tanana Upland part of the Tanacross quadrangle (modified from Hessin and others, 1978f; Curtin and others, 1976a).

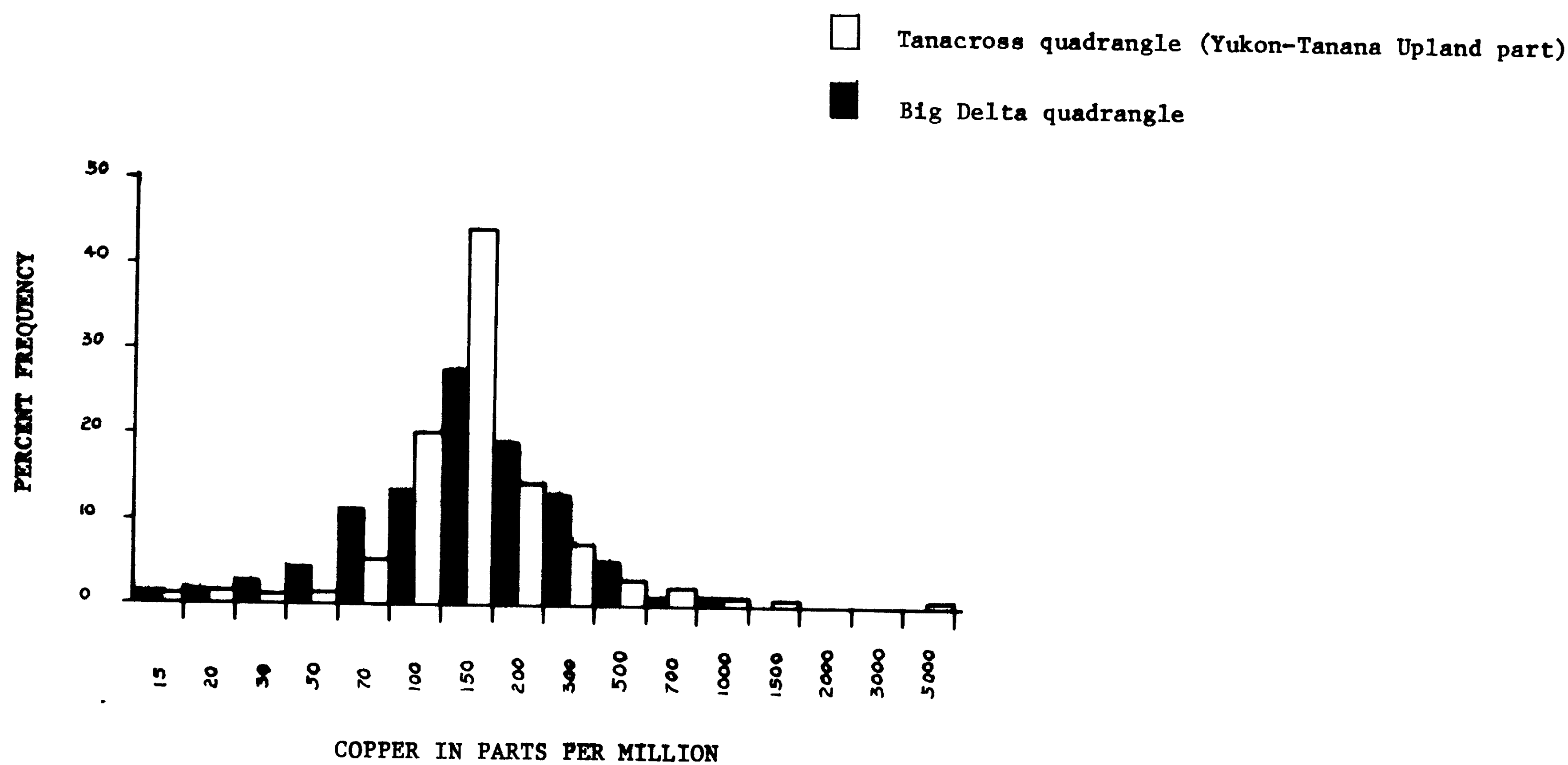

Figure 2.--Histograms comparing amounts of copper determined by six-step semiquantitative spectrographic analysis in the oxide leach of stream-sediment samples from the Big Delta quadrangle and the Yukon-Tanana Upland part of the Tanacross quadrangle (modified from Hessin and others, 1978i; Curtin and others, 1976a).

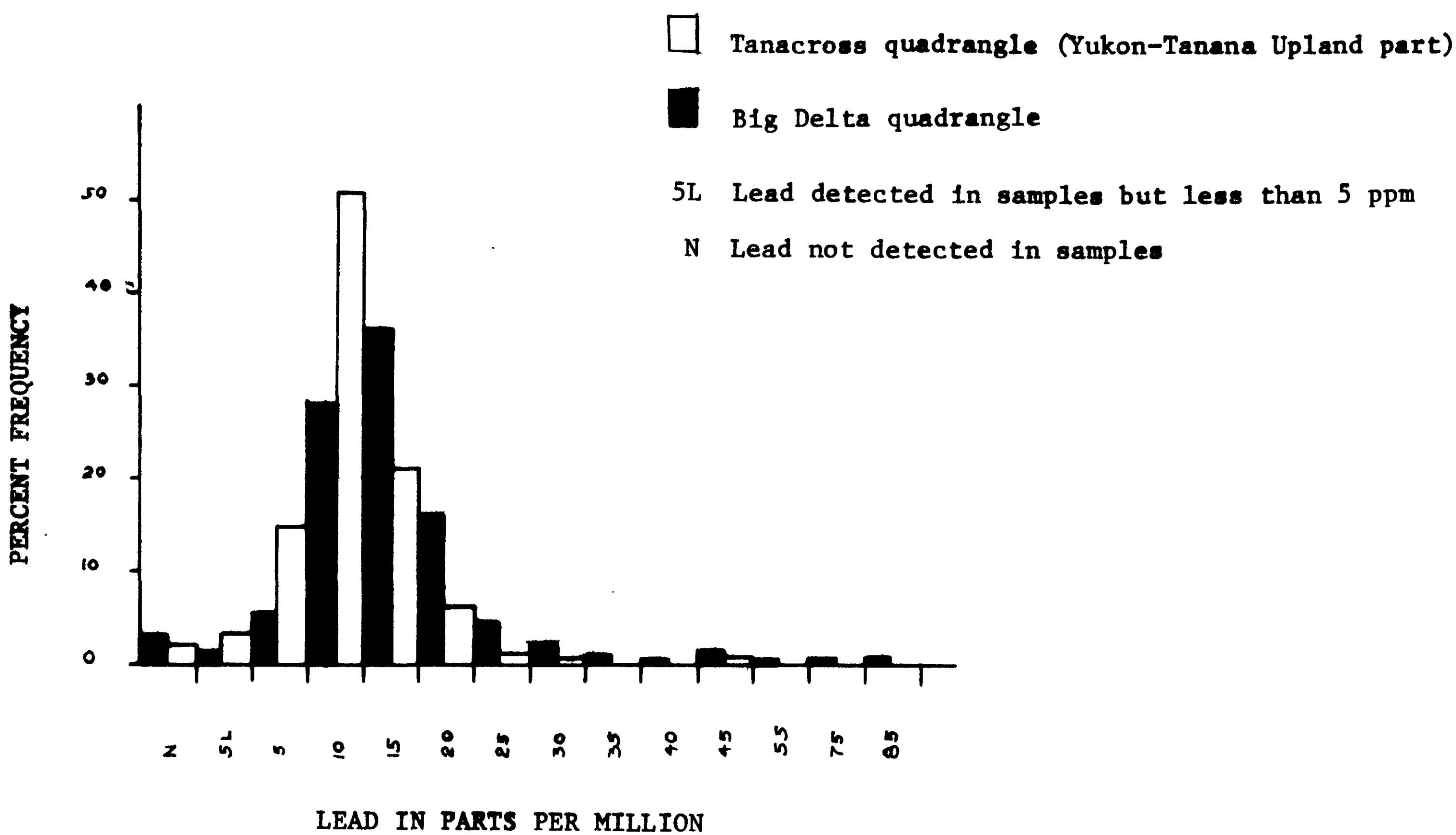

Figure 3.—**Histograms** comparing amounts of lead, determined by atomic absorption, in stream-sediment samples from the Big Delta quadrangle and the Yukon-Tanana part of the Tanacross quadrangle (modified from Hessin and others, 1978f; Curtin and others, 1976b).

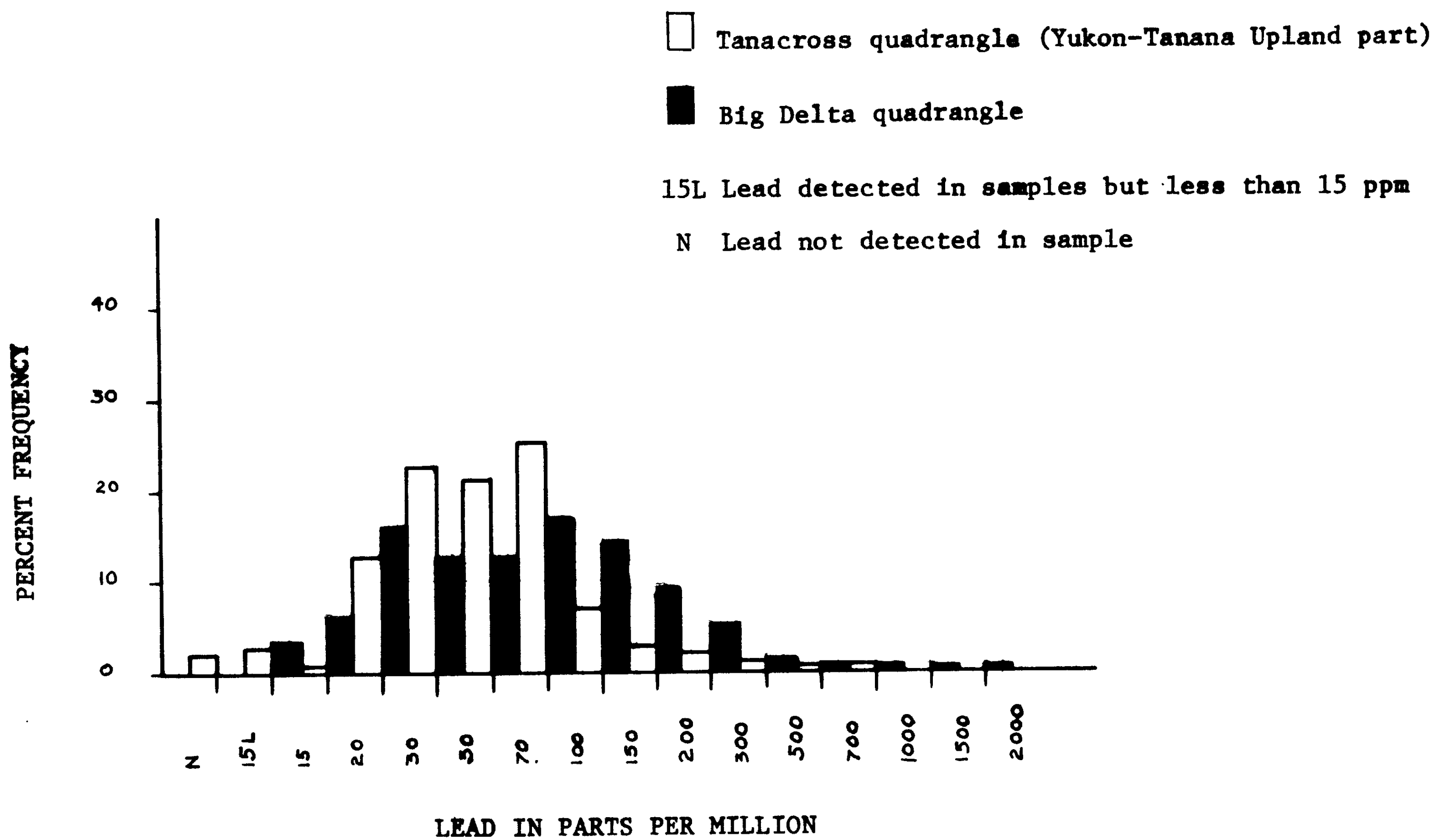

Figure 4.--**Histograms** comparing **amounts** of lead determined by six-step **semiquantitative spectrographic analysis** in the oxide leach of stream-sediment samples from the Big Delta quadrangle and the Yukon-Tanana Upland part of the Tanacross quadrangle (modified from Hessin and others, 1978i; Curtin and others, 1976b).

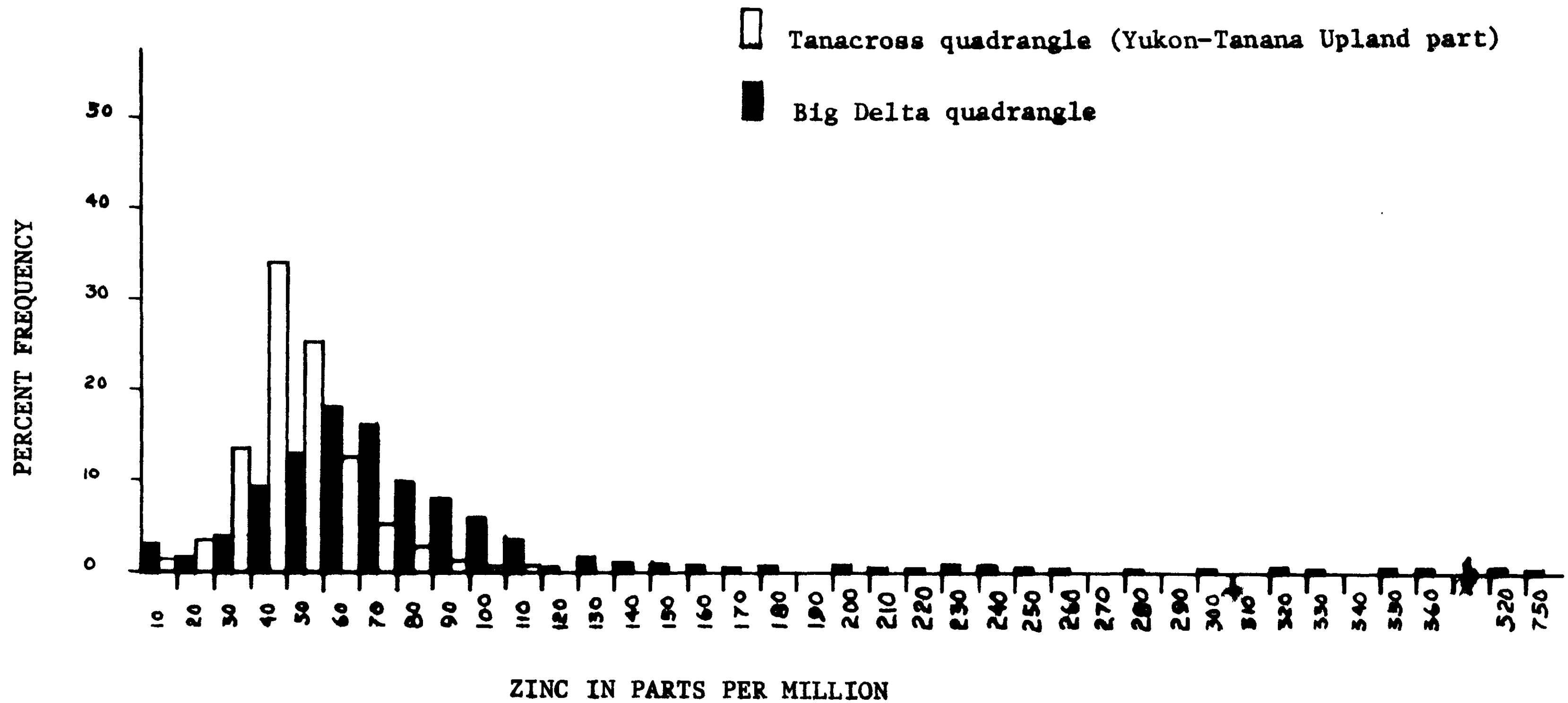

Figure 5.--Histograms comparing amounts of zinc, determined by atomic absorption, in stream-sediment samples from the Big Delta quadrangle and the Yukon-Tanana Upland part of the Tanacross quadrangle (modified from Hessin and others, 1978f; Curtin and others, 1976c).

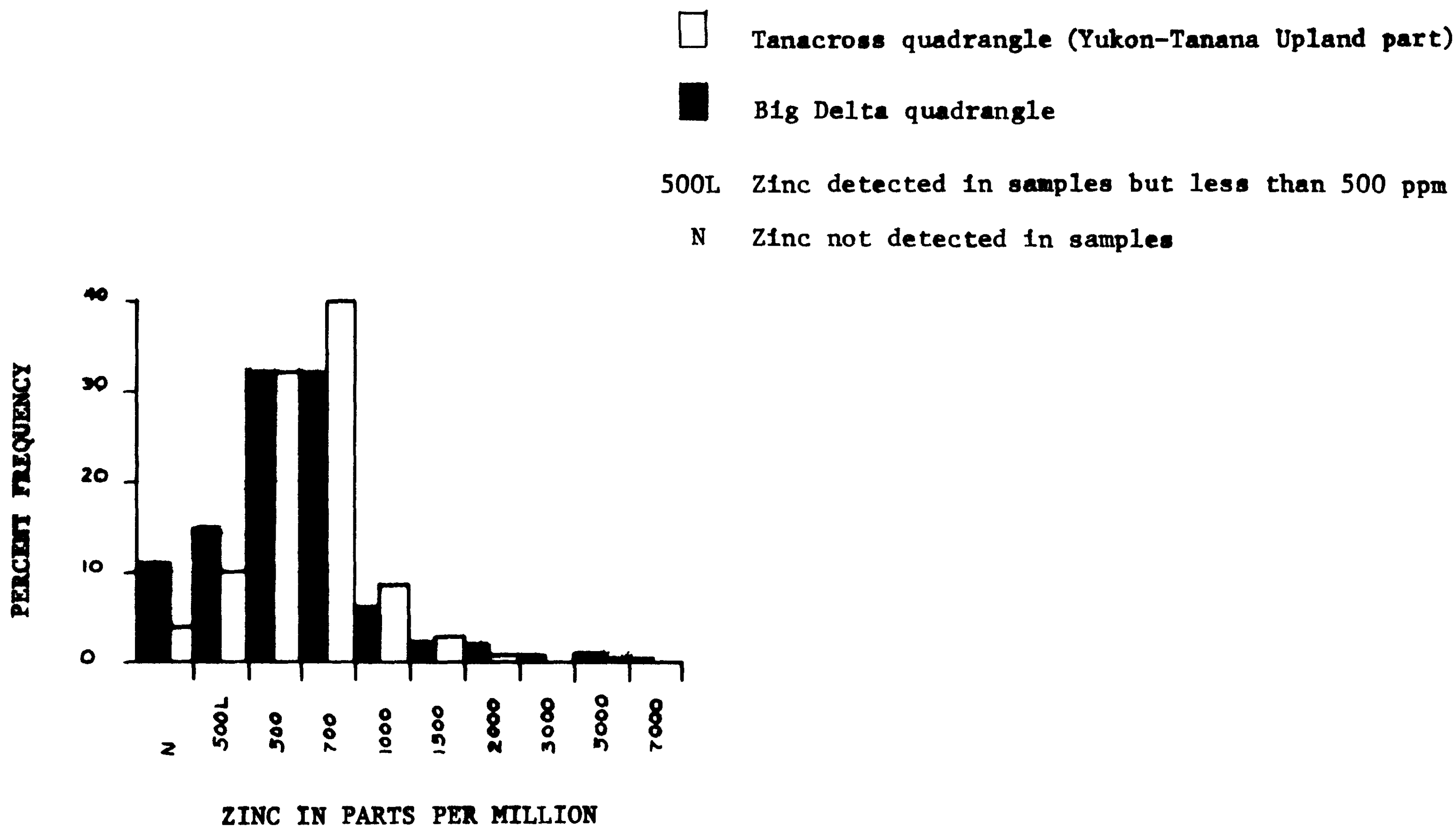

Figure 6.—**Histograms** comparing the amounts of zinc, determined by six-step semiquantitative spectrographic analysis, in the oxide leach of stream-sediment samples from the Big Delta quadrangle and Yukon-Tanana Upland part of the Tanacross quadrangle (modified from Hessin and others, 1978i; Curtin and others, 1976c).

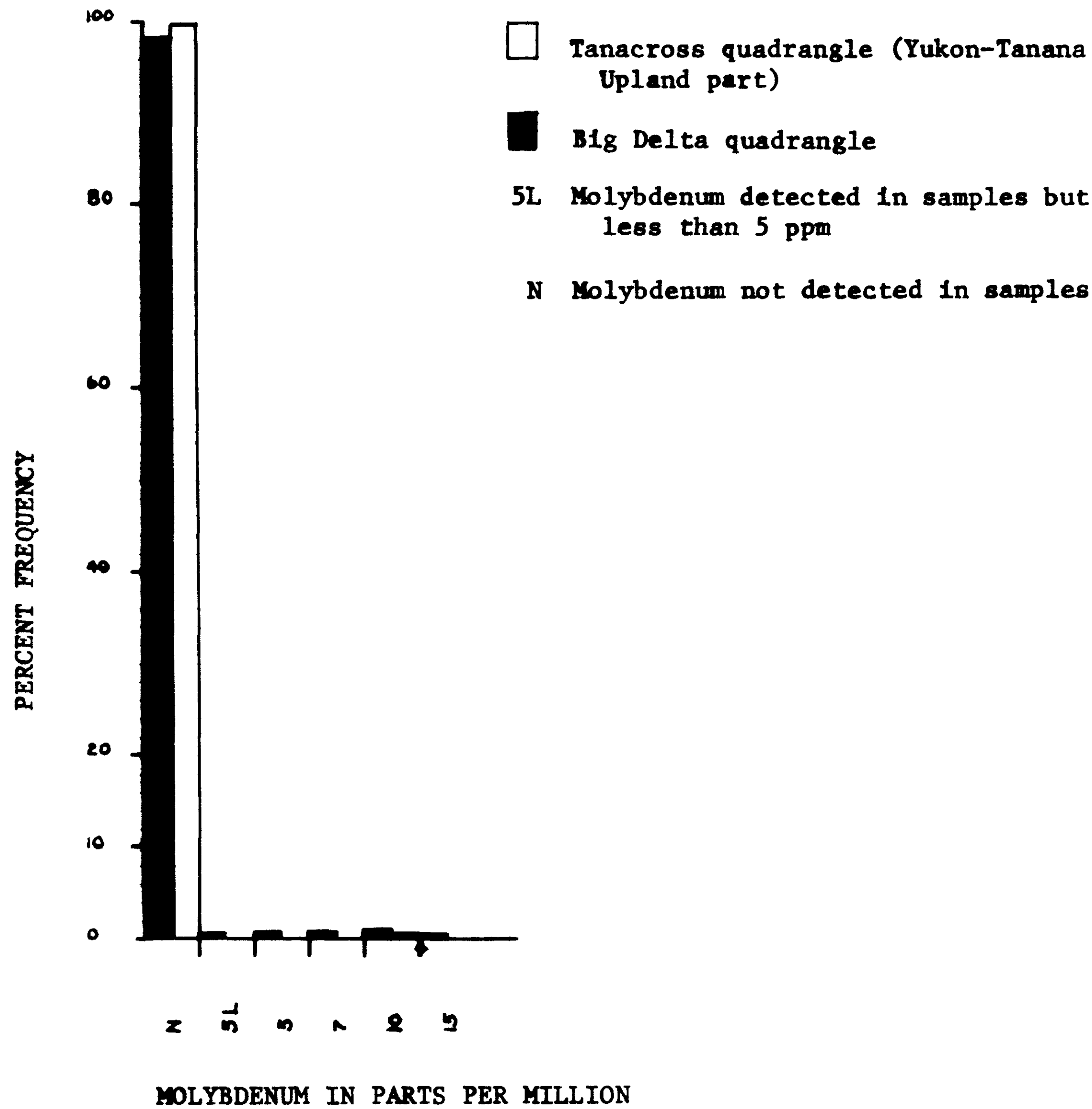

Figure 7.--Histograms comparing the amounts of molybdenum, determined by six-step semiquantitative spectrographic analysis from stream-sediment samples of the Big Delta and Yukon-Tanana Upland part of the Tanacross quadrangle (O'Leary and others, 1978; Curtin, Day, Carten, and others, 1976).

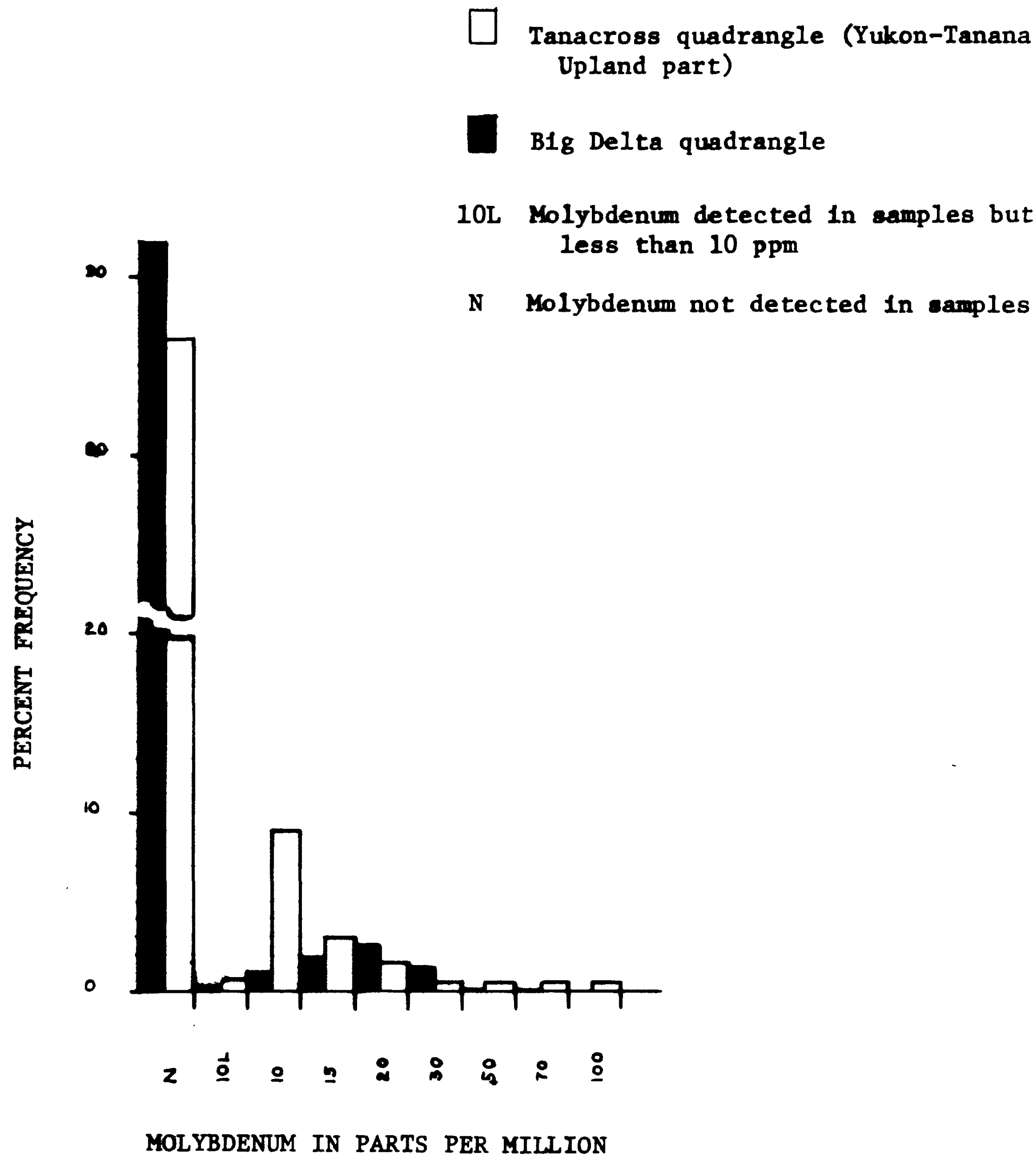

Figure 8.—Histograms comparing the amounts of molybdenum, determined by six-step semiquantitative spectrographic analysis for the oxide leach of stream-sediment samples from the Big Delta quadrangle and the Yukon-Tanana Upland part of the Tanacross quadrangle (data from O'Leary and others, 1978; Curtin, Day, Carten, and others, 1976).

TABLE 1. PROSPECTS AND MINES IN THE BIG DELTA QUADRANGLE

MAP	NAME(S)	LOCATION (TOWNSHIP AND RANGE)	DEVELOP-MENT CATEGORY	RESOURCES Minor constitu-ent(s) or potential byproducts in parentheses	FORM	TYPE	BRIEF DESCRIPTION	PRINCIPAL REFERENCE(S)
1	Banner Creek (Richardson District)	T. 7S. R. 7E.	M	Au (Pb, W, Sn)	Disseminated	Placer	Bedrock in gold-producing area is rhyolite porphyry (Cretaceous?). Gold discovered in 1905 or shortly thereafter. Recovery by open-pit mining and drifting. Lower part of Buckeye Creek, Moore Creek, Hinkley Gulch, and Democrat Creek were also mined. Gold in the mining area in which Banner Creek is included (Richardson District) ranged from 639½ to 785 in fineness. Galena, scheelite, tourmaline, and cassiterite have been found in placer concentrates from Buckeye Creek, and cassiterite has been identified from Hinkley Gulch. Recent (1970's) prospecting, claim staking, and possibly a minor amount of mining in the area. (Includes references to Buckeye Creek, Democrat Creek, Hinkley Gulch, and Moore Creek).	Saunders, 1965, p. 2, 4, Bundtzen and Reger, 1977, p. 29
2	Beaver Creek	T. 2S. R. 7E.	m	Au (Sn)	Disseminated	Placer	Ground averaging $5 per sq ft (at 1976 price) was said to have been found in the winter of 1911-1912. Several windlass dumps were taken out. Scarce cassiterite occurs in the placers	Ellsworth and Davenport, 1913 p. 208; Joesting, 1942, p. 34
3	Bear and Big Bent	T. 9S. R. 10E.	P	Au	Disseminated	Placer		

MAP	NAME(S)	LOCATION (TOWNSHIP AND RANGE)	DEVELOP-MENT CATEGORY	Minor constituent(s) or potential byproducts in parentheses	FORM	TYPE	BRIEF DESCRIPTION	PRINCIPAL REFERENCE(S)
4	Blue Lead (see also Gray Lead and Grizzly Bear)	T. 6S. R. 18E.	m	Au(Pb,Sb, Ag)	Vein	Hydrothermal	Blue Lead is a mine on one of a group of gold-bearing quartz veins discovered near Tibbs Creek in the early 1930's. These quartz veins cut Cretaceous(?) granitic rocks and commonly occur near the contact of granitic and metamorphic rocks (Paleozoic and/or Precambrian?). Faults and shearing common. In general, free gold occurs in quartz containing pyrite, arsonopyrite, and (or) stibnite. Gold content of the veins decreases with an increase in sulfides. Veins pinch and swell and range from a width of about ½ in. to about 8 ft, but widths of 3 ft or less are most common. Other mines in the area are the Gray Lead, Grizzly Bear, Michigan Lead, and Hidden Treasure. There are also other small unnamed occurrences of gold and antimony. The Blue Lead is a gold-quartz vein about 2½ ft wide with jamsonite and a small amount of pyrite in granitic country rock. More than 100 tons were mined and milled in 1938. There are more than 775 ft of underground workings in the Blue Lead extension. Mine closed down in fall of 1939. Total production from all mines in this area was about 32 oz gold and 25 oz silver from an estimated 150 tons. Minor exploration and possibly minor production in the general area in the 1970's. New claims staked.	Saunders, 1967, p. 23; Thomas, 1970, p. 8

MAP	NAME(S)	LOCATION (TOWNSHIP AND RANGE)	DEVELOP-MENT CATEGORY	RESOURCES Minor constituent(s) or potential byproducts in parentheses	FORM	TYPE	BRIEF DESCRIPTION	PRINCIPAL REFERENCES
5	Boulder Creek	T. 6S.(?) R. 18E.(?)	p	Mo	Vein	Hydrothermal (?), porphyry (?)	Molybdenite occurs sparingly in small quartz veins in Cretaceous(?) granitic rock	Joesting, 1942, p. 29
6	Butte Creek (includes Twentymile Creek, a creek in the Salcha River drainage)	T. 2S.(?) R. 10E.(?)	p	Au	Disseminated	Placer	Bedrock is mostly garnetiferous quartz-mica schist and quartzite (Paleozoic?). Staked and some development work in 1905. About 20 ft of gravel overlain by 6 ft of muck. Considerable prospecting but little production. Prospecting also on Twentymile Creek, but no production reported	Prindle, 1906, p. 123-125, Cobb, 1973, p. 127
7	Campbell	T. 7S. R. 7E.	P	Au (?)	(?)	Hydrothermal (?)	A single lode claim	
8	Caribou Creek	T. 2,3S. R. 10E.	m	Au (W, Sn, Bi)	Disseminated	Placer	Bedrock is mostly amphibolite facies garnetiferous quartz-mica schist (Paleozoic?). First mining was in 1905. A dredge was installed in the 1940's and worked most of the length of the stream. Scarce cassiterite and scheelite and small amounts of native bismuth occur in concentrates	Smith, 1941, p. 40, 43; Joesting, 1942, p. 34, 39
9	Central Creek	T. 7S. R. 17E.	P	Au	Disseminated	Placer Hydrothermal (?)	Exploratory work reported in 1927 and placer claims staked in 1939. Lode and placer claims staked 1974-1978	Smith, 1930, p. 26
10	D and D	T. 5S. R. 6E.	p	Au	Vein (?)	Hydrothermal	Active prospect in 1958	

MAP	NAME(S)	LOCATION (TOWNSHIP AND RANGE	DEVELOP-MENT CATEGORY	RESOURCES Minor constituent(s) or potential byproducts in parentheses	FORM	TYPE	BRIEF DESCRIPTION	PRINCIPAL REFERENCE(S)
11	Democrat Lode	T. 7S. R. 7E.	P	Au	Vein (?)	Hydrothermal	Adit of unknown length driven prior to 1921; gold in rhyolite; no known production, although a mill was built on the property. Prospecting and staking in the 1960's and 1975-1978	Saunders, 1965, p.2; Saunders, 1967, p. 23
12	Gold Creek	T. 1S.(?) R. 12E.(?)	p	Au	Disseminated	Placer	Part of creek on which prospects and claims are located is unknown	
13	Golden, Mary H.	T. 6S. R. 7E.	p	Au	do	do		
14	Gray Lead	T. 6S. R. 18E.	m	Au	Vein	Hydrothermal	Explored and mined 1939 to 1941. About 1,450 ft of drifts, cross-cuts, and raises driven. Mine developed along contact of granitic rocks (Cretaceous?) and gneissic schist (Paleozoic and/or Precambrian?); much faulted and sheared. Vein is about 2 ft wide and dips steeply west. Gold is fine and generally visible only on crushing and panning the ore. Renewed minor exploration and attempt at reworking tailings in area in 1970's. New claims staked in 1970's	Thomas, 1970, p. 7-9
15	Grizzly Bear (See Blue Lead)	T. 6S. R. 18E.	m	Au	Vein	do	Gold mined from quartz vein about 1½ to 2½ in. wide. Vein dips steeply south. Gold occurs near hanging wall and is coarser than in other veins in the area. Over 300 tons mined and milled. More than 300 ft of underground workings	Smith, 1939, p. 30; Thomas, 1970, p. 11; Saunders, 1967, p. 24

MAP	NAME(S)	LOCATION (TOWNSHIP AND RANGE)	DEVELOP-MENT CATEGORY	RESOURCES Minor constitu-ent(s) or potential byproducts in parentheses	FORM	TYPE	BRIEF DESCRIPTION	PRINCIPAL REFERENCE(S)
16	Heidi	T. 1N. R. 8E.	p	Au	Disseminated	Placer	Claims active 1970-1978	
17	Hopeful	T. 5S. R. 18E.	P	Au	do	do	Claims active in 1975	
18	Interior	T. 2N. R. 9E.	P	Au	do	Placer and Hydrother-mal (?)	7 lode and placer claims staked in 1976-1977	
19	Junction Creek	T. 6S. R. 6E.	P	Au	do	Placer	Restaked in 1976 and 1974	
20	Lucky Star	T. 5S. R. 18E.	P	Au	do	do	Active in 1975 and 1977	
21	Magoffin	T. 9S. R. 13E.	P	Au	(?)	Hydrother-mal	Claim on Volkmar Lake staked in 1958 and reactivated in 1974	
22	Martha (Richardson District)	T. 7S. R. 8E.	p	Au	Disseminated	Placer	Claims on upper Buckeye Creek. (See No. 1, Banner Creek)	
23	Michigan Creek	T. 9S. (?) R. 16E. (?)	m	Au	do	do	Gold discovered on Michigan Creek in 1915. Considerable prospecting on Michigan and Granite Creeks in 1916. (Both creeks flow into the South Fork Goodpaster River.) Stream gravel 13-25 ft thick. Gold very coarse. One nugget of about ½ oz found on Michigan Creek, but deposits generally low grade, and mining activity lasted only a short time	Brooks, 1918, p. 60; Thomas, 1970, p. 7; Cobb, 1973, p. 127
24	Munson Creek	T. 1S. R. 10E.	p	Au	do	do		Prindle, 1913, pl. II

MAP	NAME(S)	LOCATION (TOWNSHIP AND RANGE	DEVELOP-MENT CATEGORY	RESOURCES Minor constituent(s) or potential byproducts in parentheses	FORM	TYPE	BRIEF DESCRIPTION	PRINCIPAL REFERENCE(S)
25	Munzie Lode	T. 2N. R. 6E.	P		(?)	(?)	Lode claims near head of Colorado Creek; claims staked in 1971 and 1977	
26	Nickel Creek Probably the same as Rick's Nickel Prospect and claims named Noribu	T. 2S.(?) R. 14E.(?)	p	Ni, Cr (Ag,Pt,Zn,Pb,Cu,Au)	Pods and segregations(?)	Hydrothermal	In silica-carbonate zone adjacent to serpentinized peridotite. Peridotite in this region is reported to have small areas with segregations of high-grade chromite 1 ft thick and 3 ft or so long, but for the most part the chromite content is less than 1 percent	Joesting, 1942, p. 16, 18; Saunders, 1967, p. 23
27	No Grub Creek	T. 3S. R. 11E.	M	Au (Bi, W)	Disseminated	Placer	Bedrock is mostly quartz-mica schist (Paleozoic). Mining intermittent from early 1900's to present (1977). Considerable native bismuth found in association with gold and subordinate scheelite. Gold reported to be coarse and irregular and derived from gold and bismuth-bearing quartz veins. Claims also staked on Salcha River at mouth of No Grub Creek	Smith, 1942, p. 39; Charles Shield, 1952, oral commun.
28	Nugget Discovery	T. 1S. R. 6E.	P	Au	Disseminated	Placer	New claims staked 1976-1978 on Nugget Creek, a tributary to the South Fork of the Chena River	
29	Pasco Creek	T. 3S. R. 11E.	M(?)	Au	do	do	First record of claims 1954; some claims active in 1976-1977	
30	Pearl	T. 3S. R. 11E.	P	Au	do	do	Claims near mouth of Goose Creek, tributary to Salcha River	
31	Pine Creek	T. 2S. R. 7E.	m(?)	Au (Sn)	do	do	Scarce placer cassiterite reported (Presence of gold assumed). There are also lode gold claims in the area.	Joesting, 1942, p. 34

MAP	NAME(S)	LOCATION (TOWNSHIP AND RANGE	DEVELOP-MENT CATEGORY	RESOURCES Minor constituent(s) or potential byproducts in parentheses	FORM	TYPE	BRIEF DESCRIPTION	PRINCIPAL REFERENCE(S)
32	Raven	T. 27N. R. 7E.	P	Mo	(?)	Hydrothermal	Claims originally staked in 1960, but active in 1970 to 1977	
33	Redmond Creek	T. 6S. R. 6E.	p	Au	Disseminated	Placer	Prospecting during the winter of 1908-1909. Depth to bedrock reported as 40 to 50 ft. May have been a small amount of mining in the headwater tributaries. Glacer and First Chance Creeks, said to be tributaries of Redmond Creek, have been staked and possibly mined.	Ellsworth, 1910, p. 245; Wedow and others, 1954, p. 11; Prindle and Katz, 1913, p. 142
34	Ricks	T. 2S.(?) R. 12E.(?)	p	Au (Ag,Pt,Zn,Pb,Cu,Ni,Cr)	(?)	(?)	50 lode claims staked in 1939, 1940, and 1956. Exact location unknown	
35	Ricks Creek	T. 1S.(?) R. 14E.(?)	p	Au	Disseminated	Placer	Placer claims staked in 1953. Exact location on Ricks Creek unknown	
36	Tenderfoot Creek (Richardson District)	T. 7S. R. 8E.	M	Au (Pb)	do	do	Bedrock is metasedimentary and metaigneous with common small quartz veins and stringers. Gold discovered in 1905 and is very low grade. Gold has been found for about 3.75 mi along the stream. The gold carries a high percentage of silver. Highest values are reported where gravels are thickest. Alluvium and loess are 30 ft thick near the head of the stream and more than 155 ft thick near the mouth. Recent (1978) prospecting, and claim staking in the area and possibly a small amount of mining. Gold bearing galena float found in placer. This stream was the largest producer in the Richardson gold District. Total placer gold production from the Richardson District prior to 1930 was about 95,000 oz along with about 24,000 oz of silver. Production since 1930 not known	Prindle and Katz 1913, p. 113, 141; Cobb, 1973, p. 127; Smith, 1939a, p. 51; Saunders, 1967, p. 23, Eberlein and Menzie, 1978, p. 31.

MAP	NAME(S)	LOCATION (TOWNSHIP AND RANGE)	DEVELOP-MENT CATEGORY	inor constitu-ent(s) or potential byproducts in parentheses	FORM	TYPE	BRIEF DESCRIPTION	PRINCIPAL REFERENCE(S)
37	Tibbs Creek	T. 6S. R. 18E.	m	Au	do	do	Limited placer mining prior to 1950, but most of the attention has been given to nearby lode deposits (see also Blue Lead, Gray Lead, and Grizzly Bear). Minor amount of prospecting on some tributaries	Cobb, 1973, p. 137
38	Van Curler Lode	T. 1N. R. 7E.	P	(?)	(?)	(?)	Claims active 1971-1978	
39	Willie Association	T. 1N. R. 6E.	P	Au	Disseminated	Placer	Placer claims staked on Colorado Creek active 1970-1977	
40	Xenophon, Xenia, Xestus, Xerxes	T. 1N. R. 7E.	P	(?)	(?)	(?)	Lode claims staked in 1974	
41	Unnamed	T. 2N. R. 16E.	P	W (Sn)	Vein (?)	Hydrothermal (?)	Lode claims staked in 1978	
42	Kevin	T. 7S. R. 7E.	P	Au(?)	Vein (?)	Hydrothermal (?)	Lode claim staked in 1970	

Table 2.--*Description of occurrences of sulfides.*

TABLE 2

DESCRIPTION OF OCCURRENCES OF SULFIDES

MAP NUMBER	FIELD NUMBER	LOCATION BY TOWNSHIP AND RANGE T	R	SULFIDES	DESCRIPTION OF ROCKS	OCCUR-RENCE	REMARKS
1	74Fr658	26N	7E	?	Dark grey, fine-grained	D	Dike; iron oxide stain
2	74Fr651B	26N	7E	Pyrite	Greenish-grey, fine-grained	do	Dike or sill; iron oxide stain
3	74AWr248	26N	5E	Gray Crystals	Greenstone	do	
4	74AWr675	26N	5E	?	Quartz Biotite Gneiss	do	
5	74AFr2338	27N	6E	?	Granodiorite	do	Near contact?
6	74AFr2270	27N	6E	?	Felsic	do	Dike
7	74AFr3110B	7S	17E	?	Gneiss	do	
8	74AFr2348B	27N	6E	?	Porphyritic mafic	do	Dike; Cr: 150 ppm; Ni: 100 ppm
9	74AFr2350c	27N	6E	?	Gneiss	do	
10	74AFr2351	27N	6E	?	Ultramafic	do	Cr: 700 ppm; Ni: 150; ppm
11	74AFr3094A	8	19E	?	Aplitic	do	Dike; iron oxide stain
	74AFr3094C			?	Granodiorite	do	Altered
12	74AFr3098	8S	19E	Pyrite	Porphyritic felsic intrusive	do	Oxidized
13	74AFr644	8S	18E	?	Porphyritic felsic	do	Dike, iron oxide stained
14	74AWr333	8S	15E	oxidized	Garnet-amphibole gneiss	do	
15	75AFr557	9S	12E	?	Fine-grained	do	Dike cutting augen gneiss
16	76AFr131	9S	14E	Metallic Crystals up to 3 cm. across	Greenschist	do	Massive and schistose: Cr: 2000 ppm; Ni: 1000 ppm
17	77AWr349	8S	8E	Trace	Quartz mica schist	do	
18	74AFr608	7S	18E		Gneiss	do	Iron oxide stain
19	74AFr603A	7S	18E	Pyrite, arsenopyrite	Vein in Quartz Biotite granitic rock	V	Magnetite (?) Vein cutting biotite granitic rock
20	74AFr601A	7S	18E		Mylonite gneiss	D	Iron oxide stain
	74AFr601B	7S	18E	?	Augen gneiss	do	Altered with iron oxide stain
	74AFr601C	7S	18E	?	Coarse-grained felsic intrusive	do	
	74AFr601D	7S	18E	?	Fine-grained felsic intrusive	do	
	74AFr601E	7S	18E	?	Fine-grained felsic intrusive	do	
	74AFr601F	7E	18E	?	Fine-grained felsic intrusive	do	
21	74AFr3055	7S	18E	Pyrite Molybdenite	Quartz	V	Mineralized area in granitic rock: euhedral quartz crystals line vugs
22	74AWr173	7S	18E	light-gray crystals	Fine-grained felsic dike	D	
23	74AWr174	7S	18E	?	Quartz	V	Spectographic data given here not published. Quartz vein in granitic rock.
24	74AWr175	7S	18E	Metallic specs	Quartz	D	Vein in granitic rock; quartz stained green
25	74AWr177C	7S	18E	?	Quartz	do	Vein: quartz stained greenish-black.
	74AWr177D	7S	18E	?	Quartz-feldspar	do	Iron oxide stain.
26	74AWr179	7S	18E	?	Quartz	do	Vein in granitic rock; quartz stained green-brown
	74AWr181A			?	Quartz		Bi: 7 ppm Locality in mining area
	74AWr181B			?	Quartz		Bi: 30 ppm
27	74AWr181C	7S	18E	?	Fine grained	do	Dike, greenish-gray; cuts granitic rock; Bi: 150 ppm
	74AWr181D			?	Porphyritic	do	Bi: 10 ppm
	74AWr181E			Pyrite	Quartz(?)	do	
28	74AFr2320	8S	17E	?	Gneiss	do	Iron oxide stain. Metamorphosed dike (?)
29	74AFr2321	8S	17E	?	Basalt	do	Dike; iron oxide stain
30	74AFr2322B	8S	17E	?	Porphyritic basalt	do	Dike
31	74AFr2317	7S	17E	?	Porphyritic felsic	do	Dike
32	74AFr2315	7S	17E	?	Porphyritic felsic	do	Dike
33	74AFr2314	7S	17E	?	Mafic	do	Dike
34	74AFr2312	7S	17E	?	Granodiorite	do	
35	74AFr2311	7S	17E	?	Granodiorite	do	

CHEMICAL DATA[2] IN PPM

MAP NUMBER	Ag	As	Au	Cu	Mo	Pb	Sb	Sn	W	Zn
1	N	N	0.80	150	N	15	N	N	N	N
2	30.	N	N	700	N	N	N	30	N	N
4	1.5	3,000	1.10	3	N	15	N	N	N	N
5	N	N	N	5	N	30	N	N	N	N
6	N	N	N	10	N	20	N	N	N	N
7	N	N		50	N	10	N	N	500	N
8	N	N	N	50	N	N	N	N	N	N
9	N	N	N	70	N	N	N	N	N	N
10	N	N		15	N	N	N	N	N	200
	N	N		70	N	N	N	N	N	N
11	N	N	N	15	3	20	N	N	N	N
	N	N	N	20	7	30	N	15	150	N
12	N	N	N	1.0	N	15	N	7	N	N
13	0.5	N	.05	7	N	10	N	7	N	<500
15	N	N	N	15	N	7	N	N	N	N
15	N	N	N	70	N	10	100	N	N	N
16	N	N	N	10	N	N	N	N	N	<200
17	N	N	N	30	N	50	N	N	N	N
18	N	N	N	30	N	20	N	N	N	N
19	70	1500	1.00	200	N	15	700	N	N	N
20	N	N	N	7	3	30	N	N	N	N
	.7	N	N	10	N	30	N	7	N	N
	N	N	N	15	N	15	N	7	N	N
	N	N	N	15	N	20	N	7	N	N
	N	N	N	7	N	15	N	7	N	N
	N	N	N	15	N	15	N	20	N	N
21	7	>10,000	0.3	7	30	20	100	N	N	1500
	0.7	>10,000	0.15	1.5	N	15	N	N	N	300
22	N	N	N	1.5	N	20	N	N	N	N
23										
24	0.5	1,000	N	30	N	N	N	N	N	N
25	N	N	N	20	N	7	N	N	150	N
	N	N	N	2	N	30	N	N	N	N
26	N	5000	0.20	1.5	N	N	N	7	N	N
	.5	>10,000	.10	1	N	N	N	N	N	N
	2.0	>10,000	.3	7	3	30	N	7	N	N
27	100.	>10,000	4.0	7	N	50	500	N	N	N
	10	10,000	1.5	50	N	7	N	20	N	N
	N	N	.05	10	N	7	N	7		
28	N	N	N	20	N	50	N	10	N	N
29	N	N	N	50	N	10	N	N	N	N
30	N	N	N	5	N	10	N	N	N	N
31	N	N	N	7	N	50	N	N	N	N
32	N	N	N	10	N	10	N	7	N	N
33	N	N	N	5	N	50	N	N	N	N
34	N	N	N	2	N	15	N	N	N	N
35	N	N	N	7	N	30	N	N	N	N

MAP NUMBER	FIELD NUMBER	LOCATION BY TOWNSHIP AND RANGE T	R	SULFIDES	DESCRIPTION OF ROCKS	OCCUR-RENCE	REMARKS
36	74AFr2308A	7S	17E	?	Gneiss	D	
	74AFr2308B			?	Granodiorite	do	
37	74AFr3062	7S	17E	?	Augen Gneiss	do	Iron oxide stain
38	74AFr2324	7S	17E	?	Augen Gneiss	do	Iron oxide stain
39	74AFr2327	7S	17E	?	Mafic	do	Dike
40	74AFr2329	7S	17E	Pyrite	Mafic	do	Dike
41	74AFr2330	7S	17E	?	Gneiss	do	
42	74AWr2331	7S	17E	?	Gneiss	do	
43	74AWr180	6S	18E		Granodiorite	do	Mineralization in quartz veins in this area; some mining
	180A			?	Gneiss	do	
	180B			?	Porphyritic granodiorite	do	
	180C				Quartz (?)	do	
	180D			Molybdenite	Quartz feldspar	do	Vein with gray-green banding.
	180E				?	do	
44	74AWr186	6S	18E	?	Quartz	do	Vein with green staining cutting felsic intrusive rock.
45	74AWr188	6S	18E	?	Felsic intrusive	do	Iron oxide staining.
46	74AFr616	6S	18E	Stibnite	Quartz	do	Vein cutting granitic rock
47	77AFr3201	6S	18E	?	Porphyritic; intermediate composition	do	Gray-green staining
48	74AFr70D	6S	17E	?	Mafic	do	Dark greenish-gray dike cutting quartzitic gneiss
49	74AFr622	5S	16E	?		do	Dike cutting altered gneiss
50	74AFr570	7S	14E	?	Igneous	do	Dike, brown stained, cuts gray gneiss
51	74AFr567	7S	14E	?	Felsic	do	Dike iron oxide stained; cuts gray grey gneiss B: >5000 ppm
52	74AFr2297	7S	14E	?	Quartz biotite schist	do	Near contact with garnetiferous gneiss
53	74AFr3035	7S	15E	?	Diabase	do	Dike cutting augen gneiss
54	74AFr2294	7S	14E	?	Garnetiferous gneiss	do	
55	74AFr3101	6S	14E	?	Pegmatite (?)	do	Boulder; country rock is biotite gneiss
56	75AFr3093	5S	15E	?	Granitic (?)	do	Dike with limonite and manganese stains
57	75ARr136B	6S	16E	Black metallic	Altered gneiss	do	Iron oxide and manganese stain; prospect trench
	75AFr136C	6S	16E	Black metallic	Altered gneiss and breccia	do	Iron oxide and manganese stain; prospect trench
	75AFr136D	6S	16E	Black metallic	Altered gneiss and breccia	do	Iron oxide and manganese stain Bi: 10 ppm
	75AFr136H	6S	16E	?	Quartz		Quartz vein cutting altered gneiss; prospect trench manganese and Brown stain, Bi: 10ppm
	75AFr136I	6S	16E	?	Quartz and felsic		Quartz vein cutting altered gneiss; manganese and brown stain Bi: <10 ppm
	75AFr136L	6S	16E	Minor iron sulfides Grey:yellow metallic material	Quartz		Quartz vein cutting altered and unaltered gneiss; patches of yellow stain up to 3 cm across; prospect pits Bi: 30 ppm
58	77AFr2031	6S	13E	Pyrite	Biotite gneiss	do	Cataclastic texture
59	75AFr3390	5S	13E	?	Mafic	do	Dike
60	77AFr3046	5S	12E	Pyrite	Fine grained schist	do	Schist intensely folded
61	78AFr231A	4S	16E	Galena	Quartzite and quartz-mica schist	do	
	78AFr231B	4S	16E	?	Felsic	do	Dike
62	75AFr3260	4S	17E	?	Quartzite	do	Limonite stain
63	75AFr4299	4S	17E	Pyrite	Quartz muscovite schist	do	
64	75AFr921	4S	18E	?	Marble	do	Marble occurs in area of felsic and mafic dikes and breccia composed of igneous rock
65	75AWr53B	4S	18E	?	Gneiss	do	Medium to coarse grained
66	75AFr3249	4S	16E	?	Quartzite	do	Brecciated quartzite with limonite stain in fault zone (?)
67	75AWr579	3S	17E	?	Greenstone; greenschist	do	

CHEMICAL DATA[2] IN PPM

MAP NUMBER	Ag	As	Au	Cu	Mo	Pb	Sb	Sn	W	Zn
36	N	N	N	1	N	20	N	N	N	N
	N	N	N	2	N	15	N	N	N	N
37	N	N	N	15	N	15	N	N	N	N
38	N	N	N	1	N	20	N	N	N	N
39	N	N	N	7	N	20	N	7	N	N
40	N	N	N	5	N	20	N	N	N	N
41	N	N	N	7	N	30	200	10	N	N
42	N	N	N	10	N	30	N	N	N	N
43	N		N	1.5	N	20	N	N		N
	N	N	N	50	N	30	N	N	N	N
	N	N	N	0.5	N	15	N	N	N	N
	<.5			.7	N	15	N	N		N
	N	N	N	0.5	20	10	N	N	N	N
	<.5	>10,000	.30	1.0	N	N	N	N		N
44	N	10,000	1.0	N	N	N	100	N	N	N
45										
46	1.0	1,500		20	N	200	>10,000	N	N	300
47	N	N	N	<5	N	20	N	N	N	N
48	N	N	N	50	N	N	N	N	N	N
49	N	N	N	70	N	15	N	N	N	N
50	N	N	N	20	N	30	N	7	N	N
51	N	N	N	7	N	15	N	N	N	N
52	N	N	N	15	N	20	N	N	N	N
53	N	N		100	N	N	N	N	N	N
54	N	N	N	2	N	N	N	7	N	N
55	N	N	N	5	N	20	N	N	N	N
56	N	N	N	30	N	30	N	N	N	N
57	N	N	N	30	N	10	N	N	N	N
	0.5	500	0.1		N	N	N	70	N	N
	0.5	500	<0.05	70	N	20	N	20	N	N
	N	N	0.35	150	N	30	N	N	N	N
	0.5	200	N	30	N	30	N	20	N	N
	7	10,000	1.0	300	N	50	100	70	N	N
58	N	N	N	<5	N	<10	N	N	N	N
59	N	N	N	20	N	10	N	N	N	N
60										
61										
62	N	N	N	30	N	30	N	N	N	N
63	N	N	N	10	N	10	N	N	N	N
64	N	N	N	70	N	N	N	N	N	N
65										
66	N	N	N	200	N	30	N	N	N	N
67	N	N	N	<5	N	N	N	N	N	N

MAP NUMBER	FIELD NUMBER	LOCATION BY TOWNSHIP AND RANGE T	R	SULFIDES	DESCRIPTION OF ROCKS	OCCUR-RENCE	REMARKS
68	75AFr3217	3S	17E	?	Quartz	D	Quartzite breccia with copper stain
69	75AFr3190B	3S	17E	?	Schist	do	Breciated mineralized land in schist; copper stain
	75AFr3190C	3S	17E	?	Schist	do	Zone of gossan
	75AFr3190D	3S	17E	?	Breccia	do	Copper stained
70	75AFr3190D	3S	17E	?	Greenschist	do	Cr: 2000 ppm; Ni: 1500 ppm
71	75AFr2134	3S	17E	?	Quartz	do	Quartz vein cutting greenschist
72	75AWr586	3S	18E	?	Granitic gneiss	do	
73	77AFr3186A				Greenschist and quartzite		
	77AFr3186B	3S	18E	?	Greenschist and quartzite	do	Limonite zone in quartzitic and feldspathic rocks
	77AFr360	3S	18E	?	Quartzite	do	Iron stain
74	77AFr360	3S	18E	Silver-colored	Quartzite	do	
75	75AWr610	3S	18E	(?)	Basalt	do	Dike cutting quartzite
76	75AWr613	2S	18E	?	Felsic	do	Porphyritic intrusive with feldspar phenocryst.
77	75AFr3178	4S	16E	Pyrite(?)	Quartzite	do	Float
78	75AFr3132A	4S	16E	?	Pegmatite and gneiss	do	Iron-stained dike cutting iron-stained altered gneiss
	75AFr3132B						
	75AFr3132C						
	75AFr3132D						
	75AFr3132E						Bi: 15 ppm
79	75AFr3119	4S	14E	?	Ultramafic	do	Cr: 3000 ppm; Ni: 3000 ppm.
							Cr: 1000 ppm; Ni: 150 ppm
							Cr: 2000 ppm; Ni: 300 ppm
80	77AWr409	3S	15E	?	Fine-grained siliceous	do	zone of red stained siliceous rock cutting gneiss
81	77AWr304	2S	14E	Silver-colored	Schist	do	Mineralized layers interlayered with marble and quartzite.
82	77AFr532	2S	16E	Silver-colored	Mafic	do	Fine-grained dike
83	77AFr530	2S	16E	?	Felsic	do	Medium-grained granitic intrusive; speck of malachite
84	77AFr2073	3S	13E	?	Chloritic phyllite	do	Contact with feldspathic cataclastic gneiss
85	77AFr2086	3S	13E	?	Amphibolite (garnetiferous)	do	Interlayered with micaceous quartzite: amphibolite contains vein and vugs of altered and brown-stained material
86	77AWr336	3S	13E	?	Amphibolite	do	Interlayered with quartzite and mica-schist
87	77AFr2079	3S	12E	?	Garnetiferous gneiss	do	Interlayered with amphibolite and quartzite
88	77AFr4243	3S	12E	?	Quartz	do	Highly Iron-stained with numerous vugs
89	77AFr4242	3S	12E	Dark-colored	Mica schist	do	
90	77AFr4241	3S	12E	?		V ?	Black iridescent rock cuts garnetiferous amphibole gneiss; appears to contain gold specks
91	75AFr4356	2S	11E	Yellow-colored	Ultramafic	D	Cr: 3000 ppm; Ni: 2000 ppm
92	72AWr123	2S	11E	Pyrite	Amphibolite	do	
93	77AFr2066	2S	12E		Quartzite	do	Reddish-brown weathered specks of sulfide
94	77AFr4222	2S	13E	Pyrite	Quartzite	do	
95	75AFr3278	2S	13E	?	Carbonate	do	Orange silica-magnesite zone associated with ultramafic rock
96	76AFr370	4S	7E		Pegmatite	V	Ultramafic rocks Ni: 1000 ppm
97	76AFr372	4S	7E		Quartzite	do	Contains a pink mineral (sulfides not seen) Iron-stains and black streaks
98	77AWr356	2S	7E	Pyrite	Phyllite	D	Pyrite cubes along foliation surfaces
99	76AWr205	4S	5E	Silver-colored	Mafic	do	Dike cutting quartzite and quartz muscovite schist
100	76AWr169	4S	5E	Pyrite	Gneiss	do	

CHEMICAL DATA[2] IN PPM

MAP NUMBER	Ag	As	Au	Cu	Mo	Pb	Sb	Sn	W	Zn
68	10	N	N	5000	N	3000	N	N	N	3000
69	0.5	N	N	300	N	300	N	N	N	2000
	10	N	N	3000	20	1500	N	N	N	N
	N	N	N	100	N	30	N	N	N	N
70	1.0	N	N	1000	N	30	N	N	N	N
71	N	N	N	30	N	50	N	N	N	N
72	N	N	N	<5	N	15	N	N	N	N
73	<0.5	N	N	<5	N	20	N	N	N	<200
	N	N	N	<5	N	50	N	50	N	700
	N	N	N	10	N	50	N	N	N	N
74	N	N	N	70	N	30	N	N	N	N
75	N	N	N	20	N	<10	N	N	N	<200
76	N	N	N	70	N	300	N	20	N	200
77	N	N	N	5	N	30	N	N	N	N
78	N	N	N	100	N	50	N	N	N	N
	N	N	N	7	N	30	N	N	N	N
	N	N	N	50	N	70	N	N	N	N
	N	N	N	50	N	70	N	15	N	200
	N	N	N	5	N	30	N	30	N	200
79	N	N		30	N	N	N	N	N	N
	N	N		30	N	N	N	N	N	<200
	N	N		70	N	N	N	N	N	N
80	N	N	N	150	N	N	N	N	N	N
81	N	N	N	150	N	10	N	N	N	N
82										
83	N	N	N	300	N	30	N	N	N	N
84	N	N		20	N	20	N	N	N	<200
85	N	N	N	50	N	10	N	N	N	<200
86	N	N	N	30	N	10	N	N	N	<200
87										
88										
89										
90										
91	N	N	N	70	N	N	N	N	N	N
92	N	200	N	150	N	70	N	N	N	N
93	N	N		30	N	<10	N	N	N	N
94	N	N		5	N	<10	N	N	N	N
95	N	N	N	7	N	N	N	N	N	N
96	N	N	N	<5	N	N	N	N	N	N
97										
98	N	N	<0.05	30	N	N	N	N	N	N
99										
100	N	N	N	<5	N	70	N	N	N	N

MAP NUMBER	FIELD NUMBER	LOCATION BY TOWNSHIP AND RANGE T	R	SULFIDES	DESCRIPTION OF ROCKS	OCCUR-RENCE	REMARKS
101	64AWr185	3S	6E	Pyrite	Mylonite gneiss	D	
102	64AWr238	3S	5E	Pyrite	Quartzitic schist	do	Weathered pyrite causes brown-stained patches
103	76AFr407	2S	5E	?	Felsic	do	Vuggy, igneous rock in contact with quartzite; iron and mangenese stains
104	64AWr241	3S	4E	Pyrite	Graphitic schist	do	Pyrite commonly weathered out
105	75AFr322	1S	18E	Pyrite	Felsic	do	Dike containing weathered pyrite cutting granitic rock
106	75AFr2197	1S	18E	?	Granodiorite or quartz monzonite	do	
107	75AFr3452	2S	16E	Black metallic	Ultramafic	do	Mostly sepentinized peridotite; Cr: 1000 ppm; Ni:1500 ppm
108	75AWr631A	1S	18E	?	Granitic	do	Hornblende-rich, foliated granitic rock
	75AWr631B	1S	18E	?	Felsic	do	Dike cutting granitic rock (see 631A)
109	75AFr3411	1N	17E	?	Quartzite	do	
110	75AFr3341	1N	17E	?	Quartzite	do	Also chert or metavolcanic in area
111	75AFr3343	1N	17E	?	Greenstone	do	Includes some serpentinite; Cr: 1000 ppm; Ni: 150 ppm
112	77AFr3333	1N	17E	?	Ultramafic	do	Mostly serpentinized peridotite
113	77AFr3195	1N	17E	?	Greenstone	do	Epidote-quartz veinlets through greenstone
114	75AFr3416	1N	16E	?	Greenschist	do	Chlorite abundant in more schistose layers
115	75AWr393	1N	16E	?	Gneiss	do	Gneiss is hornblende rich with very thin feldspathic layering
116	75AWr381	1N	16E	Silver-colored	Greenstone	do	Epidote-carbonate veinlets
117	75AFr3309	1N	16E	?	Greenstone	do	Mineralized fault zone with bull quartz and brecciated quartzite
118	75AFr3445	1S	15E	Pyrite	Greenschist	do	Abundant limonite; oxidized pyrite
119	75AFr474	1S	15E	Pyrite	Greenschist	do	Includes abundant greenstone
120	75AFr596	1S	15E	Silver-colored	Greenstone	do	Apparent flow banding and breccia
121	75AFr597	1S	15E	?	Greenstone	do	Minor amounts of quartzite
122	75AFr598B	1S	15E	?	Greenstone	do	Red to darkgreen greenstone with calcite filling a ygdules and red iron stain (hematite ?)
	75AFr598C	1S	15E	?	Felsic	do	Porphyritic dike with quartz phenocrysts cutting foliated greenstone (see 75AFr598B)
123	75AFr601	1S	15E	?	Greenstone	do	
124	75AFr602	1S	15E	?	Felsic	do	Dike cutting foliated greenstone
125	77AWr305	1S	16E	Pyrite	Marble	do	Includes finely laminated carbonate and gray phyllitic partings
126	75AFr889	1S	15E	?	Quartzite	do	
127	75AFr612	1S	16E	?	Greenstone	do	Porphyritic greenstone near fault
128	75AFr879	1S	16E		Meta-igneous	do	Near contact between ultramafic and semischist unit
129	75AFr512	1S	14E	?	Quartzite	do	Heavy iron oxide stain; sulfides leached
130	75AWr694	1S	14E	?	Quartzite	do	Quartzite contains minor amounts of carbonate and silty "clots"
131	75AFr510	1S	14E	?	Igneous	do	Dike rock cutting altered (iron-oxide stained) quartzite
132	75AFr504	1S	14E	?	Quartzite	do	Spectographic analyses on altered (heavily iron-stained) quartzite
133	75AWr698	1S	14E	?	Quartzite	do	Quartzite with minor iron oxide stain
134	75AWr700A	1S	14E	?	Quartzite	do	Quartzite is banded and very fine grained; Cr: 1500 ppm; Ni: 1000 ppm
	75AWr700B	1S	14E	?	Quartz	do	Iron oxide stain
	75AWr700D	1S	14E	?	Siltite	do	
135	75AWr701	1S	14E	?	Quartzite	do	Iron oxide stain, B:1500 ppm
136	75AFr500	1S	14E	?	Quartzite	do	Iron oxide stain

CHEMICAL DATA[2] IN PPM

MAP NUMBER	Ag	As	Au	Cu	Mo	Pb	Sb	Sn	W	Zn
101										
102										
103	N	N	N	<5	N	15	N	N	N	N
104										
105	N	N	N	15	N	>10	N	N	N	N
106	N	N	<0.05	150	N	10	N	N	N	N
107	N	N	N	30	N	N	N	N	N	N
108	N	N	N	<5	N	10	N	N	N	N
	N	N	N	<5	N	15	N	N	N	N
109	N	N	N	30	N	N	N	N	N	N
110	N	N	N	70	N	10	N	N	N	N
111	N	N		50	N	15	N	N	N	N
112										
113	N	N	N	150	N	<10	N	N	N	<200
114	N	N	N	500	N	10	N	N	N	200
115	N	N	N	70	N	N	N	N	N	N
116	N	N	N	70	N	N	N	N	N	N
117	N	N	N	30	N	30	N	10	N	N
118	N	N	N	70	N	30	<100	N	N	200
119	N	N	N	70	N	<10	N	N	N	N
120	N	N	N	<5	N	N	N	10	N	N
121	N	N	N	30	5	N	N	N	N	<200
122	N	N		50	N	10	N	N	N	N
	N	N	N	<5	N	<10	N	10	N	N
123	N	N		50	N	10	N	N	N	N
124	N	N	N	20	N	N	N	N	N	N
125										
126	N	N	N	70	7	15	N	N	N	N
127										
128	N	N	N	200	N	N	N	N	N	N
129										
130	N	N	0.20	50	N	<10	N	N	N	N
131	50.0	>10,000	0.15	300	N	20,000	>10,000	>1,000	N	1,500
132	1.0	N	N	30	N	10	N	<10	N	N
	N	N	N	30	N	10	N	N	N	1,500
133	N	N	N	30	N	10	N	N	N	N
134	N	300	N	20	N	N	N	10	N	N
	N	1000	N	<5	N	<10	<100	N	N	<200
	N	<200	N	100	N	<10	N	N	N	N
135	N	1000	N	100	N	<10	N	70	N	N
136	N	N	N	15	N	10	N	N	N	N

MAP NUMBER	FIELD NUMBER	LOCATION BY TOWNSHIP AND RANGE T	R	SULFIDES	DESCRIPTION OF ROCKS	OCCUR-RENCE	REMARKS
137	75AWr641D	1N	14E	?	Marble	D	Interlayered with amphibolite, schist, and quartzite
	75AWr641E	1N	14E	?	Amphibolite	do	Interlayered with marble; Cr: 1000 ppm
138	75AFr830A	2N	15E	Silver-colored	Diorite	do	Dike with iron stains cutting granitic rock or gneiss; cu: 10%
	75AFr830B	2N	15E		Granitic		
139	75AFr816	2N	14E		Quartzite	do	Magnetite present
140	75AFr835	2N	15E	?	Biotite Gneiss		Altered (iron oxide stained) biotite gneiss; B: >2000 ppm in some samples; tourmaline (?)
141	77AFr3087	1S	13E	Pyrite	Quartzitic greenschist	do	
142	77AFr319	1N	13E	Silver-colored	Quartzite	do	
143	77AFr3137	1S	13E	?	Quartzite	do	Patch of mineralized quartzite in biotite granitic rock
144	77AFr2058	1N	12E	?	Fine grained mafic or ultramafic	do	Dike (?); Cr: 1000 ppm
145	77AFr2055	1N	12E	Pyrite	Marble	do	Pseudomorphs (?) of pyrite cubes.
146	75AFr956	1N	11E	?	Quartzite	do	
147	76AFr463	1N	11E	Silver-colored	Quartzite	do	Iron oxide stain
148	76AFr458	1N	11E	Silver-colored	Quartzite	do	Quartzite in contact with marble; Bi: 10 ppm
149	76AFr459	1N	11E	Silver-colored	Quartzite	do	Iron oxide stained and locally brecciated
150	75AFr4335	2N	11E	?	Phyllite	do	Sulfide cubes
151	75AFr4334	2N	11E	Pyrite (?)	Phyllite	do	Iron oxide stained phyllite with pyrite (?) cubes
152	75AWr755	2N	12E	Pyrite (?)	Slate	do	Pyrite cubes (?),
153	78AFr238A	1N	10E	?	Greenstone	do	
	78AFr238B			Galena Sphalerite(?)	Marble	do	Galena in secondary silica layer in impure limestone
	78AFr238C			Pyrrhotite	Skarn	do	Skarn zone with garnet and pyroxene
154	75AFr37	2S	10E	?	Quartzite	do	Iron oxide stain
155	75AWr50	2S	10E	?	Quartzite	do	Yellow (arsenic?) stain
156	75AFr28	2S	10E	?	Diorite (?)	do	
157	75AFr29	2S	10E	?	Quartzite	do	Iron oxide and manganese stains
158	75AFr26	1S	10E	Silver-colored	Quartzite	do	Sulfides very abundant locally; iron oxide stain
159	75AFr25	1S	10E	Silver-colored	Quartzite	do	Iron oxide stain
160	75AFr24	1S	10E	Silver-colored	Quartzite	do	Iron oxide stain
161	75AFr23	1S	10E	?	Quartzite	do	Iron oxide stain; quartzite contains clusters of garnet
162	75AFr22	1S	10E	?	Quartzite	do	
163	77AFr3263	1S	10E	Pyrite	Greenstone	do	
164	75AFr48	2S	9E	?	Phyllite	do	
165	75AWr42	1S	10E	Gold-colored	Greenstone	do	Near contact with marble
166	76AFr470	1N	11E	?	Quartzite	do	Iron oxide stain
167	77AWr440A	1N	11E	Pyrite	Quartzite	do	Iron oxide stain
	77AWr440C	1N	11E	?	Quartz	do	Iron oxide stain
168	77AFr492	1N	10E	Silver-colored	Quartzite	do	Iron oxide stain, marble present
169	75AWr125	1N	10E	Silver-colored	Quartzite	do	
170	75AFr9	1N	10E	?	Quartzite	do	Iron oxide stain

CHEMICAL DATA[2] IN PPM

MAP NUMBER	Ag	As	Au	Cu	Mo	Pb	Sb	Sn	W	Zn
137	N	N	N	< 5	N	< 10	N	N	N	N
	N	1000	N	30	N	N	N	N	N	N
138	N	N	N	70	N	N	N	N	N	N
	N	N	N	< 5	N	20	N	N	N	N
139										
140	N	N	N	< 5	N	20	N	N	N	N
	N	N	N	30	N	20	N	N	N	N
	N	N	N	15	N	10	N	N	N	N
	N	N	N	5	N	10	N	15	N	200
	N	N	N	15	N	30	N	N	N	200
141	N	N	N	<5	N	<10	N	N	N	N
142	1.0	N	N	50	5	50	N	N	N	N
143										
144	N	N		50	N	20	N	N	N	N
145	3.0	N		N	N	<10	N	N	N	N
146	N	N	<0.05	200	N	10	N	N	N	N
147										
148	N	N		50	N	70	N	70	N	200
149										
150	N	N	N	70	N	<10	N	N	N	N
151	N	N	N	70	N	10	N	N	N	<200
152										
153										
154										
155	1.0	200	N	30	5	10	N	N	N	N
156										
157										
158										
159										
160										
161										
162										
163										
164										
165										
166	N	N		5	N	15	N	N	N	N
167	1.0	500	N	50	N	20	N	N	N	N
	N	N	N	< 5	N	< 10	N	N	N	N
168	N	N	N	< 5	N	15	N	N	N	N
169										
170										

MAP NUMBER	FIELD NUMBER	LOCATION BY TOWNSHIP AND RANGE T	R	SULFIDES	DESCRIPTION OF ROCKS	OCCUR-RENCE	REMARKS
171	75AFr7	1N	10E	Silver-colored	Quartzite	D	
172	77AFr554	1N	10E	Silver-colored	Quartzite	do	
173	75AFr46	2S	9E	?	Quartzite	do	Iron oxide stain
174	75AWr25	1N	9E	Pyrite	Slate	do	Spectographic data not published
175	75AFr2014	1N	9E	?	Quartzite	do	Iron oxide stain
176	75AWr112	1N	9E	Silver-colored	Quartzite	do	High in sulfides; quartz schist present
177	75AWr114	1N	9E	?	Quartzite	do	
178	77AFr561	1N	9E	Silver-colored	Mafic	do	Dike high in sulfides; Bi: <10 ppm
179	70AWr226	2N	10E	Pyrite ?	Calcareous phyllite	do	Iron oxide stain
180	77AFr3232	1S	7E	Pyrite?	Quartzite		
181	76AWr295	1S	8E	?	Greenstone		
182	76AWr294A	1S	9E	Chalcocite Bornite	Quartz	do	Quartz vein containing azurite and malachite
	77AWr294B	1S	9E	?	Greenstone	do	Malachite present
183	77AFr125	1N	7E	Silver-colored	Quartzite	do	
184	77AFr119	1N	7E	?	Quartzite	do	

CHEMICAL DATA[2] IN PPM

MAP NUMBER	Ag	As	Au	Cu	Mo	Pb	Sb	Sn	W	Zn
171										
172	N	N	N	50	N	20	N	N	N	N
173										
174										
175										
176	N	N	N	50	N	15	N	N	N	N
177										
178	N	N	N	20	N	20	N	N	N	N
179										
180	N	N	N	30	N	N	N	N	N	N
181										
182										
183	N	N	N	50	20	30	N	N	N	N
184	N	N	N	30	N	20	N	N	N	N

Table 3.--*Description of delineated tracts.*

Tract 1

A. The tract is permissive for the occurrence of the following deposit types:

1. Porphyry copper.

2. Vein deposits, especially tungsten veins.

A model of tonnages and average grades of porphyry copper deposits is presented in table 5.

B. The following characteristics were used to delineate the tract:

1. Known mineralization - The tract contains no mines or prospects, either active or inactive.

2. Permissive rock types and structures - Lithologically, the tract is characterized by granitic rocks (Tg and TMzg) which probably vary in composition from granodiorite to quartz monzonite. Their textures range from equigranular to porphyritic, and they range in grain size from fine to coarse grained. The granitic rocks occur in several different intrusions, some of stock size. Dikes, of both mafic and felsic composition, are especially common in the southern part of the tract. Veins of both bull and secondary quartz occur. Locally the intrusions have produced contact effects. The country rocks are quartz-biotite gneiss, augen gneiss, quartzite, greenstone, and minor marble (Pzp€g). The western margin of part of the tract is the Shaw Creek fault, a throughgoing, left-lateral fault. Minor faults and small areas of tectonic breccia also occur. The intrusive rocks are not foliated.

3. Sulfide occurrences - The tract contains a few known, scattered occurrences of minor amounts of disseminated sulfides associated with granitic rocks and dikes.

4. Geochemical data

a. Anomalous elements - The table below presents the number of samples of each medium that were taken within the delineated tract, and the number of times indicated elements reached anomalous levels (see table 4). Elements for which no analysis was made are indicated by a dash.

Media	Number samples	Cu_{AA}	Pb_{AA}	Zn_{AA}	Cu	Pb	Zn	Mo	Sn	W
Stream sediments ---	13	3	5	0	4	5	0	1	2	0
Pan concentrates ---	13	-	-	-	6	5	1	4	7	6
Oxide leach --------	13	-	-	-	0	3	0	2	0	1
Vegetation ---------	13	-	-	-	0	0	1	4	1	0

b. Other elements reaching anomalous levels: Be, in oxide leach.

5. Aeromagnetic interpretation - The tract contains magnetic reversals; this could be due to the presence of abundant dike rocks or may be a feature of the metamorphic rocks which are hosts to the granitic rocks.

6. Alteration - Thin sections of the granitic rocks show partial alteration of feldspars to sericite and kaolinite, and of biotite to chlorite. Some of the gneisses are iron stained.

Tract II

A. The tract is permissive for the occurrence of the following deposit types:

1. Porphyry copper.
2. Vein deposits, including gold, antimony, and molybdenum.

A model of tonnages and average grades of porphyry copper deposits is presented in table 5.

B. The following characteristics were used to delineate the tract.

1. Known mineralization - The tract contains several inactive lode gold mines, and there has been an attempt to reactivate one or more of these mines; production was small (see table 1). The tract also contains an inactive and active molybdenum prospect. Placer gold has been found on Tibbs Creek.

2. Permissive rock types and structures - Lithologically, the tract is characterized by granitic rocks (Kg and TMzg) which range in composition from granodiorite to quartz monzonite. Minor amounts of quartz diorite also occur. The textures of the granitic rocks range from equigranular to porphyritic, and their grain size varies from medium fine to coarse grained. The granitic rocks are part of a group of intrusions, some of which are of stock size. Some porphyritic rocks, probably of Tertiary age, may represent shallow intrusions and associated dikes. Country rocks are augen gneiss, minor amounts of quartz-biotite gneiss, and very minor amounts of hornblende gneiss (Pzp€g). The rocks of the tract also are considerably faulted, especially in the vicinity of the lode gold mines (see table 1). Many of the more prominent faults have a northerly trend.

3. Sulfide occurrences - The tract contains numerous occurrences of sulfides; most occur in granitic rocks and felsic dikes.

4. Geochemical data

a. Anomalous elements - the table presents the number of samples for each medium that were taken within the delineated tract, and the number of times indicated elements reached anomalous levels (see table 4). Elements for which no analysis was made are indicated by a dash.

Media	Number samples	Cu_{AA}	Pb_{AA}	Zn_{AA}	Cu	Pb	Zn	Mo	Sn	W
Stream sediments ---	25	1	1	0	4	1	0	3	0	0
Pan concentrates ---	23	-	-	-	4	3	0	0	0	3
Oxide leach --------	24	-	-	-	1	0	3	3	0	0
Vegetation ---------	25	-	-	-	1	0	0	6	0	0

b. Other elements reaching anomalous levels - None.

5. Aeromagnetic interpretation - A possible magnetic reversal is indicated within the tract.

6. Alteration - Thin sections of granitic rocks show alteration of feldspars to sericite and of biotite and hornblende to chlorite. Local iron staining occurs in small shear zones.

Tract III

A. The tract is permissive for the occurrence of porphyry copper deposits.

For a model of the tonnages and average grades of such deposits see table 5.

B. The following characteristics were used to delineate the tract:

1. Known mineralization - The tract contains no mines or prospects, either active or inactive.

2. Permissive rock types and structures - Lithologically, the tract is characterized by granitic rocks (Tg, TMzg), felsic volcanic rocks (Tf), and porphyritic hypabyssal rocks (Tf) of Mesozoic and Tertiary age. The granitic rocks range in composition from granodiorite to quartz monzonite. Their textures are generally equigranular, though a few are porphyritic; grain size is fine to medium fine. The tract contains many dikes; their compositions include mafic, felsic, and aplitic. The tract also contains veins of bull quartz and minor secondary quartz. The country rocks are augen gneiss

and semischist (Pzp€g and Pzg).

3. Sulfide occurrences - The tract contains only one known sulfide occurrence, but iron staining indicates that there are many more, especially along the northern margin.

4. Geochemical data

a. Anomalous elements - The table presents the number of samples for each medium that were taken within the delineated tract, and the number of times indicated elements reached anomalous levels (see table 4). Elements for which no analysis was made are indicated by a dash.

Media	Number samples	Cu_{AA}	Pb_{AA}	Zn_{AA}	Cu	Pb	Zn	Mo	Sn	W
Stream sediments ---	6	3	2	2	3	2	2	0	1	0
Pan concentrates ---	6	-	-	-	0	0	0	0	0	0
Oxide leach --------	6	-	-	-	1	0	0	0	0	0
Vegetation ---------	6	-	-	-	0	0	0	1	0	0

b. Other elements reaching anomalous levels: Be, in oxide leach.

5. Aeromagnetic interpretation - The tract contains contact effects around one granitic mass and a possible magnetic reversal which could be due to the presence of felsic volcanic rocks.

6. Alteration - Locally within the tract there are narrow zones, probably along minor faults, of iron-stained rocks, which are commonly brecciated. Thin sections of granitic rocks show pervasive alteration of feldspar to sericite and minor alteration of biotite. Biotite in felsic volcanic rocks is altered.

Tract IV

A. The tract is permissive for the occurrence of either

1. felsic and intermediate volcanogenic sulfide deposits.

2. lead-zinc deposits associated with metasedimentary rocks.

For models of the tonnages and average grades of felsic and intermediate volcanogenic deposits, see table 5.

B. The following characteristics were used to delineate the tract:

1. Known mineralization - The tract contains no mines or prospects, either active or inactive.

2. Permissive rock types and structures - The tract is almost entirely in a single geologic map unit (Pzg), which is characterized by semischist and other rock types which have been cataclasized and recrystallized to different degrees. These rock types include sheared quartzite, greenschist, quartzite, phyllite, greenstone, and minor marble. Protoliths include quartzose sediments, limestone, mafic to intermediate volcanic rocks, volcaniclastic sediments, shallow intrusives, and possibly felsic volcanic rocks. Some veins are present within the tract.

3. Sulfide occurrences - There are 12 known occurrences of sulfides within the tract. Three of the occurrences are associated with breccia zones and are characterized by the presence of copper (66, 68, 69). Five of the occurrences are associated with quartzose rocks (61, 63, 73, 74, 77). Other occurrences are associated with greenschist, quartz veins, a basalt dike, and gneiss.

4. Geochemical data

a. Anomalous elements - The table presents the number of samples for each medium that were taken within the delineated tract, and the number of times indicated elements reach anomalous levels (see table 5). Elements for which no analysis was made are indicated by a dash.

Media	Number samples	Cu_{AA}	Pb_{AA}	Zn_{AA}	Cu	Pb	Zn	Mo	Sn	W
Stream sediments ---	22	1	7	2	6	4	2	0	1	0
Pan concentrates ---	22	-	-	-	1	2	1	0	0	0
Oxide leach --------	22	-	-	-	0	4	2	0	0	0
Vegetation ---------	22	-	-	-	2	0	1	0	0	0

b. Other elements reaching anomalous levels - None.

5. Aeromagnetic interpretation - The tract contains indicated reversals and unclassified magnetic units which may reflect mafic units within the semischist.

6. Alteration - Shear zones within the tract show minor iron staining.

Tract V

A. The tract is permissive for the occurrence of the following deposit types:

1. Contact metamorphic deposits containing lead and zinc.

2. Lead-zinc deposits associated with metasedimentary rocks.

B. The following characteristics were used to delineate the tract:

1. Known mineralization - The tract contains two active lode prospects located northwest of the Tors pluton. An active gold placer claim occurs within the tract.

2. Permissive rock types and structures - Lithologically, this tract is characterized by several granitic plutons (Tg, TMzg) which have intruded a sequence of metasedimentary rocks which include phyllite, with thin layers and veinlets of calcite and white lenses of quartz and calcite and thin-bedded marble, and quartzites with associated minor massive marble (Pzq). Locally

greenstone occurs. Near some contacts with granitic rocks, calcareous layers have been metamorphosed to skarn. Small intricate folds are locally abundant, especially near the contact with the greenschist unit (Pzg). One aspect of this tract, which makes it difficult to interpret permissive deposit types, is the general alinement of granitic plutons with possible regional structure, as outlined by the contact of the greenschist (Pzg) and quartzite (Pzq) units.

3. Sulfide occurrences - The tract contains 31 occurrences of sulfide. Many of these are described as silver-colored sulfides occurring in quartzites. Spectrographic analysis of samples from these occurrences show relatively low contents of metals. Some other sulfides occur in rocks at the contacts of granites; an example of these is sulfide occurrence 153 (see table 2), which contains pyrrhotite, galena, and possibly sphalerite in skarn.

4. Geochemical data

a. Anomalous elements - The table presents the number of samples for each media that were taken within the delineated tract, and the number of times indicated elements reach anomalous levels (see table 4). Elements for which no analysis was made are indicated by a dash.

Media	Number samples	Cu_{AA}	Pb_{AA}	Zn_{AA}	Cu	Pb	Zn	Mo	Sn	W
Stream sediments ---	29	2	4	13	7	2	8	0	1	0
Pan concentrates ---	30	-	-	-	0	3	7	1	0	2
Oxide leach --------	27	-	-	-	3	2	10	7	0	1
Vegetation ---------	30	-	-	-	1	0	5	3	0	0

b. Other elements reaching anomalous levels: Be, in oxide leach; B, in stream sediments; Ba, in pan concentrates.

5. Aeromagnetic interpretation - The tract contains large areas of magnetic anomalies interpreted as being the result of contact metamorphism. However, the anomalies are weak and none are large enough to indicate a large body of replacement magnetite (Andrew Griscom, oral commun., 1978).

6. Alteration - Possible minor seritization.

Tract VI

A. The tract is permissive for the occurrence of mafic volcanogenic sulfide deposits.

The model of the tonnages and average grades of deposits of this type is presented in table 5.

B. The following characteristics were used to delineate the tract.

1. Known mineralization - The tract contains no mines or prospects, either active or inactive.

2. Permissive rock types and structure - The tract is characterized by greenstone, chert, and associated detrital sedimentary rocks (Pgc) of Permian age, which are probably thrust over underlying units of unknown age.

3. Sulfide occurrences - The tract contains eight occurrences of sulfides, all with relatively low metal contents (see table 2).

4. Geochemical data

2. Anomalous elements - The following table presents the number of samples for each medium that were taken within the delineated tract, and the number of times indicated elements reach anomalous levels (see table 4). Elements for which no analysis was made are indicated by a dash.

Media	Number samples	Cu_{AA}	Pb_{AA}	Zn_{AA}	Cu	Pb	Zn	Mo	Sn	W
Stream sediments ---	4	0	0	0	3	0	0	0	0	0
Pan concentrates ---	4	-	-	-	0	0	0	0	0	0
Oxide leach --------	4	-	-	-	0	0	0	0	0	0
Vegetation ---------	4	-	-	-	1	0	0	0	0	0

b. Other elements reaching anomalous levels - None.

5. Aeromagnetic interpretation - The tract contains a number of magnetic units interpreted as due to ultramafic rocks which are spatially near the tract.

6. Alteration - Minor propylitization.

Tract VII

A. The tract is permissive for the occurrence of gold placer deposits.

B. The tract has been delineated on the basis of active and inactive gold placer mines, and active gold placer prospects. The placers also contain subeconomic amounts of scheelite, cassiterite, and bismuth. The gold probably was derived from quartz and quartz-carbonate veinlets in the underlying schist. Caribou Creek was dredged in the 1940's.

Tract VIII

A. The tract is permissive for the occurrence of gold placer and vein deposits.

B. The tract has been delineated on the basis of known mineralization, active and inactive gold placer mines and prospects, and active and inactive lode mines and prospects. The placers of this district (Richardson) were discovered about 1905. They contain subeconomic concentrations of galena, scheelite, and cassiterite. This district produced more than 3,000 kg of gold.

Deposit types which are permissive for occurrence within the Big Delta quadrangle but for which specific tracts were not delineated

The Big Delta quadrangle has a low but relatively uniform potential for the occurrence of four deposit types: gold veins, molybdenum veins, tin and tungsten veins and greisens, and antimony veins. No specific tracts are delineated for these deposit types, although when specific evidence warranted, mention has been made of them when discussing tracts delineated for other deposit types. The Big Delta quadrangle contains several inactive vein gold mines which have produced a minor amount of gold. Also, there are a number of active and inactive vein gold prospects and a number of occurrences of possibly gold-bearing veins, such as those near Shawnee Peak. The potential of the quadrangle for producing significant amounts of gold from such deposits must be considered small. Two molybdenum prospects, probably vein, one active and one inactive, also occur within the quadrangle. Such occurrences are probably more important as indicators of other possible deposit types than as potential sources of molybdenum. The Big Delta quadrangle also contains an active tin-tungsten prospect, and both scheelite and cassiterite are fairly common accessory minerals in placer deposits. Thus, the quadrangle must be considered to have a significant unidentified and undetermined potential for tin and tungsten in veins and greisens. Finally, some veins in the quadrangle also contain stibnite.

There is a low and relatively uniform probability of asbestos deposits, such as those found in the Eagle quadrangle and Yukon Territory, occurring in ultramafic rocks within the quadrangle. However, no occurrence of asbestos has been observed during field mapping or checking of aeromagnetic anomalies.

One nickel, chromium, platinum prospect has been reported in the ultramafic and associated silica-carbonate rocks (pl. 1, no. 26), but from the results of geochemical sampling and fieldwork, it seems unlikely that the quadrangle contains significant resources of these metals.

Discussion of fuels and nonmetallic mineral resources

Sand gravel and riprap have been produced within Big Delta quadrangle for local construction. Gravel is mostly obtained from stream valleys and requires screening. Rock for crushing, riprap, and fill is available from local pits and quarries. Also, several rock types, such as granite, gneiss, and marble, which occur within the quadrangle, may be suitable for local use as building stone.

The uranium potential of the quadrangle is little explored, but presently known geological and geochemical data have not indicated areas of high potential. Although minor amounts of methane have been found in the Tanana valley, none are known in the Big Delta quadrangle, and significant quantities are not expected to be found. Low-grade coal or lignite is locally interlayered in subaerially deposited Tertiary rocks in the southwestern corner of the quadrangle. However, no minable occurrences are known, and the beds are mostly thin, probably discontinuous and folded.

Table 4.--*Definition of geochemical anomalies (in ppm) of selected elements for each medium.*

<u>Stream sediments</u>

$Cu_{AA} \geq 35$	$Cu \geq 50$	$Mo \geq 5$
$Pb_{AA} \geq 30$	$Pb \geq 70$	$W \geq 50$
$Zn_{AA} \geq 160$	$Zn \geq 200$	$Sn \geq 15$

<u>Pan concentrates</u>

$Cu \geq 100$	$Zn \geq 500$	$W \geq 2{,}000$
$Pb \geq 100$	$Mo \geq 10$	$Sn \geq 500$

<u>Oxide leach</u>

$Cu \geq 500$	$Zn \geq 1{,}000$	$W \geq 100$
$Pb \geq 300$	$Mo \geq 15$	$Sn \geq 70$

<u>Willow ash</u>

$Cu \geq 150$	$Zn \geq 3{,}000$	$W \geq 50$
$Pb \geq 30$	$Mo \geq 30$	$Sn \geq 5$

TABLE 5 GRADE AND TONNAGE MODELS

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

Deposit Type	Tonnage and grade variables (units in parenthesis)	Number of deposits used in developing model	Correlation coefficient of listed variable with variable on line with it in column 2	90 percent of deposits have at least	50 percent of deposits have at least	10 percent of deposits have at least
Porphyry Copper	Tonnage of ore (millions of tons)	41		20	100	430
	Average copper grade (percent)	41	with tonnage of ore = -0.07 NS	0.1	0.25	0.55
	Average molybdenum grade (percent Mo)	41		0.0	0.008	0.031
Mafic Volcanogenic	Tonnage of ore (millions of tons)	37		0.24	2.3	22.0
	Average copper grade (percent)	37	with tonnage of ore = -0.13 NS	1.1	2.2	4.1
	Average zinc grade excluding deposits without reported grades (percent)	19	with tonnage of ore = 0.03 NS	0.3	1.3	5.5
	Average gold grade-locally significant but not determined					
Felsic and Intermediate Volcanogenic Massive Sulfide	Tonnage of ore (millions of tons)	89		0.19	1.9	18.0
	Average copper grade (percent)	89	with tonnage of ore = -0.41**	0.54	1.70	5.40
	Average zinc grade excluding deposits without reported grades (percent)	41	with tonnage of ore = 0.25 NS	1.40	3.80	10.00
	Average lead grade excluding deposits without reported grades (percent)	14	with tonnage of ore = -0.02 NS	0.20	0.95	4.80
	Tonnage contained gold excluding deposits without reported gold (tons)	38	with tonnage of ore = 0.73**	0.27	2.90	32.00
	Tonnage contained silver excluding deposits without reported silver (tons)	46	with tonnage of ore = 0.82**	5.00	80.00	1300.00