MINERAL DEPOSITS OF THE TANANA - YUKON UPLANDS: A SUMMARY REPORT

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U. S. DEPARTMENT OF THE INTERIOR

Cecil D. Andrus, Secretary

BUREAU OF MINES

FOREWORD

This is one of a series of summary reports that present the findings of reconnaissance-type mineral assessments of certain lands in Alaska. It is important to remember that Alaska has not been seriously prospected for minerals other than gold--except in a few relatively limited areas. These summary reports include data developed by both contract and Bureau studies; frequently a combination of both. As digests of more detailed reports that are still in preparation, these summaries omit the detailed findings that will be presented in the main reports, but the basic data and conclusions remain the same.

Assessing an area for its potential for buried mineral deposits is by far the most difficult of all natural resource assessments. This becomes more apparent when considering that no two deposits even of the same genesis and host rock conditions are identical. Moreover, judgments prior to drilling, the ultimate test, frequently vary among evaluators and continue to change as more detailed studies add to the understanding.

Included in these reports are estimates of the relative favorability for discovering metallic and related nonmetallic mineral deposits similar to those mined elsewhere. Favorability is estimated by evaluation of visible outcrops, and analyses of sampling data, including mineralogic characteristics and associated elements, in combination with an evaluation of the processes that have formed the rocks in which they occur. Essentially, it is a comparison of a related series of prospects and the environment in which they occur with the mineral deposits and environments in well-known mining districts. Recognition of a characteristic environment allows not only the delineation of a trend but also a rough estimate of the favorability of conditions in the trend for the formation of minable concentrations of mineral materials. This is a technique long used in the mineral industry to select areas for mineral exploration. Qualifying a trend or area as "highly favorable" for the discovery of mineral deposits indicates that the combination of outcrop samples, mineralogic data and geologic conditions that have been observed essentially duplicate the conditions in a recognized mining district elsewhere.

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MINERAL DEPOSITS OF THE TANANA-YUKON UPLANDS: A SUMMARY REPORT

by

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ABSTRACT

The Bureau of Mines made reconnaissance investigations from 1975 through 1977 in the Tanana-Yukon Uplands. A wide variety of minerals and deposit types were found in highly diversified metamorphic and intrusive rocks typical of the mineralized areas of the North American Cordillera. Several metallogenic provinces were identified:

1. Granites of Tertiary-Cretaceous age and the surrounding metamorphic rocks are highly favorable for deposits of tin, tungsten, uranium, placer gold, and associated metals. This province also is favorable for strata-bound deposits of zinc, copper, and lead sulfides similar to those being developed and mined in the Yukon Territory.
2. Sedimentary rocks include marine carbonates and shales north of the Tintina Fault (e.g. Kandik-Nation area, Mt. Schwatka/Crazy Mountains region) which are highly favorable for lead, zinc, silver, copper, and barite. The study area includes part of the Kandik and Yukon Flats oil and gas basins. Near the Seventy Mile River Tertiary sediments appear favorable for coal and possibly sedimentary uranium. Bedded iron deposits and oil shale deposits are known.

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3. Mafic/ultramafic rocks occur in the eastern portion of the study area where a deposit of asbestos is being evaluated for nickel, copper, gold, and cobalt. Similar rock units near Beaver Creek appear to be highly favorable for chrome, nickel, copper, and asbestos. Platinum group metals normally occur in rocks of this type.

INTRODUCTION

This study is part of the on-going mineral availability program of the Bureau of Mines, Alaska Field Operation Center. This report addresses approximately 14 million acres of land in the Tanana-Yukon Uplands, figure 1.

During the period of 1975 to 1977, approximately 30 days of helicopter-supported field work was conducted. An additional 50 days of work was done from boat traverses and included those areas accessible on foot from the rivers. The rivers traversed included portions of Birch Creek, Beaver Creek, Fortymile, Charley, and Yukon Rivers, figure 2. This study was a regional reconnaissance of areas potentially favorable for mineralization. All locatable, saleable, or leaseable minerals, except sand and gravel, are considered, including petroleum.

This evaluation is based upon (1) field investigations of rock units which in Canada are known to host mineral deposits; (2) interpretation of air photographs (where available) to detect structural lineations that may be favorable to mineralization; (3) reconnaissance of areas of active exploration by industry; (4) analyses of stream sediment, pan concentrate, and bedrock samples; (5) analyses of the results of airborne magnetic surveys; and (6) field investigations of reported occurrences and anomalies.

This report briefly summarizes a reconnaissance investigation. The results indicate the types of deposits and commodities that may be present. The results should not be considered conclusive with respect to the ultimate mineral potential of this region.

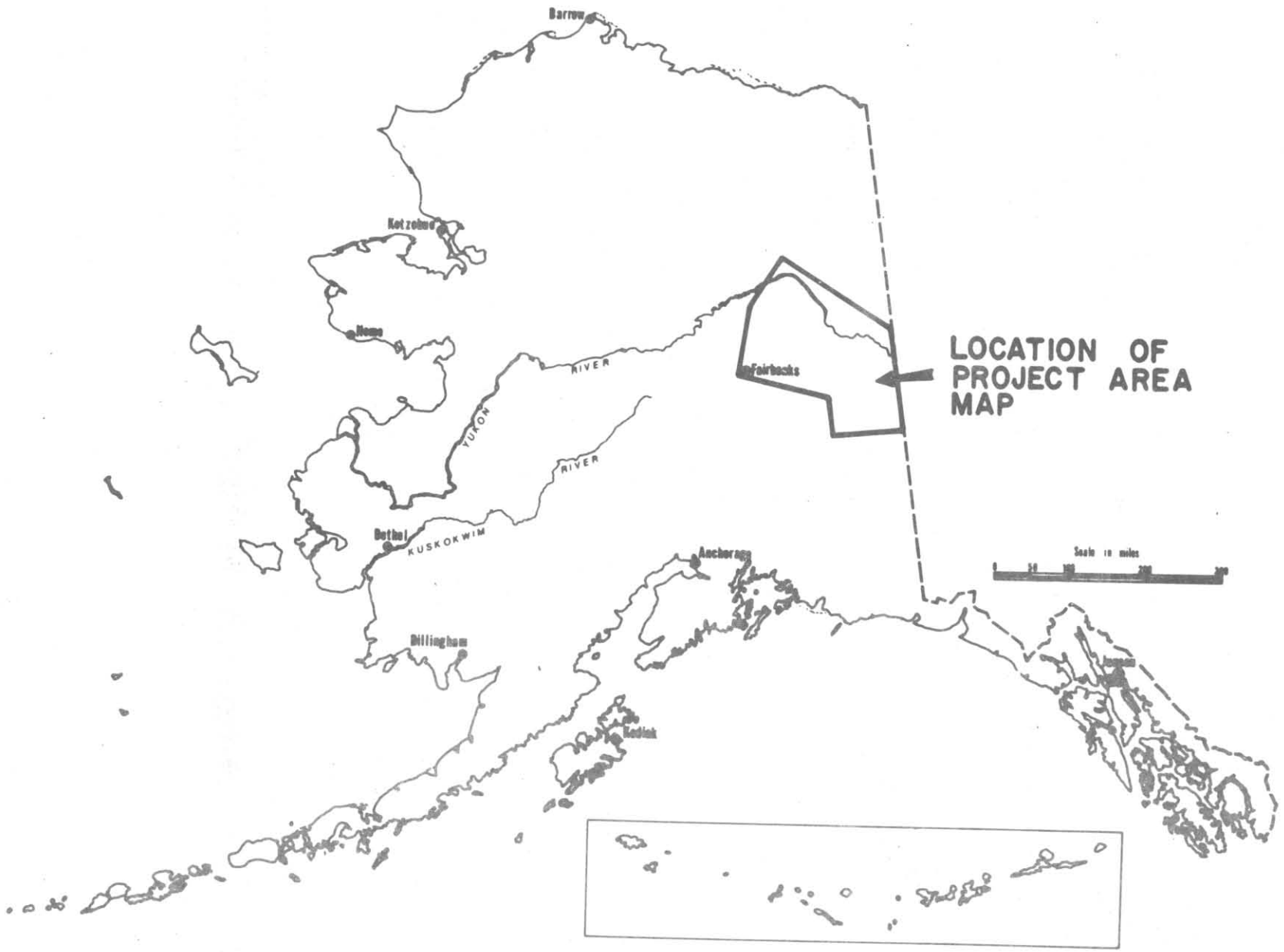

FIGURE 1. Map of Alaska showing location of Tanana-Upper Yukon project area map.

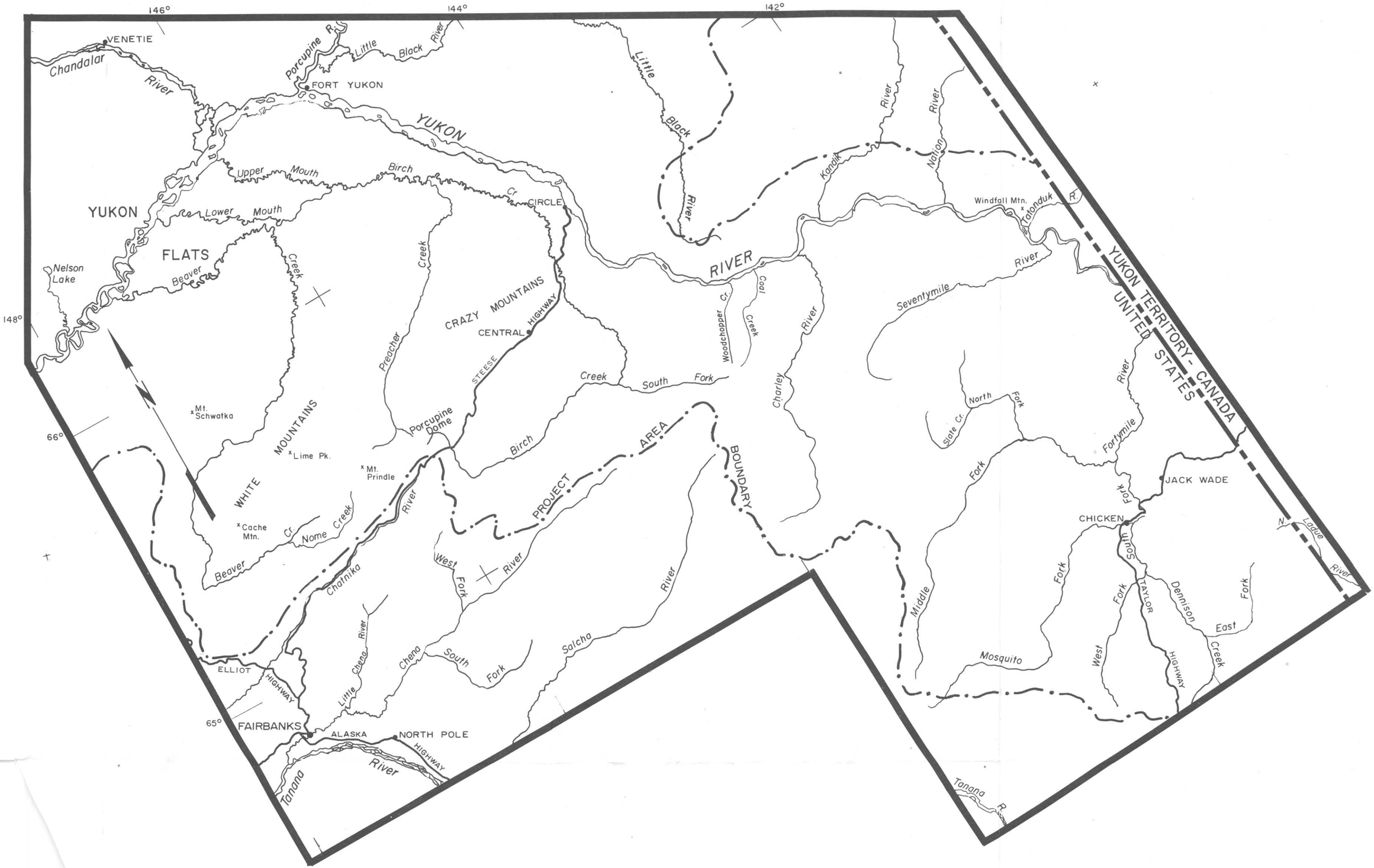

FIGURE 2.- Study area

ACKNOWLEDGEMENTS

The topographic and geologic maps used in this report were adapted from the U.S. Geological Survey published maps.

The Bureau of Mines was assisted in this study by R. C. Swainbank, Vice-President, Resource Exploration Consultants, who provided air photo interpretation of Landsat and black-and-white photography; by D. B. Colp, consulting mining engineer, Fairbanks, Alaska, who evaluated the placer gold deposits of the Fortymile region; by H. Foster and F. Weber, of the U.S. Geological Survey, who provided geologic advice and field assistance. Oil and gas data are by D. P. Blasko of the Bureau of Mines.

GENERAL ROCK STRUCTURE

The Tanana-Yukon Uplands is a structurally complex region of igneous, metamorphic, and sedimentary rocks ranging in age from Precambrian to Recent. The predominant structural feature of the Tanana-Yukon Uplands is the Tintina Fault, figure 3. The Tintina Fault is the northern extension of the Rocky Mountain Fault of the northern United States and southern Canadian Cordillera. This generally north-south continental fault system is warped to a nearly east-west strike where it extends through northwest Canada and Alaska. Highly complex, secondary faulting has developed. The Tanana-Yukon Uplands consist of three basic rock type areas (figure 3). The southeastern and central portions are composed of a deformed metamorphic complex intruded by batholiths and smaller plutons. Volcanic rocks are particularly common in the southeastern portion of the area.

The second rock type lies generally north of the Tintina Fault system and consists predominantly of sedimentary rocks. These will be further subdivided according to age and mineral potential under the following section, "Mineral Information".

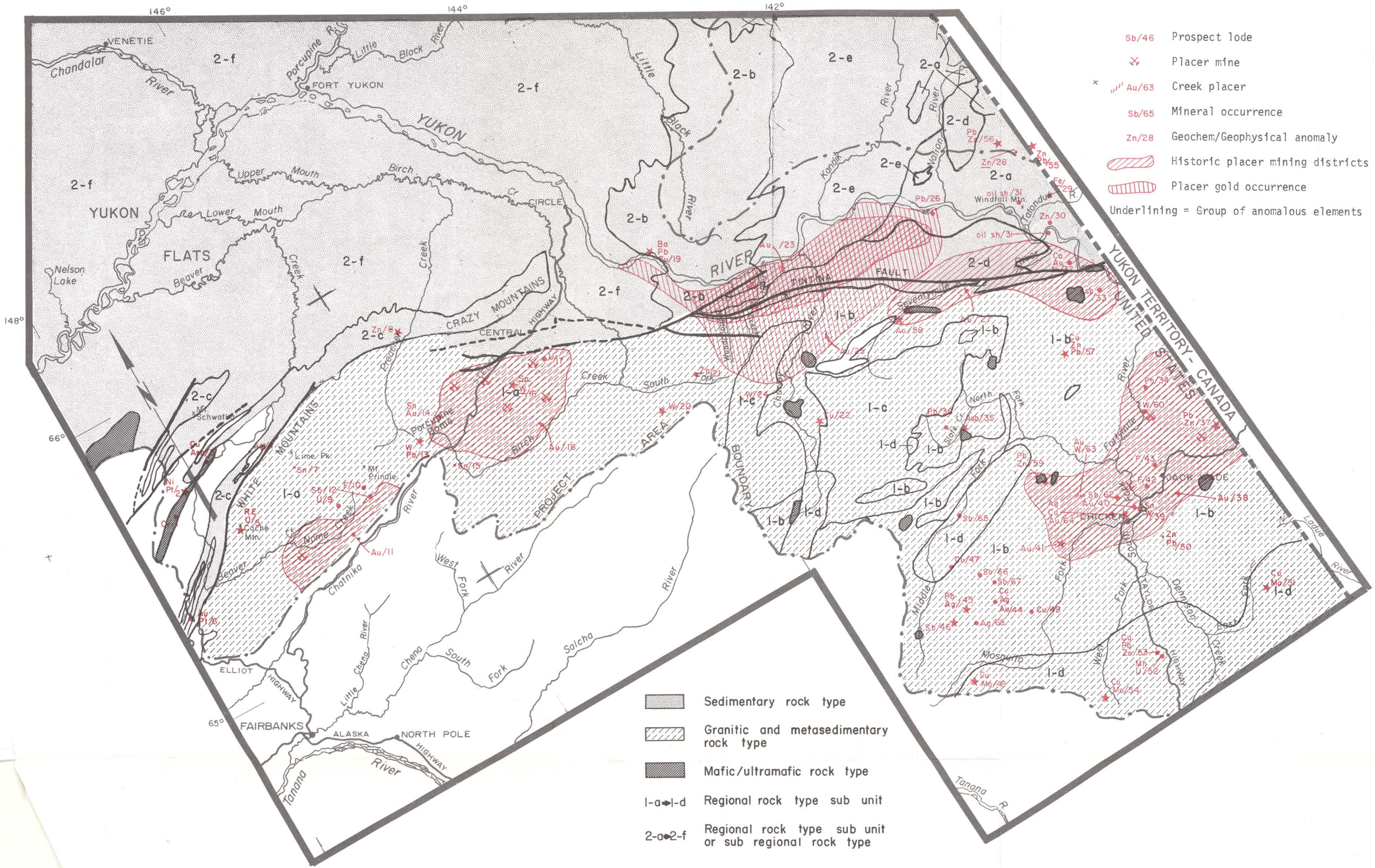

FIGURE 3.- Rock type map of the Tanana-Yukon Uplands

The third rock type consists of scattered occurrences of intrusive bodies. These intrusives are primarily found in the Fortymile/Seventymile River (11) 2/ area and immediately northwest of Beaver Creek (7).

MINERAL INFORMATION

Various metallogenic provinces have been identified within each of the rock types of the Tanana-Yukon Uplands. The following discussion is divided according to rock type and mineral occurrence data, both shown on figure 3. A summary of mineral data listed by map locations on figure 3 and 4 can be found in Appendix A. Referenced trace element data are included in Appendix B.

Mineral Deposits in Granitic and Associated Metasedimentary Rocks

Subregion 1-a and 1-b consists of granitic plutons which have intruded metasedimentary rocks, figure 3. Several tungsten prospects are located here (nos. 13, 20). The owners are continuing exploratory drilling at no. 13. Scattered occurrences of tin, tungsten, antimony, rare earths, uranium, lead and zinc are known. (Nos. 5, 7, 9, 12, 14, 15, 16, 17, 20, 24, 60, 62, 65, 66, 67). Potential deposits include vein and granitic contact types. Province 1-a includes the Circle (no. 18) and Chatanika Gold Placer Districts (no. 11) where approximately 80 people are employed in mining. Province 1-b includes the Fortymile River Placer Gold District (no. 38) where 50 to 60 people are employed in mining.

Subregions 1-a and 1-b are also favorable for strata-bound copper, lead and zinc deposits (e.g. nos. 21, 37, 57) similar to those being mined across the Canadian border at Anvil in the Yukon Territory.

Subregion 1-c includes areas of widespread pegmatites (coarse-grained granitic dikes) as exposed along the Charley River within the large granitic batholith. These have potential for lithium, beryllium, tin, rare earth

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2/ Underlined numbers in parenthesis refer to items in the references preceding the appendixes.

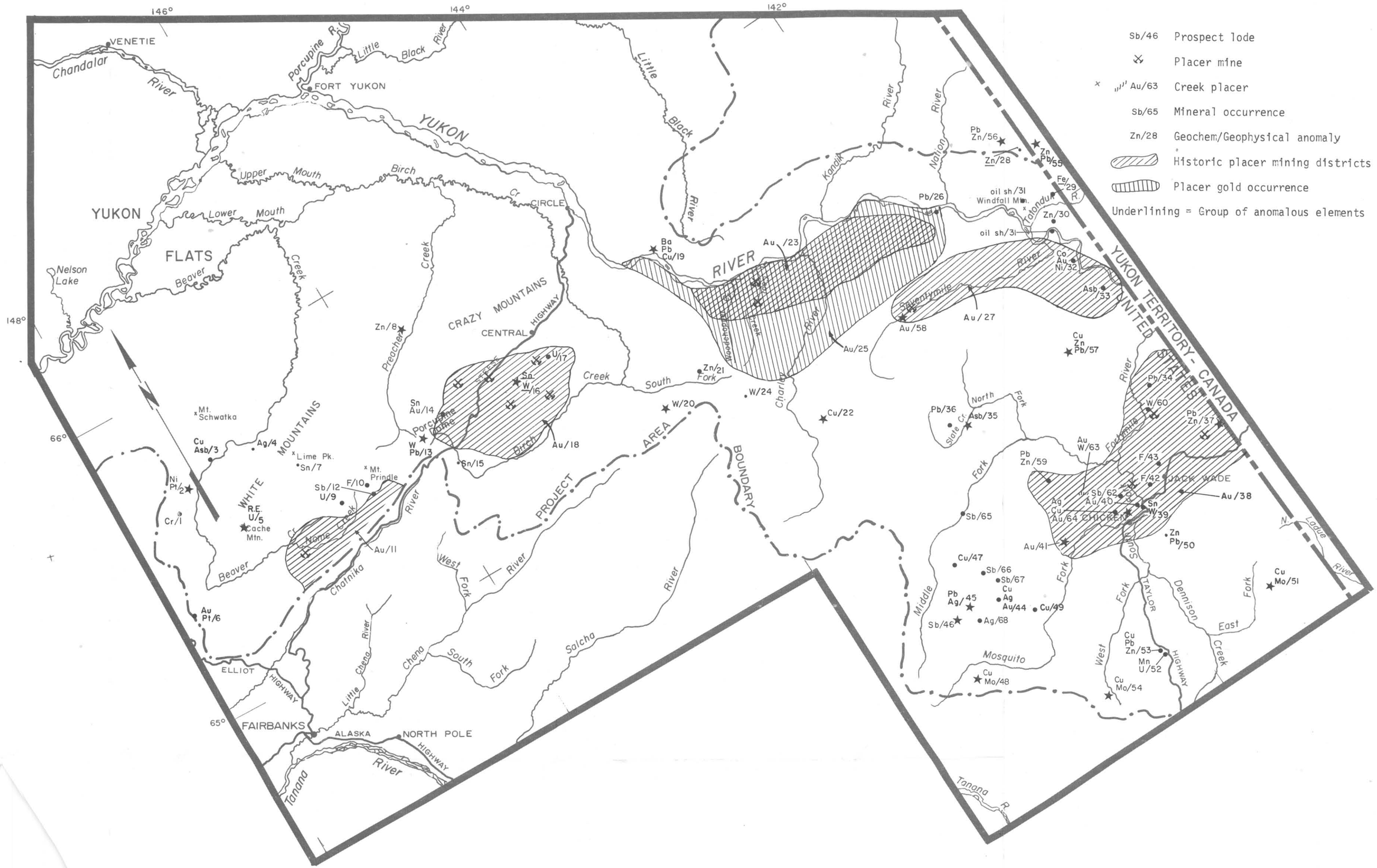

FIGURE 4.- Mineral deposits of the Tanana-Yukon Uplands

minerals, and uranium. Geochemical sampling by the U.S. Geological Survey indicates that these are present (12). Contact deposits of tin, tungsten, antimony and copper are possible (nos. 22, 44, 66, 67).

Subregion 1-d has several large, low-grade deposits of porphyry copper and molybdenum associated with shallow intrusives (e.g. nos. 48, 51, 54). The owners are continuing exploration, including drilling, on at least three of these prospects. Claims have been located apparently associated with metamorphosed volcanic rocks at locations no. 52 and 53.

Mineral Deposits in Sedimentary Rocks

There has been very little mineral exploration of the sedimentary rocks in the study region. During the past few years a number of mineral discoveries have been made in extensions of these formations in the Yukon Territory.

Subregion 2-a adjacent to the Yukon border consists of shales, carbonates, and volcanic rocks in which occurrences of zinc, lead, barite, and copper have recently been found (e.g. Nos. 28, 30, 55, 56), figure 3. Stratiform deposits of these metals in correlating carbonates and shales in the Yukon Territory include the Redstone, Howards Pass, and Gayna River deposits (23). Experience in similar environments elsewhere suggests that vein type deposits may also be found. Deposits of bedded hematitic iron (no. 29), are known near the Nation and Tatonduk Rivers. Such deposits normally extend over wide areas but these have not been explored.

Shale units of this subregion are known to contain oil shale strata such as found at Windfall Mountain (no. 31). Virtually no data is available of the size of grade of these deposits. However, from field observations, the grade is inferred to be high, at least locally. Recent analyses have indicated the presence of metallic elements in the oil shales that could possibly be recovered as by products.

Subregion 2-b consists of rock formations similar to those described in 2-a. A prospect (no. 19) was located for similar lead and barite mineralization.

Subregion 2-c contains apparently similar sedimentary rocks on the south flanks of the Yukon Flats. Reconnaissance sampling indicates that these units contain zinc, barite, silver, and lead deposits. One prospect is located near Preacher Creek (no. 8). A lead deposit has been reported near Mt. Schwatka but the location is not known.

Subregion 2-d consists of a series of non-marine sandstones and conglomerates. The series is known to include unevaluated coal seams. Worldwide, rocks of this type in an area of igneous activity are considered favorable for sedimentary uranium. The conglomerates are thought by some (18) to be the source for the placer gold found in Woodchopper and Coal Creeks. Presently, gold placer mining in the area employs about 25 people. In 1977, a dredge was reactivated on Coal Creek.

Subregion 2-e. Both old and intermediate age sedimentary rocks form the Kandik basin. The basin is believed to be favorable for natural gas and oil (5). Since 1972, exploration for oil and gas has included geophysical work and three exploratory wells, all of which were dry. However, the basin apparently remains of interest to the oil industry.

Subregion 2-f. These rocks form the Yukon basin which is also thought to contain gas and oil. The non-marine sediments in the basin are considered favorable for sedimentary uranium. Minor occurrences of low grade coal have been reported (9). No drilling is known and apparently very little surface mineral exploration has been done.

Deposits Associated with Mafic/Ultramafic Rocks

These rocks occur at widely scattered localaties within the study areas but are particularly concentrated in the Fortymile/Seventymile Rivers region (11) and near Beaver Creek (7). Copper, chrome, nickel, platinum group metals, gold, and asbestos occur in both of these localities, e.g., nos. 27, 32, 33, 35, 58 and nos. 1, 2, 3, and 6 respectively, figure 3. Reconnaissance sampling as part of this study and results of previous work by others indicate that exploration for minable deposits of these minerals may be justified. Deposit types may include magmatic segregations (chrome, nickel, copper, gold, and platinum deposits); serpentine alteration (asbestos, jade); and placer (platinum group minerals and gold).

Little detailed work has been done on these types of deposits except on the asbestos prospect (no. 35) on Slate Creek, a tributary to the Middle Fork of the Fortymile River. A privately financed exploration program is currently in progress at this location.

MINERAL POTENTIAL

Favorable geological units, known deposits and occurrencs described in the foregoing discussion of Mineral Information were combined in an attempt to delineate areas favorable for mineral development, figure 5. Areas containing known mineralization that may represent deposits of a size and grade mined elsewhere were considered most highly favorable. Less favorable areas may indeed indicate less mineral potential, but they may merely indicate less data and previous exploration. Certainly the recent developments in the adjacent Yukon Territory have demonstrated that areas such as Anvil Range and MacKenzie Mountains previously passed over for the presumed lack of mineralization may become major metal producers.

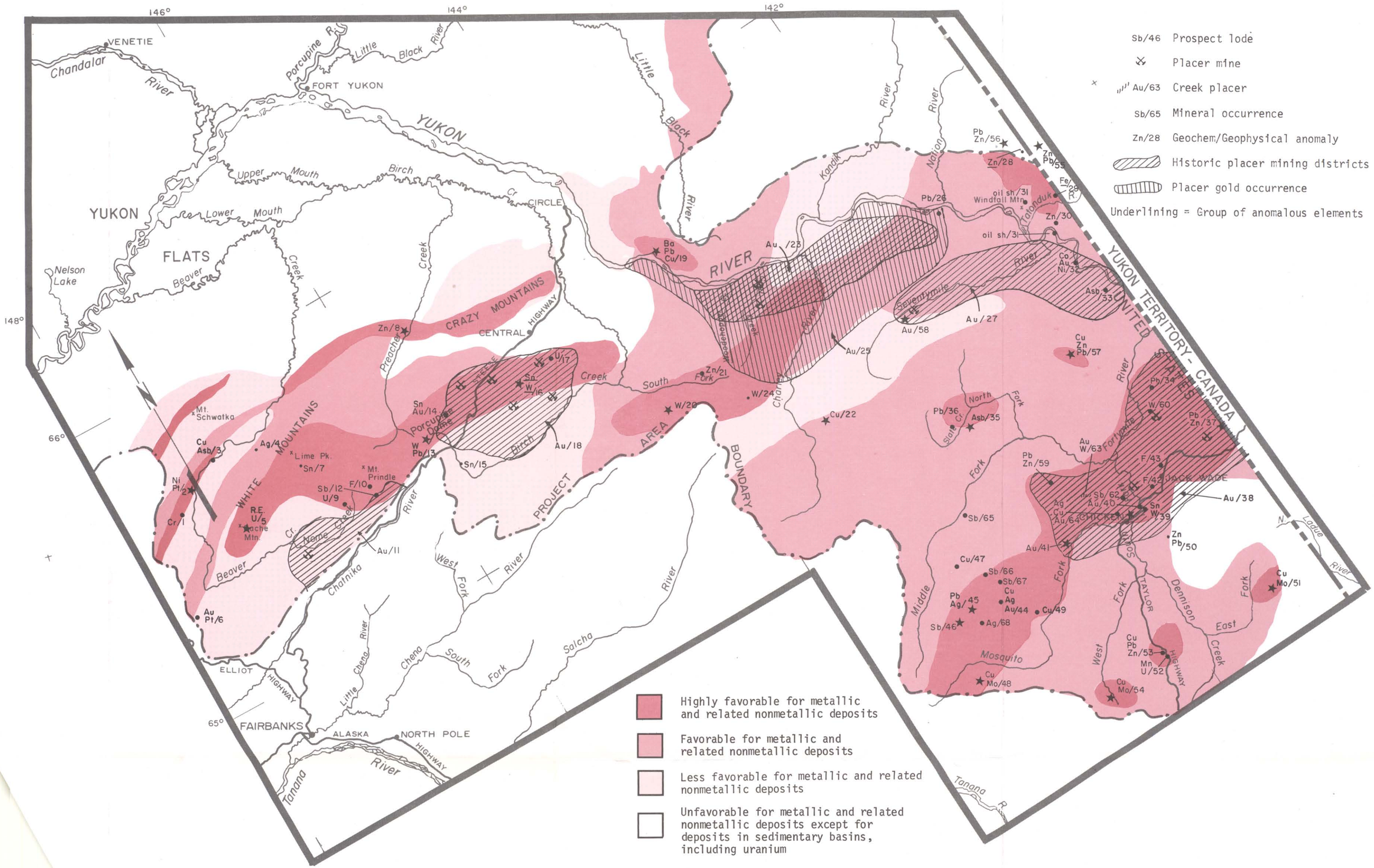

FIGURE 5.- Mineral potential map of the Tanana-Yukon Uplands

Potential energy resources (9) (figure 6), include oil, gas, geothermal heat, coal, sedimentary uranium, and hydroelectric sites. Too little information is currently available to rate any of these as to low, moderate or high favorability for development. Figure 7 depicts areas where such developments seem possible.

ON-GOING STUDIES

Estimates of mineral potential as presented in figure 5 are tenuous at best. Areas considered favorable continue to change as new information is developed through discoveries, and theories of rock structure correlation are consequently modified. The Bureau of Mines continually updates such maps using data obtained by field examinations and by monitoring the work of other agencies and the exploration by industry. During the 1978 field season, it is planned to further study the lead and zinc deposits in the southern and western portions of the Yukon Flats and lead, zinc, copper, oil shale, and uranium reported along the upper Nation River.

CONCLUSION

The Tanana-Yukon Uplands study area (about 14 million acres) is a diverse intusive, metamorphic, and sedimentary environment typical of the highly mineralized areas of the North American Cordillera. Areas favorable for vaious mineral deposits were found in portions of all three rock assemblages. The following areas appear to be favorable for mineral deposits:

1. Granitic and metamorphic rocks
    a) Areas of known copper/molybdenum porphyry mineralization in the upper South Fork of the Fortymile and Ladue Rivers.
    b) The Fortymile gold placer district is also favorable for stratiform base metal, tin, and tungsten deposits.

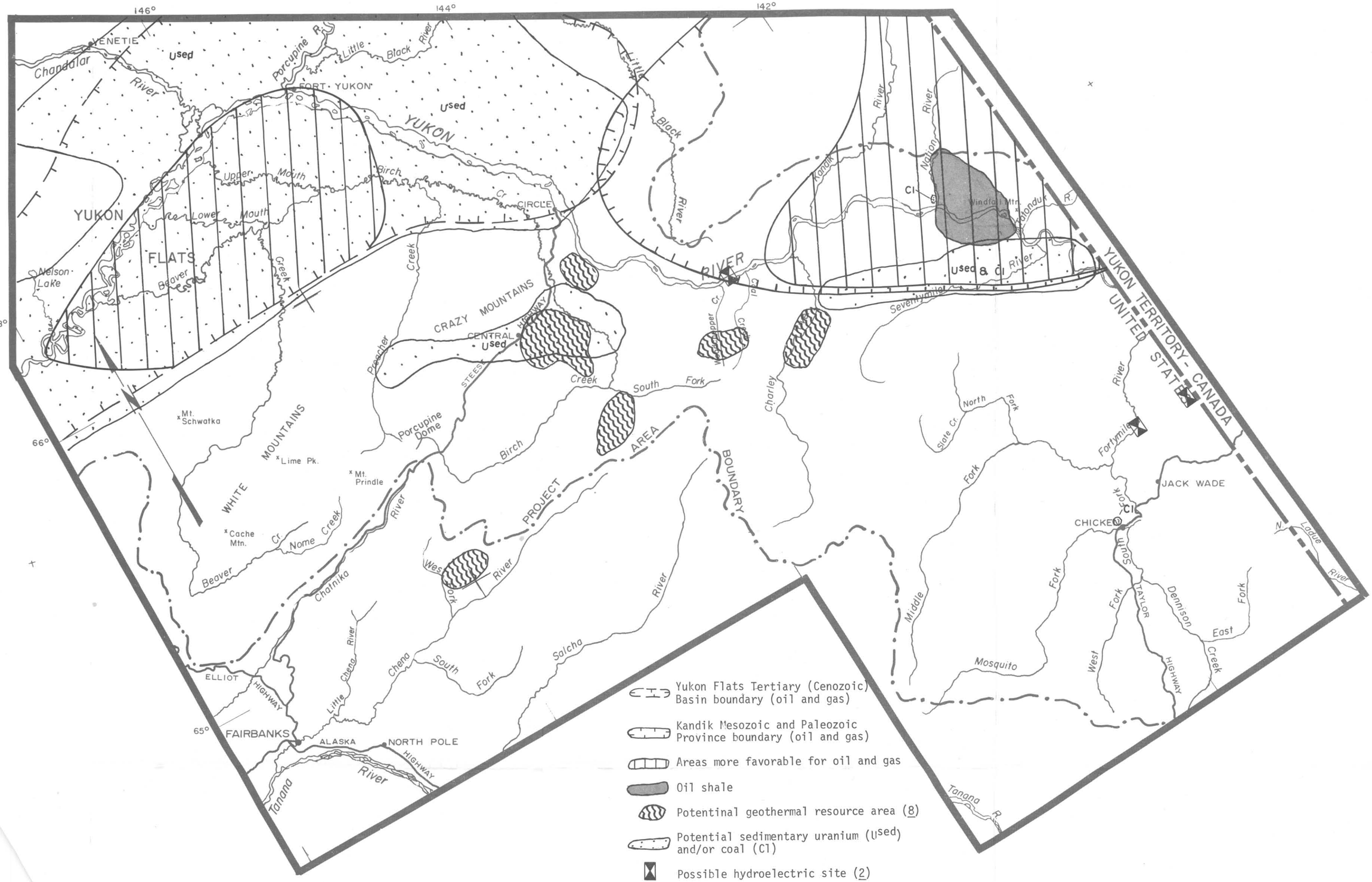

FIGURE 6.- Energy potential map of the Tanana-Yukon Uplands

c) A zone 10 to 15 miles wide extending from the Charley River through the Circle gold placer district to Beaver Creek is favorable for tin, tungsten, uranium, and other metals.

2. Sedimentary rocks

a) The area east of the Nation River contains lead, zinc, copper, iron, uranium, and oil shale.

b) Sedimentary rocks flanking the south, west, and east sides of the Yukon Flats contain lead, zinc, silver, and barite deposits.

3. Mafic/Ultramafic Terrane

Scattered localities of the Seventymile and Fortymile River areas, and the area immediately west of Beaver Creek may contain asbestos, chrome, copper, nickel, platinum, cobalt, and gold.

REFERENCES

1. Barker, J. C. and K. H. Clautice. Anomalous Uranium Concentrations in Artesian Springs and Stream Sediments in the Mount Prindle Area, Alaska. BuMines OFR 130-77. 1977. 19 pp.

2. Berg, H. C. and E. H. Cobb. Metalliferous Lode Deposits of Alaska. U. S. Geol. Survey Bull. 1246. 1967. 254 pp.

3. Berryhill, R. V. Summary Report of Minerals Examination--Copper Creek Prospect, Eagle Quadrangle. BuMines, Alaska Field Operations Center Files, 1963.

4. Bottge, R. G. U. S. BuMines verbal communication. Data on file, Alaska Field Operation Center, Juneau, Alaska. 1977.

5. Bottge, R. G. (ed.) Alaska's Mineral Potential, 1978. A Situation Report prepared by the Alaska Field Operation Center, Juneau, Alaska. BuMines. 1978. 7 pp. 8 sheets.

6. Brabb, Earl E. and Michael Churkin, Jr. Geologic Map of the Charley River Quadrangle, East-central Alaska. U. S. Geol. Survey Map I-573. 1969.

7. Chapman, R. M., F. R. Weber, and B. Taber. Preliminary Geologic Map of the Livengood Quadrangle, Alaska. U. S. Geol. Survey Open File Map 483, 1971.

8. Colp, D. B. Fortymile Placer District Resource Inventory, Alaska. BuMines Open-file Report in progress.

9. Conwell, C. N. Energy Resource Map of Alaska. Alaska Div. of Geol. and Geophy. Surveys, 1977.

10. Cyprus Anvil. Annual Report 1975, Vancouver, Canada, 20 pp.

11. Foster, H. L. Geologic Map of the Eagle Quadrangle, Alaska. U. S. Geol. Survey, 1976.

12. Foster, H. L., and M. E. Yount. Maps Showing Distribution of Anomalous Amounts of Selected Elements in Stream-Sediment and Rock Samples, Eagle Quadrangle, Alaska. U. S. Geol. Survey Miscellaneous Field Studies Map MF-356, 1972.

13. Foster, R. L. Nickeliferous Serpentinite near Beaver Creek, East-central Alaska in Some Shorter Mineral Resource Investigations in Alaska. U. S. Geol. Survey Circ. 615. 1969. pp. 2-4.

14. Hammitt, J., verbal communication of industry data compiled in 1976. Bear Creek Mining Co., Spokane, Washington.

15. Holm, Bjarne. Bedrock Geology and Mineralization of the Mount Prindle Area, Yukon-Tanana Uplands, Alaska. Unpub. M.S. Thesis, Univ. of Alaska. 1973. 54 pp.

16. Kimball, A. L. Reconnaissance of Tatonduk River Red Beds. BuMines OFR 1-69. 1969. 11 pp., 4 fig. NTIS Number: PB 183-780.

17. Mertie, J. B., Jr. Gold Placers of the Fortymile, Eagle, and Circle Districts, Alaska. U. S. Geol. Survey Bull. 897-C. 1938. 128 pp.

18. Mertie, J. B., Jr. Tertiary Deposits of the Eagle-Circle District. U. S. Geol. Survey Bull. 917-D. 1942. 264 pp.

19. Nelson, A. E., W. S. West, and J. J. Matzko. Reconnaissance for Radioactive Deposits in Eastern Alaska. U. S. Geol. Survey Circ. 348. 1954. 21 pp.

20. O'Leary, R. M., S. K. McDanal, C. M. McDougal, and others. Spectrographic and Chemical Analyses of Geochemical Samples and Related Data from the Tanacross Quadrangle, Alaska. U. S. Geol. Survey Open-file Report 76-422. 1976. 240 pp.

21. Saunders, R. H. Mineral Occurrences in the Yukon-Tanana Region, Alaska. State of Alaska, Dept. of Natural Resources, Division of Mines and Minerals. Special Report No. 2. 1967. 59 pp.

22. Sinclair, W. D., J. M. Maloney, and D. B. Craig. Mineral Industry Report, 1976. Yukon Territory. Indian and Northern Affairs. 1976.

23. Sinclair, W. D., J. A., Morin, D. B. Craig, and M. Marchand. North of Sixty, Mineral Industry Report, 1975, Yukon Territory, 1976, 210 pp.; available by mail from Printing and Publishing, Supply and Services Canada, Ottawa, K1A 0S9.

24. Staff. Alaska 1/250,000 Scale Quadrangle Map Overlays Showing Mineral Deposit Locations, Principal Minerals, Number and Type of Claims. BuMines OFR 20-73, 1973. 110 overlays (updated yearly).

25. Unpublished mineral data prepared for Representative L. Meeds by member companies of the Northwest Miners Association. January, 1978. On file with BuMines, Fairbanks, Alaska.

26. U.S.S.R., Ministry of Geology. "Metallogenic Provinces of the U.S.S.R., 1967 (1971). Telburg Geologic Map Service, Sag Harbor, New York, (all materials in Russian) in color. Scale 1:2,500,000. Set of 17 maps.

27. Weber, F. R., and R. M. Chapman. Geochemical Analyses of Bedrock and Stream Sediment Samples from Livengood Quadrangle. U. S. Geol. Survey Open-file Map 530. 1972.

28. Wedow, Helmuth, Jr., M. G. White, and others. Reconnaissance for Radioactive Deposits in Eastern Interior Alaska. 1949. U. S. Geol. Survey Circ. 335. 1954. 22 pp.

29. Worl, R. G., R. E. Alstine, and A. V. Heyl. Fluorite in the United States. U. S. Geol. Survey Map MR-60. 1974.

APPENDIX A: SUMMARY OF MINERAL DATA

(refer to figure 4 for map locations)

Map Location No.	Commodity	Remarks
1.	Chromium	Up to 12.8% chromium in sheared black chromite from scree slope 8/ Pan concentrate samples show anomalous chrome values in this area.
2.	Nickel, platinum	Nine-hundred ninety-nine claims staked on the Beaver mafic/ultramafic complex in 1972. Continuing assessment work (24).
3.	Copper, asbestos	Pyroxenite containing up to one-half inch veins of amphibole asbestos in large angular pieces of float rock along the bank of a Beaver Creek slouth. Malachite, azurite and chalcopyrite occur weakly to moderately disseminated throughout occasional pieces of this rock.
4.	Silver	Preliminary geochemical data indidates highly anomalous silver values associated with black shales.
5.	Rare earths, uranium	Claims staked in 1972 and 1977 (24) Preliminary USGS (27) and USBM geochemical data indicates higher than background values in lead, zinc, silver, molybdenum, tin, nickel, lanthanum, and uranium.
6.	Gold, platinum	Sixty-six claims were staked in 1968 and have since been abandoned (24).

Map Location No.	Commodity	Remarks
7.	Tin	Preliminary sample data by the Bureau shows these areas in the margin of the Lime Peak pluton to contain highly anomalous amounts of tin as well as zinc, lead, and uranium.
8.	Zinc	High concentrations of zinc (11,000 ppm) and barium in an iron-stained stream sediment. The area is within Lower Paleozoic (?) gray chert pebble conglomerate and shale. Thirty-one claims were staked in 1970 but are no longer active (24).
9.	Uranium	Anomalous uranium in sediments from streams (up to 400 ppm) and in a half-mile long series of artesian springs (up to 570 ppm) near a granite-schist contact (1). Tin and tungsten values also higher than background. Active exploration by industry.
10.	Fluorite	A six-inch-wide fluorite vein reported near the granite contact of the Mt. Prindle pluton (15).
11.	Gold	Northwest portion of the Chatanika Placer District. Most production from dredge operations on Nome Creek. Cassiterite and monazite in Nome Creek placers.
12.	Antimony	Stibnite deposit reported uncovered in 1926, and subsequently covered by dredge tailings. Lenses of stibnite one foot thick also reported on Dempsey Pup (21).

Map Location No.	Commodity	Remarks
13.	Tungsten, lead	Three-hundred and sixty-eight claims were staked in 1974; exploration and drilling is continuing (24) Local geology includes calc-schist, quartz-muscovite schist, and granitic rock. Surrounding area is geochemically anomalous in tungsten.
14.	Tin, silver, gold	Occurrence found by early prospectors near the head of Dome Creek. No follow-up investigation has been reported.
15.	Tin	Preliminary geochemical data show anomalous values of tin in pan concentrate samples in this area.
16.	Tin, tungsten, gold	Up to 62% cassiterite occurs in concentrates from creek placers. Thirty lode claims staked in 1976(24). Tin, tungsten, and radioactive minerals are found in placers of Deadwood, Miller, Portage, and Bedrock Creeks(19)
17.	Uranium	A select sample of a pegmatite on the west side of Ketchum Creek analyzed 300 ppm uranium.
18.	Gold	Circle Placer District has produced an estimated 277,650 ounces of gold and 52,270 ounces of silver by-product(4). Approximately 80 persons employed seasonally.
19.	Lead, barite, copper	Barite occurs as thin lenses, veins, and nodules within black argillite. Thirty claims staked in 1969 for barite and lead but since have lapsed (24). Preliminary geochemical data indicate high copper values in stream sediments a few miles to the west.

Map Location No.	Commodity	Remarks
20.	Tungsten	Eighty-eight claims staked in 1974 but since lapsed(24). Local geology includes calc-schist, quartz-mica schist, and tourmaline-bearing granitic rock. The area is geochemically anomalous in tungsten and molybdenum.
21.	Zinc	An iron-stained graphitic zone is highly anomalous in zinc, molybdenum, copper, barium, and other elements. The zone, which is several hundred feet wide, appears to be stratiform in the local schist units and to extend for at least one-half mile. Geochemical data shows the drainage area to be anomalous in zinc and molybdenum with with associated values in lead and barite.
22.	Copper	Chalcopyrite, bornite, and scheelite in an altered limestone segment of a small roof pendant in the Charley River Batholith(3) A lode claim staked in 1946 for copper, lead, and tungsten has been abandoned(24).
23.	Gold	Gold placer production in the area of Woodchopper Creek to Fourth of July Creek has exceeded (as of 1963) 200,000 ounces(4). Dredging operations have recently resumed on Coal Creek. Approximately 25 people are seasonally employed in 1977.
24.	Tungsten	Area highly anomalous in tungsten, above background values in uranium. Complex igneous intrusive in the vicinity.

Map Location No.	Commodity	Remarks
25.	Gold	A pan concentrate survey has indicated the presences of placer gold along the lower Charley River and many of the tributaries to the Yukon and Charley Rivers.
26.	Lead	Large pieces of galena reported in creek gravels (21).
27.	Gold	Seventymile River gold placer area. Gold production has exceeded 230,000 ounces (8). Several people are seasonally employed on Alder Creek. Cinnabar reported on Canyon Creek and placer platinum on Lucky Gulch (21).
28.	Zinc	Sample data shows anomalous zinc (14). Local geology includes Precambrian shale and dolomite (6).
29.	Iron	Forty lode claims staked in 1969 for iron (24). Hematitic red beds of Cambrian to Precambrian age assay up to 33.4% soluble iron (16).
30.	Zinc	Traces of zinc oxide visible in black shale interbedded with limestone. A six-foot chip sample analyzed 3100 ppm zinc.
31.	Oil shale	Calico Bluff Formation of rythmically interbedded limestone and oil shale. Oil shale also occurs at Windfall Mountain, 8 miles to the north.
32.	Cobalt, gold, nickel	Sulfide-bearing rock encrusted with cobalt bloom, reportedly collected from a gold- and nickel-bearing vein in basaltic greenstone (2). Seven claims located in 1952 but have since lapsed (24).

Map Location No.	Commodity	Remarks
33.	Asbestos	Minor occurrence of crysotile asbestos in creek float.
34.	Lead	Galena reported in placer concentrate (21).
35.	Asbestos	Veinlets to 3/8 inches wide exposed over approximately three hundred yards on a ridge crest. A major drilling and exploration program has outlined asbestos along 1200 ft. strike and 1000 ft. dip.
36.	Lead	Large pieces of galena float found in gravel(21).
37.	Lead, zinc	Area of anomalous lead and zinc; ninety-three claims staked in 1976(24). Exploration including drilling is continuing.
38.	Gold	Fortymile Placer District which has produced approximately 452,000 ounces ounces of gold. Between 50 and 60 people are seasonally employed in the District. It is estimated that 1,386,000 ounces could still be recovered from known placer ground (8). Tin, tungsten, and mercury reported in numerous placers (21).
39.	Tin, tungsten, uranium	Tin, tungsten, and uranium-bearing(17). thorianite reported in creek placers(28).
40.	Gold	On-going exploration and development of underground gold prospect.
41.	Gold	Gold quartz veins and stringers in greenstone (21). Previous mining from 40 foot adit.

Map Location No.	Commodity	Remarks
42.	Fluorite	Reported occurrence northeast of Chicken (29).
43.	Fluorite	Reported occurrence in vicinity of Jack Wade (29).
44.	Copper, silver, gold	Silver and gold values associated with a small copper occurrence in a limestone roof pendant. Area to have anomalous amounts of copper.
45.	Lead, silver	Silver-bearing galena in a calcite vein with a small amount of copper (21). A 12-foot chip sample assayed 2% lead and 520 ppm silver.
46.	Antimony	One-hundred ninety-nine lode claims staked in 1970 (16). Exploration including drilling, is continuing.
47.	Copper	Several unverified reports of copper by prospectors.
48.	Copper, molybdenum	Disseminated pyrite, chalcopyrite, and trace molybdenite in a felsic intrusive. Large block of claims (Mosquito Group) located in 1970 (24) Limited drilling has been undertaken.
49.	Copper	Minor copper minerals exposed in prospect pits.
50.	Lead, zinc	Geochemical sampling has shown area to have anomalous amounts of these elements (20).

Map Location No.	Commodity	Remarks
51.	Copper, molybdenum	Disseminated pyrite, chalcopyrite, and trace molybdenite in a felsic hypabyssal intrusive. Two large claim groups (Taurus and Bluff) staked in 1970 and 1971 (24). Exploration, including drilling, is continuing.
52.	Manganese, uranium	Two claims staked in 1950's for manganese and uranium, no longer active (24).
53.	Copper, lead, zinc	Five claims staked in 1967 for copper, lead, and zinc; 40 claims staked in same area in 1975 (24).
54.	Copper, molybdenum	Disseminated pyrite, chalcopyrite, and trace molybdenite in a felsic intrusive. In 1971, 52 claims were staked (Peternie Group) (24). Exploration, including drilling, is continuing.
55.	Zinc, lead	Thirty claims staked in Canada in 1975 for zinc and trace lead (22). Geologic units extending across the border include Precambrian shales and carbonates.
56.	Lead, zinc	Solid sulfide possibly strata-bound mineralization. Grades up to 17% zinc and 2% lead reported (25).
57.	Copper, zinc, lead	Solid sulfides, possibly strata-bound, with values to 1% copper, 5% zinc, 3% lead, and 2 ounces of silver per ton.
58.	Gold	Quartz vein in extensive shear zone in mafic intrusive and metamorphic rocks (21). Abandoned 100 foot adit and mill.

Map Location No.	Commodity	Remarks
59.	Lead, zinc	A mafic dike with disseminated sulfides contains .11% lead and .05% zinc. The area has geochemically anomalous amounts of copper, lead, and zinc.
60.	Tungsten	Veinlets with scheelite found in placer cut.
61.	Copper	Minor vein copper reported(21).
62.	Antimony	Lode prospect, past exploration(21).
63.	Gold, tungsten	Gold placer with abundant scheelite.
64.	Silver, copper, gold	Zone of sulfides in sericitized diorite 40 to 50 feet wide(21).
65.	Antimony	Discovery of stibnite reported in 1917(21).
66.	Antimony	Discovery of stibnite reported in 1935(21).
67.	Antimony	Stibnite prospect(21).
68.	Silver	Silver reported in a 15-foot wide zone of magnetite(21).

APPENDIX B - RECONNAISSANCE SAMPLING PROGRAM

In 1977 the reconnaissance survey within the project area included 1048 stream sediment samples and 527 pan concentrate samples. Data from geochemical studies by government and industry were used whenever possible. The reconnaissance was limited to the region shown within the "Limits of Trace Element Sampling," figure B-1, B-2. Also sample density was variable.

Histograms were compiled from semiquantitative emission spectrographic data of the sediment samples. For the elements Ag, B, Ba, Be, Co, Cu, Ga, Mo, Mn, P, Pb, Sn, V, and Zn the threshold value was calculated at the 90th, 95th, and 98th percentile levels. The anomalous levels Ni, P and U were determined by visual scan of the data. Similar histograms were compiled for analyses of the pan concentrate samples. Anomalous levels were also determined by visual scan. Uranium samples were analyzed by fluorometric methods.

Where geographical groups of samples are anomalously high in certain elements, they were so outlined on figure B-1 and B-2, respectively. Elements which occur in these geographical areas as moderately anomalous or only occasionally high are listed as minor accessory elements. Erratic, individually high sample analyses or areas that were high in only one element were generally not considered.

The interpretation of the data as represented on figure B-1 and B-2 is preliminary and will be further refined in a later report.

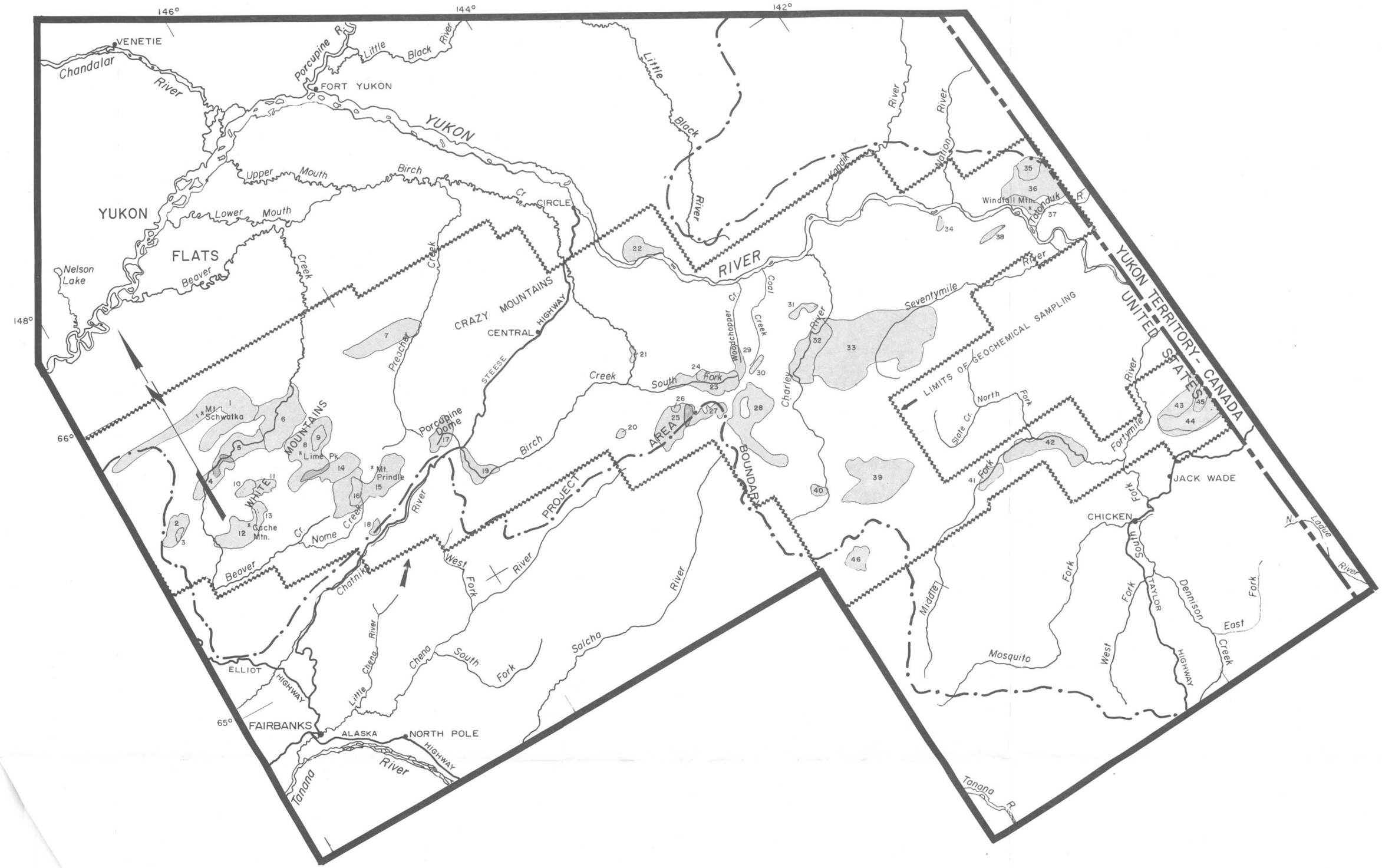

FIGURE B-1. Stream sediment sample map of the Tanana-Yukon Uplands

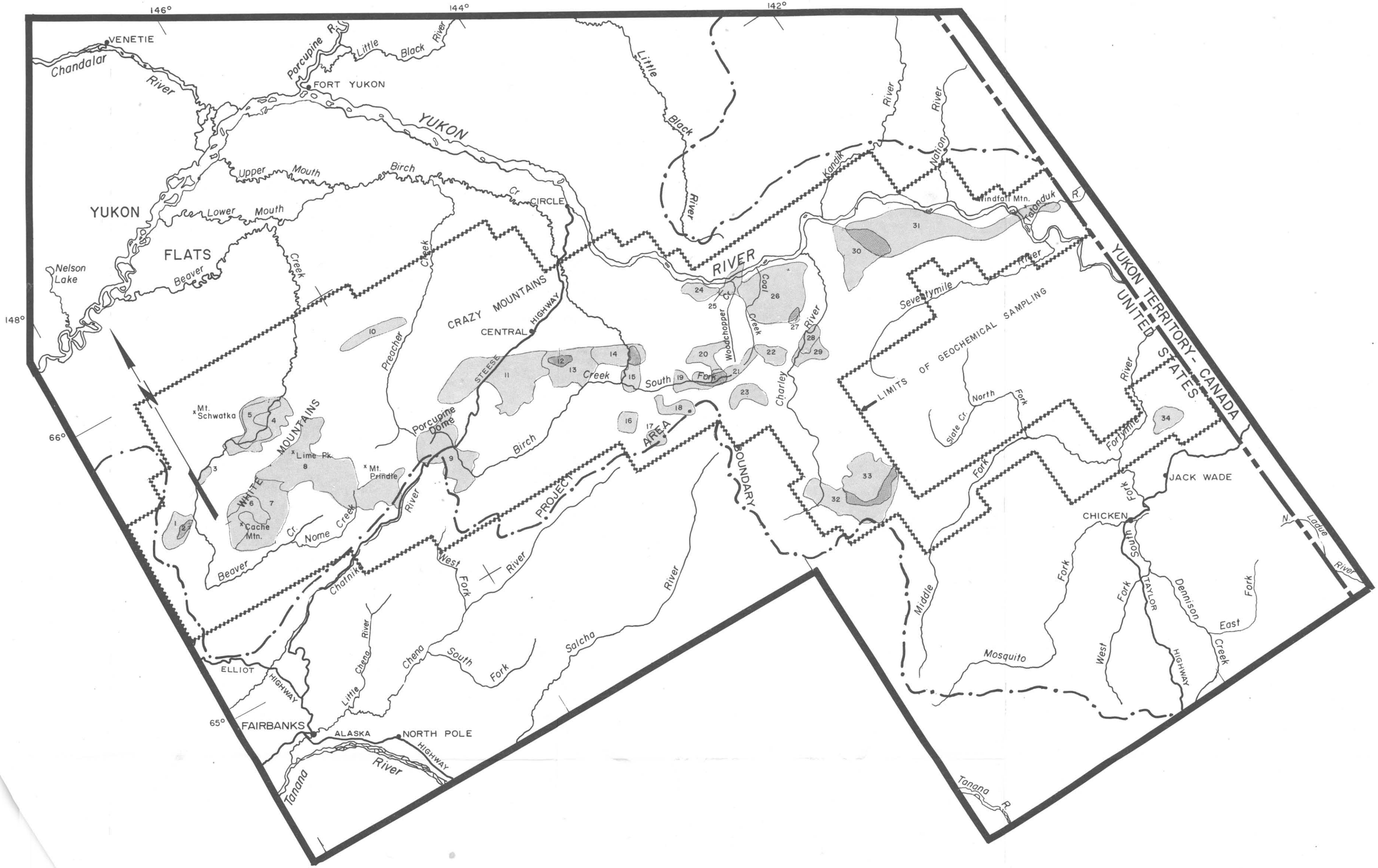

FIGURE B-2. Pan concentrate sample map of the Tanana-Yukon Uplands

EXPLANATION

Anomalies of stream sediment sample data.

Area Map No.	Anomalous Trace Elements 1/ Major	Minor
1	Zn	--
2	Mn, Ni, V	Ag, Cu
3	--	B, Sb, W
4	Co	--
5	Sr, Zn	Ag, Ba
6	Ag, Co, Zn	Ba, Be, Mn, Pb, Sb
7	Pt, Zn	Ag, Ba, Co
8	Pb, U, Zn	Ag, Mo, W
9	Ag, Be, Ga, Mo, Mn, Pb, Sn, U, W, Zn	--
10	Ag, Zn	Co, Cu, Ni
11	Zn	Pb, Sn
12	U, W	Mo
13	Ag, B, Be, Ga, Pb, Sn, U, W	--
14	B, Be, Ga, Ni, Pb, Sn, U, V	--
15	U, W	--
16	B, Be, Ga, Sn, U, W	Mo
17	Mo, W	--
18	Mo, W	--
19	--	Ag, B, Ga, V
20	--	Mo, W
21	B, Mo, Pb, Sn	--
22	Ba, Co, Cu, Pb, V	--
23	B, Co, Mo, Zn	--
24	Ba, Co, Cu, Mo, Pb, V	--
25	Ag, W	B, Ba, Mo
26	Ag, B, Ba, Pb	--
27	W	Mo
28	U, W	Be, Pb
29	B, Mo, U	--
30	Zn	--
31	Ba, V	--
32	Be	Co, Pb
33	Co, Ni	Cr, Cu
34	Zn	--
35	B, Pb	--
36	Sb, Zn	P
37	Ba	--
38	Cu	Co

1/ Anomalous regions are based on groups of samples with generally consistent higher level values of the elements.

EXPLANATION

Anomalies of stream sediment sample data.

Area Map No.	Anomalous Trace Elements 1/ Major	Minor
39	--	Cu, Pb, Sn 2/
40	Ag, Be, Pb 2/	--
41	P, V	Cu, Pb
42	Ba, Pb	Co, Cu
43	Ag, Cu	Co, Mo, Ni
44	Cu	Co, Mo, Ni
45	Ag	--
46	Ag, Pb, Sn 2/	--

1/ Anomalous regions are based on groups of samples with generally consistent higher level values of the elements shown.

2/ Adopted in part from Foster, H. and Yount, M. 1972 (12).

EXPLANATION

Anomalies of pan concentrate samples.

Area Map No.	Anomalous Trace Elements 1/ Major	Minor
1	Cu	--
2	La, Mo	Sn
3	Pb	--
4	Cu	Ag
5	Cu, W	Be, La, Sn
6	B, Be, La, Sn, W	Y
7	Pb, Sn, W	Nb, Y
8	B, Be, Cu, Pb, Mo, Sn, W	Ce, La, Nb, Y
9	B, Sn, W	Mo
10	--	Cu, Pb
11	Ag, Cu, La, Mo, Sn, W	Pb
12	Be, La, Sn, W	--
13	Ce, La, Sn, W, Y	Mo
14	Ag, Cu, La, Mo, Sn, W	Pb
15	Be, Ce	Ag
16	Mo	--
17	Ag, Mo, W	--
18	W	Mo
19	Ag, Be, Mo, W	--
20	Mo	W
21	Ag, Be	--
22	Mo, W	--
23	Be, W	La, Sn
24	Ag, Be	--
25	Ag, Pb	--
26	Ag	Be
27	W	--
28	Ag, B, Be, Y	W
29	W, Y	--
30	Ag	--
31	Mo, Pb	Ag
32	Ce, La, Y	--
33	B, La, W, Y	Ag
34	Ag, W	--

1/ Anomalous regions are based on groups of samples with generally consistent higher level values of the elements shown.

GEOCHEMICAL DATA ON PORTIONS OF THE TANANA/YUKON UPLANDS

by
James C. Barker
Glenn T. Hall

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Illustrations

Illustrations (cont.)

Tables

GEOCHEMICAL DATA ON PORTIONS OF THE TANANA/YUKON UPLANDS

by
James C. Barker[1]
Glenn T. Hall[2]

INTRODUCTION

A geochemical survey in 1977 was conducted in portions of the Livengood, Circle, Charley River and Eagle 1:250,000 quadrangles. This work was done to provide additional mineral information to the Federal-State Land-Use Planning Commission of Alaska. The work was funded by a special Congressional appropriation and is part of an on-going mineral availability program of the Bureau of Mines, Alaska Field Operation Center.

Previous geochemical studies have been conducted in portions of the study area by Burand, 1965, 1968 (1) (2), Foster and Yount, 1972 (3), Holm, 1973 (4), Sainsbury and Thomas, 1975 (5), and Weber and Chapman, 1972 (6).

Base maps referred to in this report are the USGS topographical one degree quadrangles.

GEOCHEMICAL RECONNAISSANCE

A total of 1048 stream sediment and 527 pan concentrate samples were collected. Sampling was done by various river craft and limited helicopter support.

The histograms (Table 1) were compiled from the analyses of stream sediment samples for the elements Ag, B, Ba, Be, Co, Cu, Ga,

[1]Mining Engineer, Alaska Field Operation Center, Fairbanks, Alaska.
[2]Engineering Technician, Alaska Field Operation Center, Fairbanks, Alaska.
[3]Underlined numbers in parentheses refer to items listed in the References at the end of this report.

Mo, Mn, P, Pb, Sn, V, and Zn. The threshold value was then calculated at the 90th percentile, while anomalous levels were calculated at the 95th and 98th percentile levels. These levels are exhibited in Table 2. The anomalous levels of Ni, P, Pt, Sr, Sb, and Zn were determined by visual scan of the data. Results are plotted on plates 5 through 24 and 37, 38.

Similar histograms (Table 3) were compiled for analyses of the pan concentrate samples. Anomalous levels were also determined by a visual scan of the histograms for the elements of Ag, B, Be, Ce, Cu, La, Mo, Pb, Sn, W, and Y (Table 4). The results are plotted on plates 25 through 36. An additional 108 pan concentrate analyses taken during the 1977 field program in the intrusive/metamorphic terrane of northeastern Alaska are included in the histogram compilations. This was done in an attempt to provide broader geochemical background determinations.

Sample density was variable with the higher density in areas most seriously being considered for the upcoming land-use decisions.

SAMPLING AND ANALYTICAL PROCEDURES

Stream Sediment Samples

Stream sediment samples were collected with a steel shovel from the finer sandy portion of the active channel or deepest most active part of a dry creek bed. Organic rich material was avoided. Samples were put in water-resistant paper sample bags and air-dried before screening and analysis. Float-rock, outcrop and stream characteristics were noted and recorded at each sample station.

A pulverized fraction (-200 mesh) of the -80 mesh portion of each sample was analyzed by 6-step, D-C arc semiquantitative optical emission

spectrographic methods for 40 elements. These analyses were made by the University of Alaska, Mineral Industry Research Laboratory under the direction of Dr. P.D. Rao.

Uranium and thorium analyses were made by the State of Alaska, Division of Geological and Geophysical Surveys Laboratory under the direction of H. Potworowski. Samples were analyzed for uranium fluorometrically, following hydrofluoric acid/nitric acid digestion and preparation of a pellet by fusion with a carbonate, fluorite flux. Thorium values were determined by colorimetry.

Pan Concentrate Samples

Pan concentrate samples were collected to enhance recognition of resistate minerals with high specific gravity such as those containing tin, tungsten, gold, zirconium, barium and some of the rare earths. Generally, these minerals are at best only poorly detectable with routine stream sediment sampling and analysis procedures.

As with the stream sediment samples, the pan samples were collected with a steel shovel from the finer portion of the active channel. A 14" pan was filled, panned to approximately a 40 gram sample and carefully washed into a plastic bag. In the laboratory, the material was air dried and screened at 14 mesh. The minus material was magnetically separated and the non-magnetics were further concentrated with bromoform (2.85 sp.g.). The sinks were pulverized to minus 200 mesh and analyzed by semiquantitative optical emission spectrography for 24 elements. The analyses were also performed by the Mineral Industry Research Laboratory, Univer-

sity of Alaska.

Similar sample station data as with stream sediments was recorded.

ON-GOING STUDIES

Sample splits of stream sediments are currently being analysed for uranium and thorium. These splits will also be analysed by copper, lead, zinc, silver, and molybdenum by atomic absorption procedures.

Pan concentrates from the upper Yukon River region are also being quantitatively ~~being~~ analysed for gold.

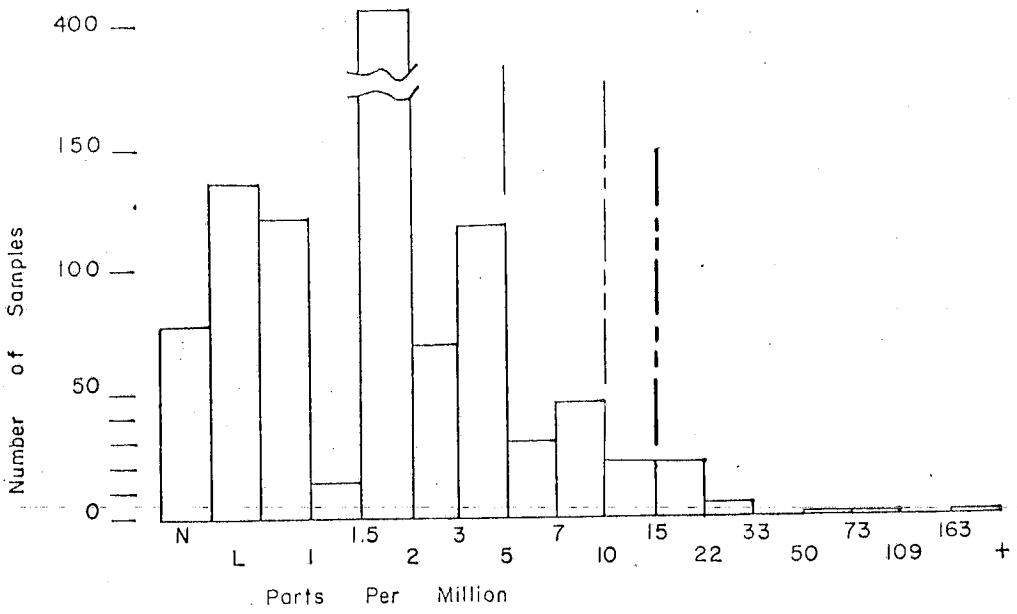
All of the above results will be available in a supplemental report at a later date.

REFERENCES

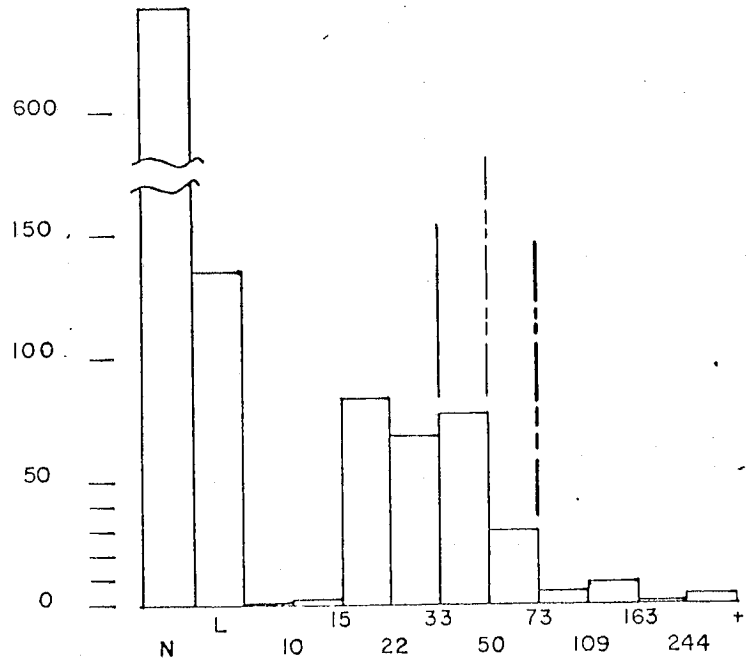
1. Burand, W.M., 1965, A geochemical investigation between Chatanika and Circle Hot Springs, Alaska Division of Geol. & Geophys. Surveys Report 5, 11 p.
2. _____, 1968, Geochemical investigations of selected areas in the Yukon-Tanana region of Alaska 1965 and 1966: Alaska Div. of Mines and Minerals Geochem. Rept. 13.
3. Foster, H.L., and Yount, M.E., 1972, Map showing distribution of anomalous amounts of selected elements in stream-sediment and rock samples, Eagle quadrangle, Alaska: U.S. Geol. Survey Map MF 356.
4. Holm, Bjorne, 1973, Bedrock geology and mineralization of the Mt. Prindle area, Yukon-Tanana Upland, Alaska: Master's thesis, Univ. of Alaska.
5. Sainsbury, C.L., and Thomas, B.I., 1975, Locations of anomalous concentrations of metals in Alaskan placer concentrate samples: U.S. Bureau of Mines OFR-56075.
6. Weber, F.R., and Chapman, R.M., 1972, Geochemical analyses of bedrock and stream sediment samples from Livengood quadrangle. U.S. Geol. Survey Open-file Map 530.

TABLE 1. - Histogram of

SEDIMENT SAMPLES

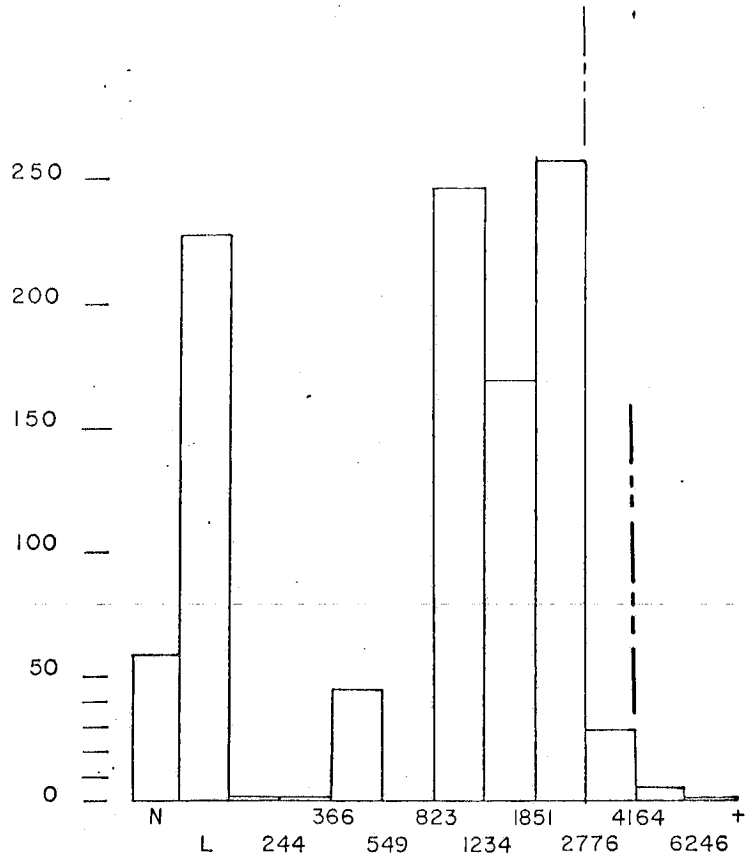


Be.

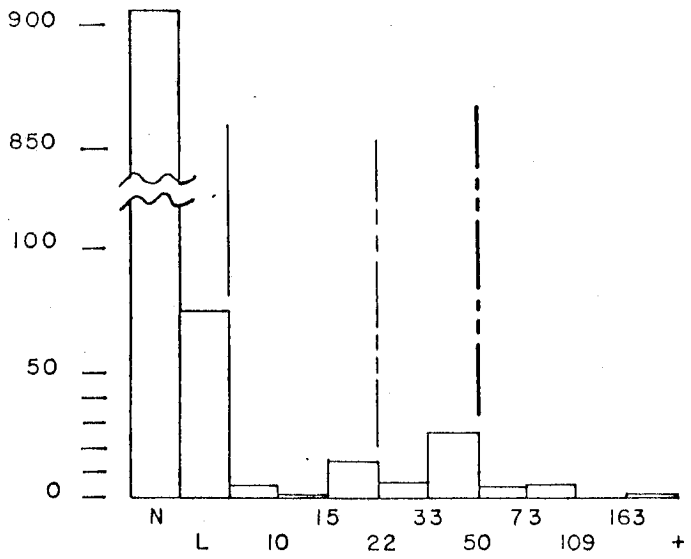


Co.

SEDIMENT SAMPLES

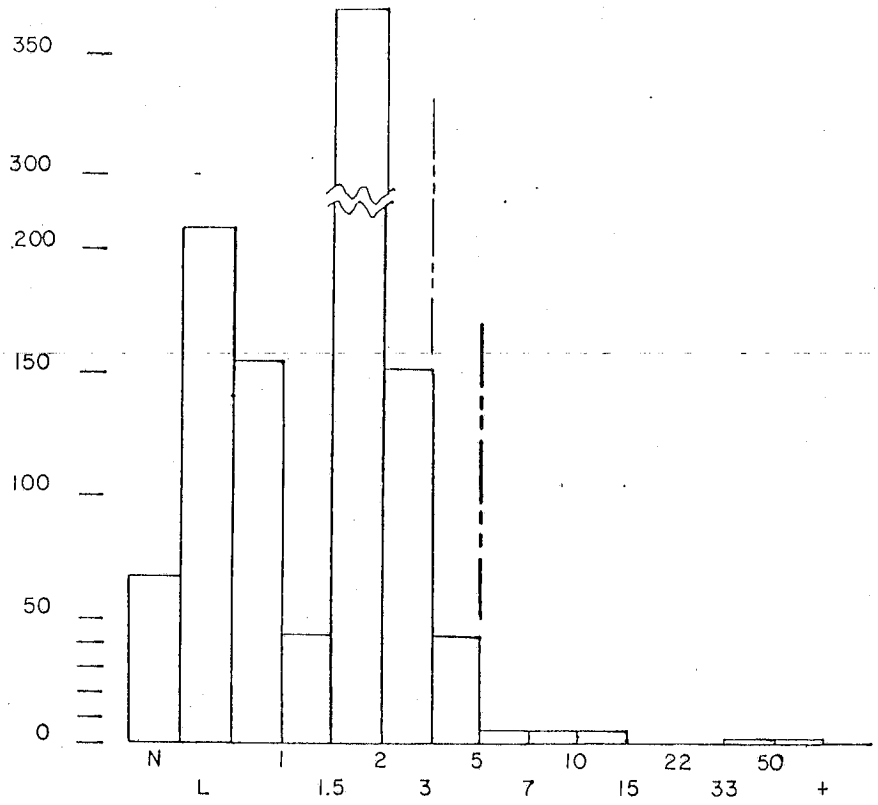


P.

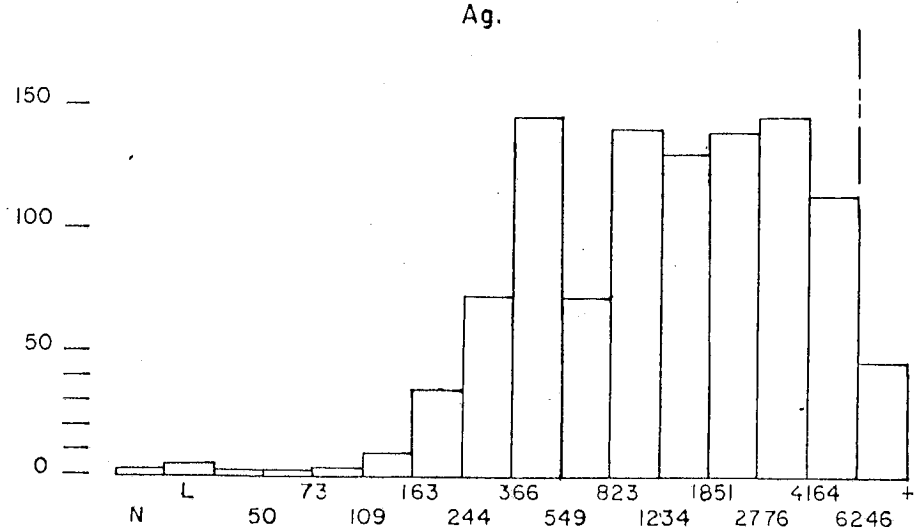


Mo.

SEDIMENT SAMPLES

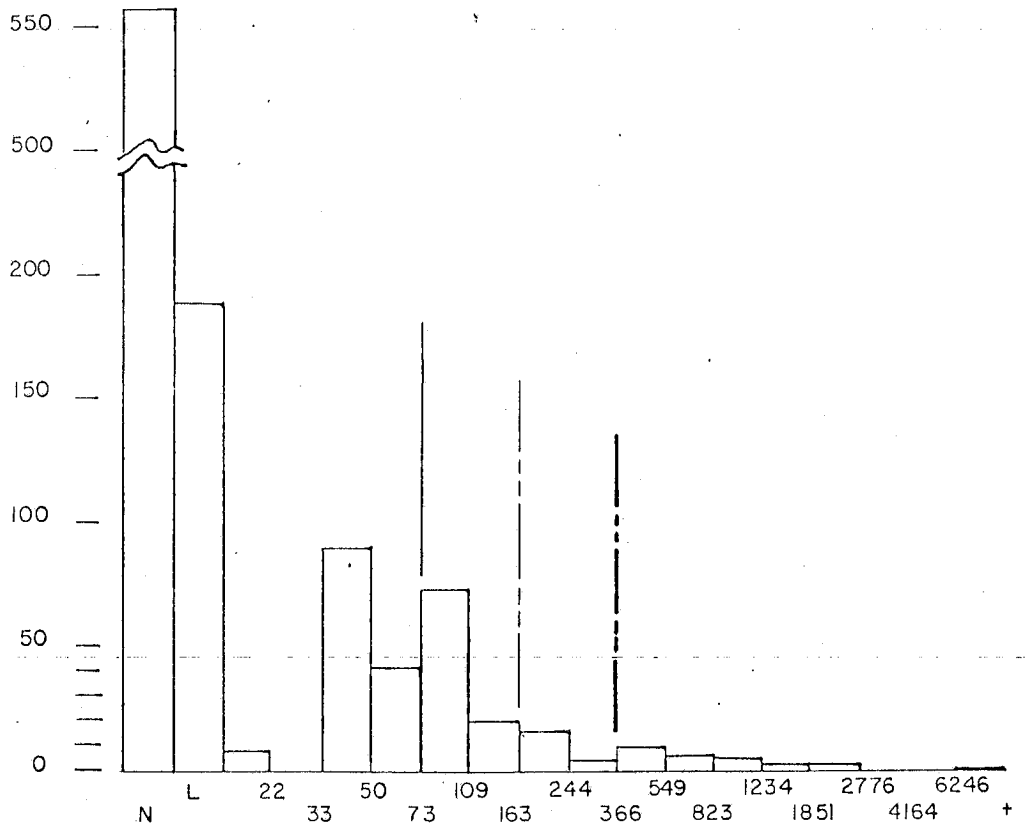


Ag.

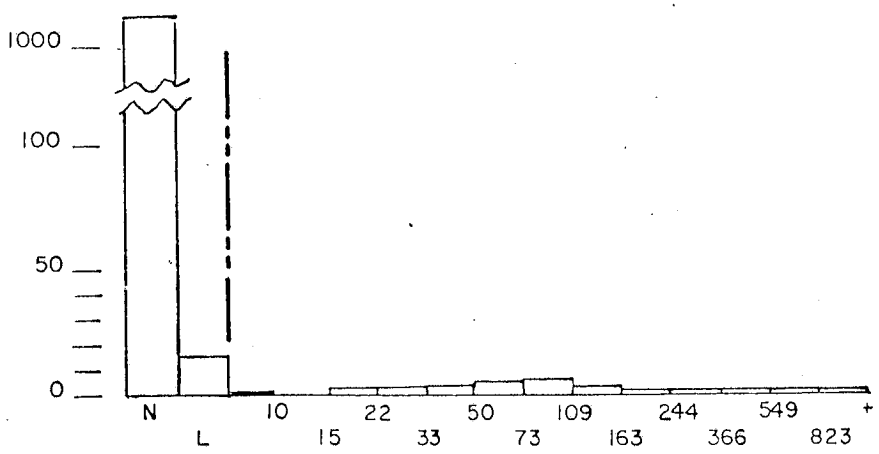


Mn.

SEDIMENT SAMPLES

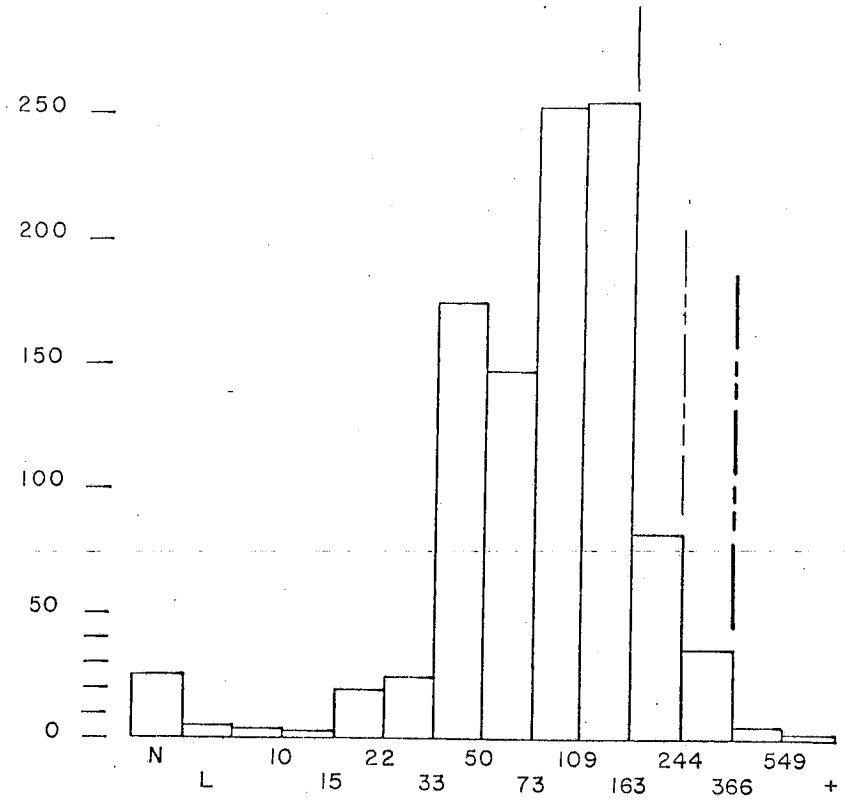


Pb.

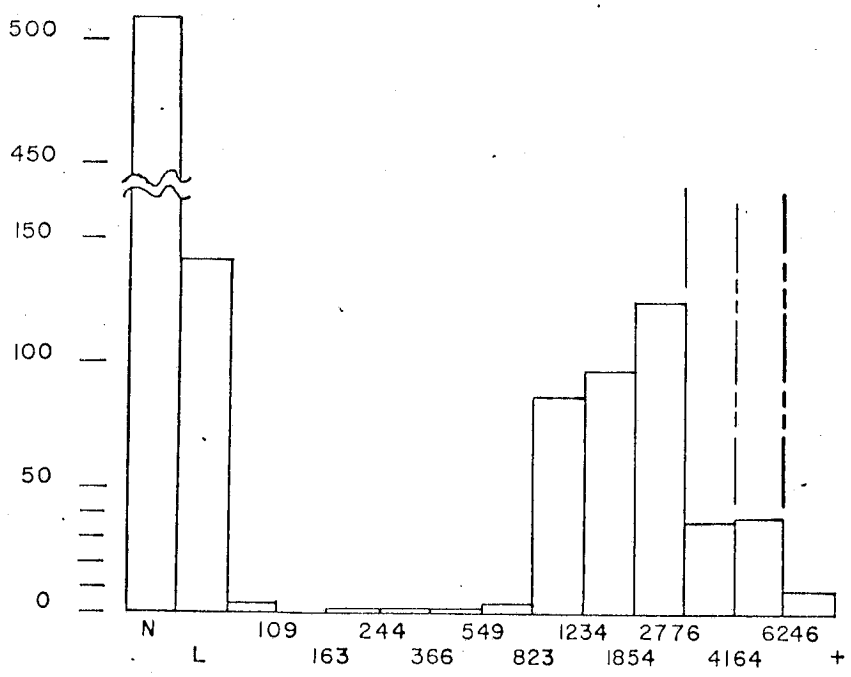


Sn.

SEDIMENT SAMPLES.

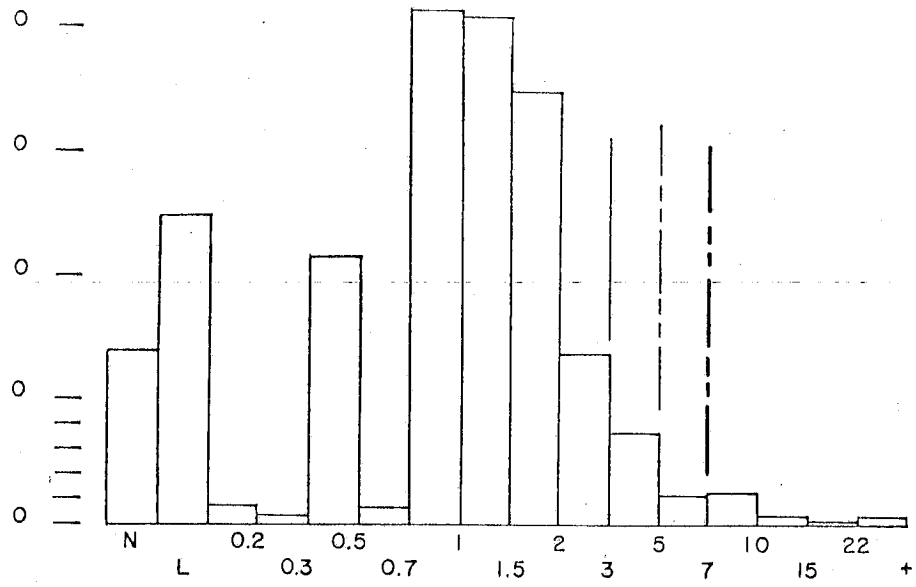


B.

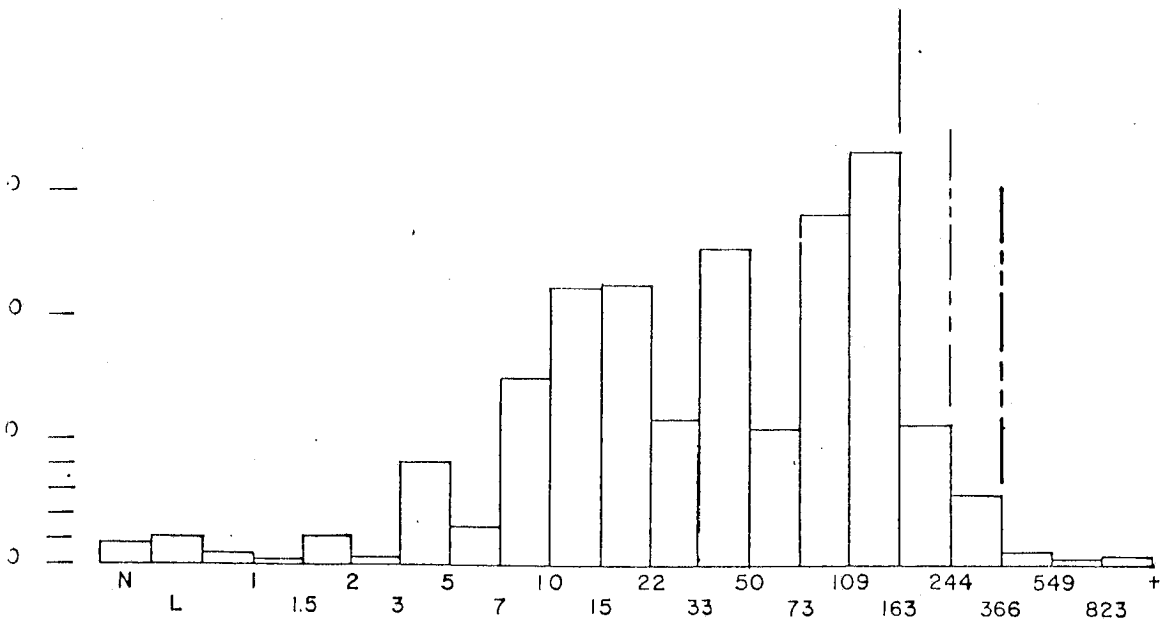


Ba.

SEDIMENT SAMPLES

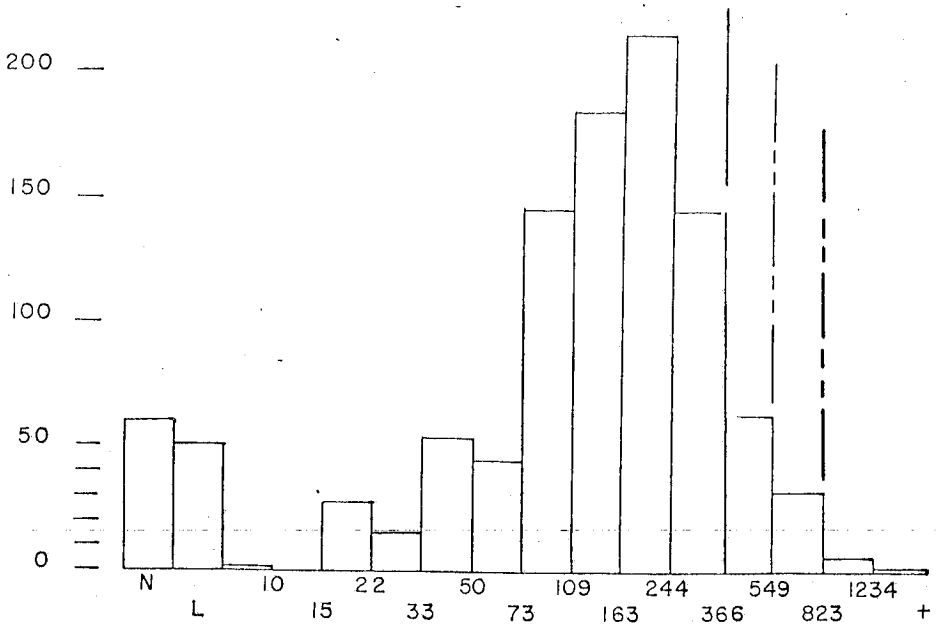


Ga.

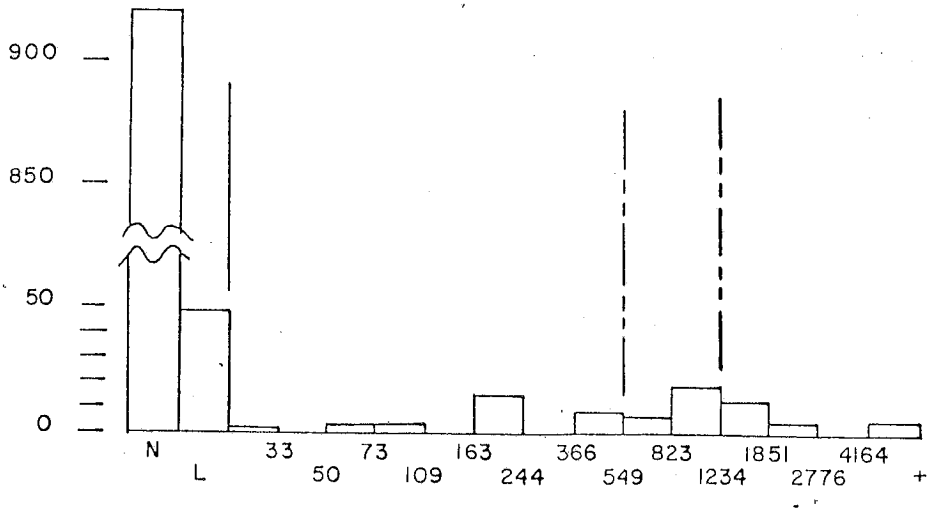


Cu.

SEDIMENT SAMPLES



V.



Zn.

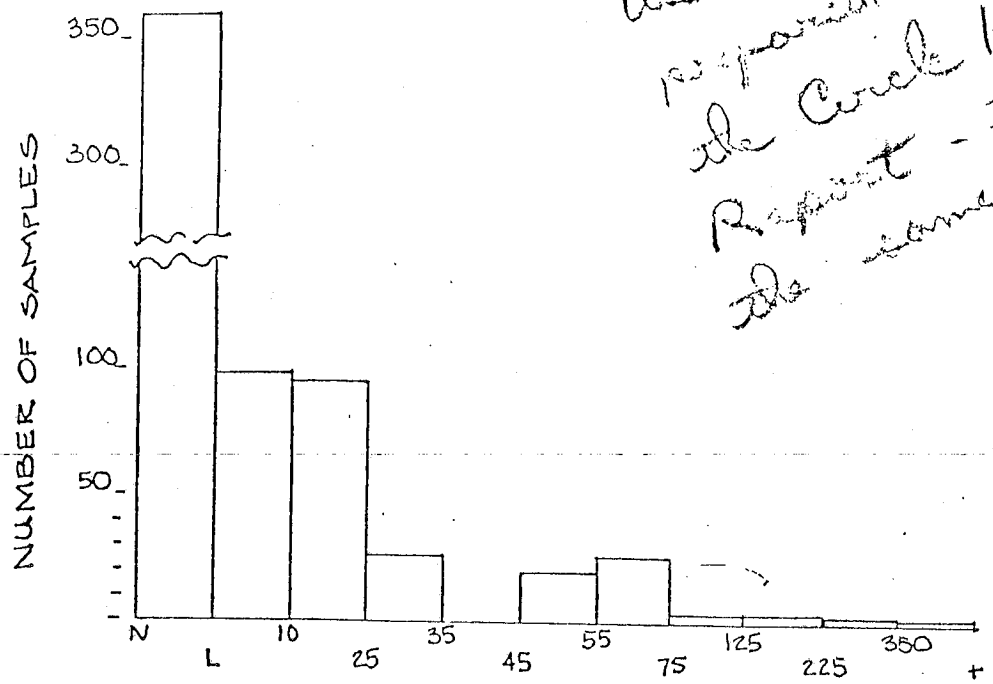
Table 2. - Anomalous levels for stream sediment data

Element	Sed samples		
	90% (threshold)	95% (weakly) (anomalous)	98% (highly) (anomalous)
Ag	- -	3.5	6
B	151	201	301
Ba	2001	3001	5000
Be	7	11	16
Ce	- -	- -	- -
Co	45	61	71
Cu	151	201	301
Ga	3.5	6	8
La	- -	- -	- -
Mn	- -	6000	- -
Mo	- -	30	70+
Nb	- -	- -	- -
Ni	- -	700	1000+
P	- -	3000	3500+
Pb	100	151	301
Pt	- -	L	50+
Sb	- -	100	1000+
Sn	- -	L	20+
Sr	- -	Any	- -
V	350	501	701
W	- -	- -	- -
Y	- -	- -	- -
Sn	- -	500	1500+

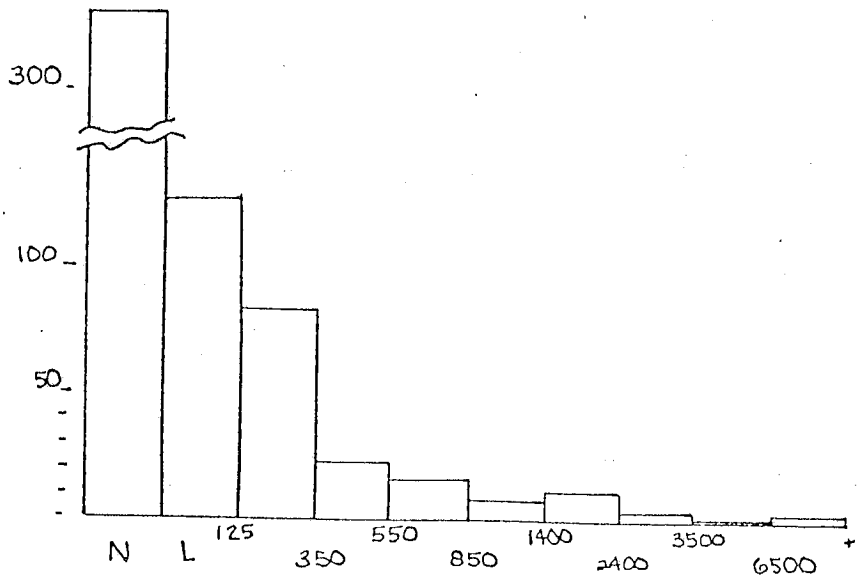
- -Not analysed for

PAN CONCENTRATE SAMPLES

Use figure as appropriate for the Circle Hot Spot Report - these are the same graphs

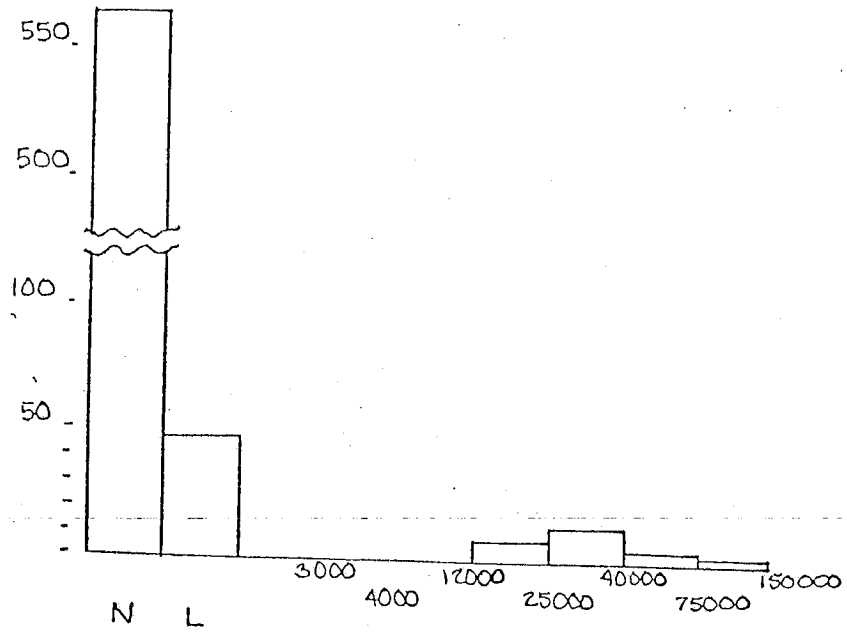


MOLYBDENUM (PARTS PER MILLION)

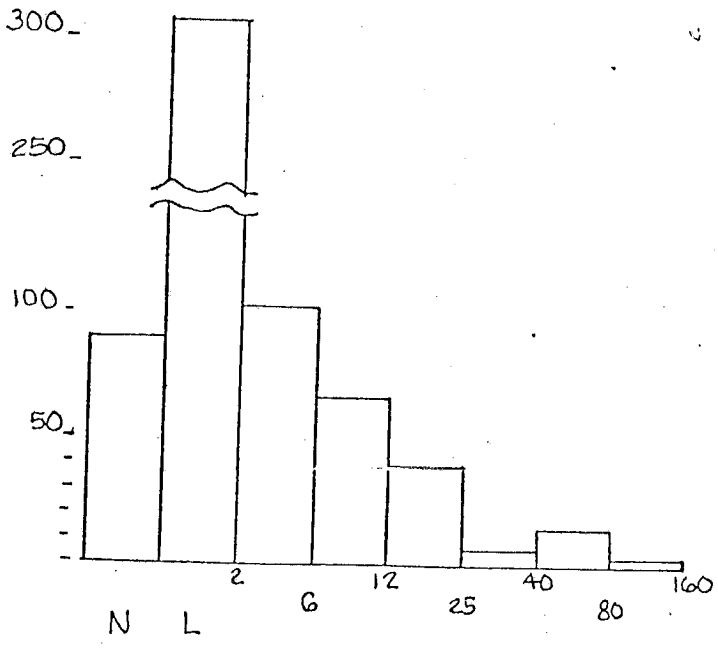


LEAD

PAN CONCENTRATE SAMPLES

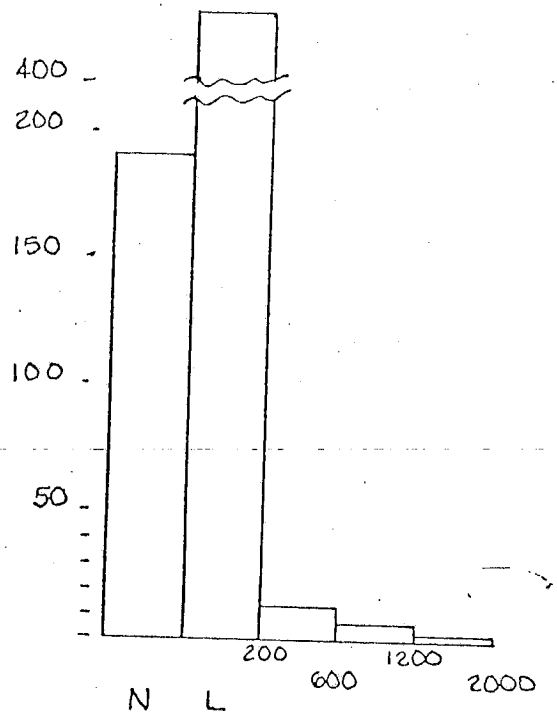


CESIUM



BERLYLIUM

PAN CONCENTRATE SAMPLES



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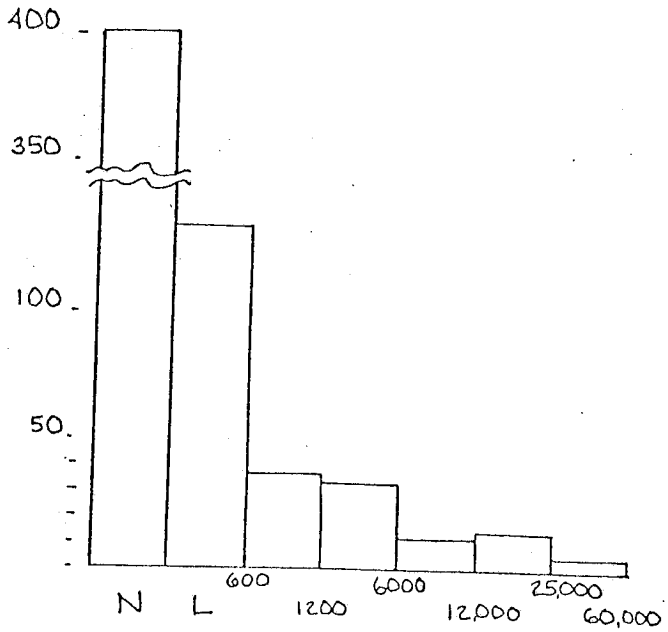
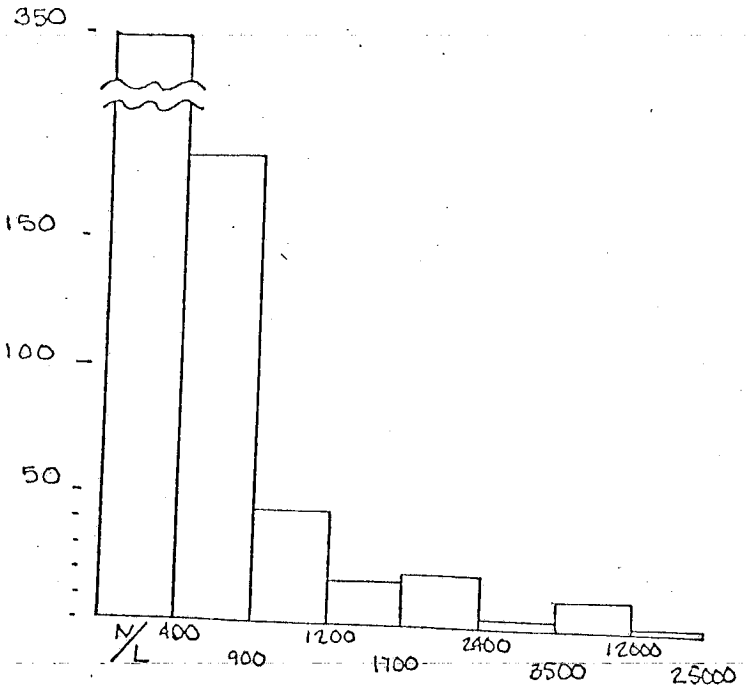
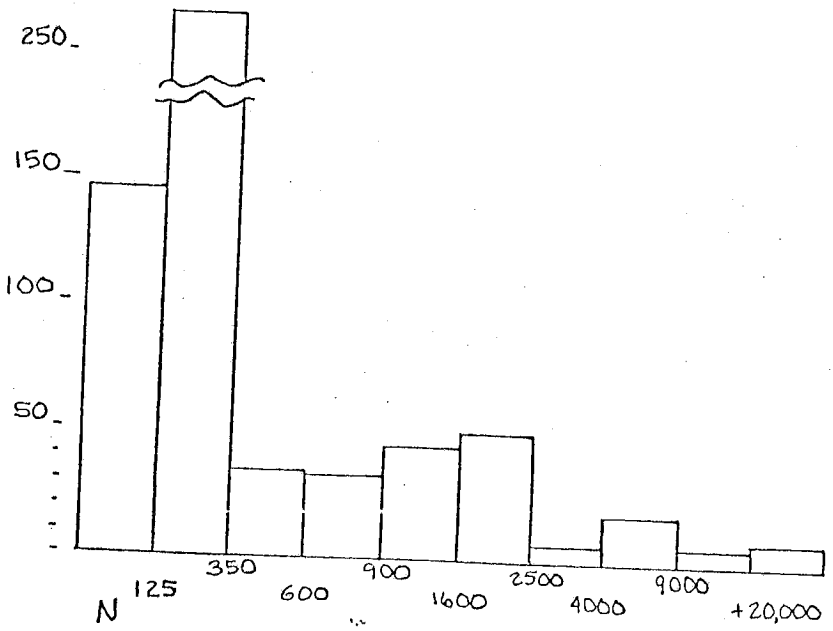


LANTHANUM

PAN CONCENTRATE SAMPLES

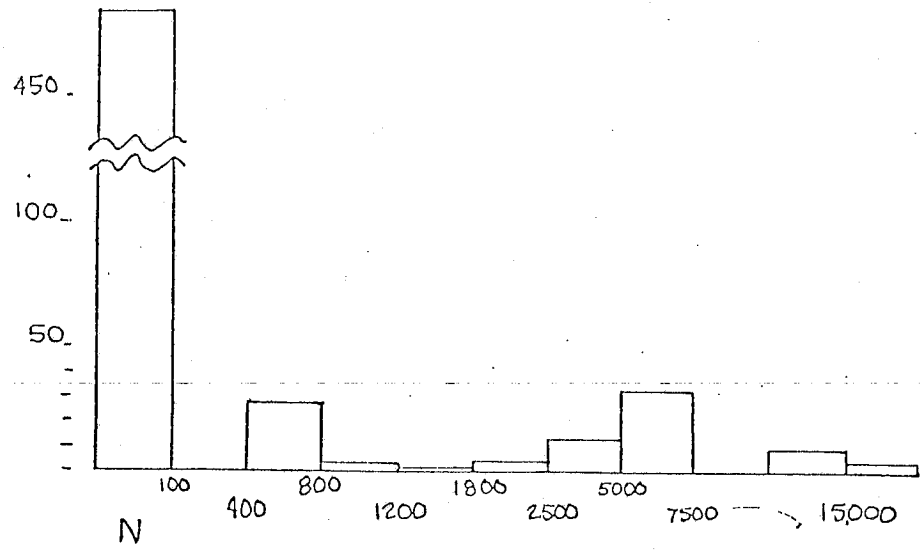


YTTRIUM

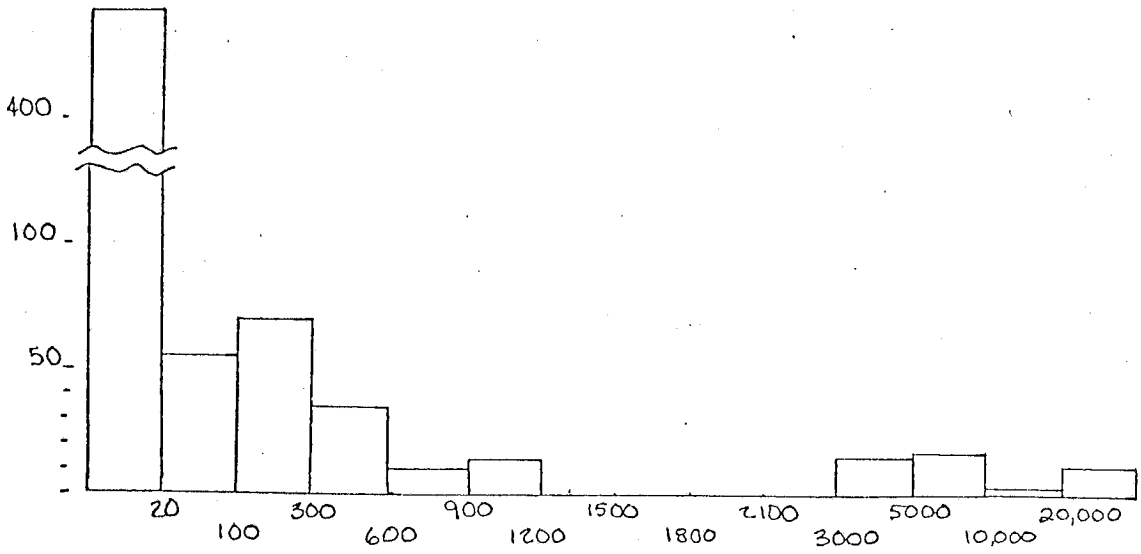


BORON

PAN CONCENTRATE SAMPLES



TUNGSTEN



TIN

Table 4. : Anomalous levels for pan concentrate data.

Element	Pan samples		
	90%	95%	98%
Ag	15	20	30
B	850	1801	2501
Ba	- -	- -	- -
Be	6	13	40
Ce	L	100	25,001
Co	- -	- -	- -
Cu	500	702	1001
Ga	- -	- -	- -
La	500	6001	9001
Mn	- -	- -	- -
Mo	25	56	126
Nb	300	601	1201
Ni	- -	- -	- -
P	- -	- -	- -
Pb	350	851	3401
Pt	- -	- -	- -
Sb	- -	- -	- -
Sn	100	1000	3001
Sr	- -	- -	- -
V	- -	- -	- -
W	1000	1801	5001
Y	900	1201	3501
Sn	- -	- -	- -

- -Not analysed for