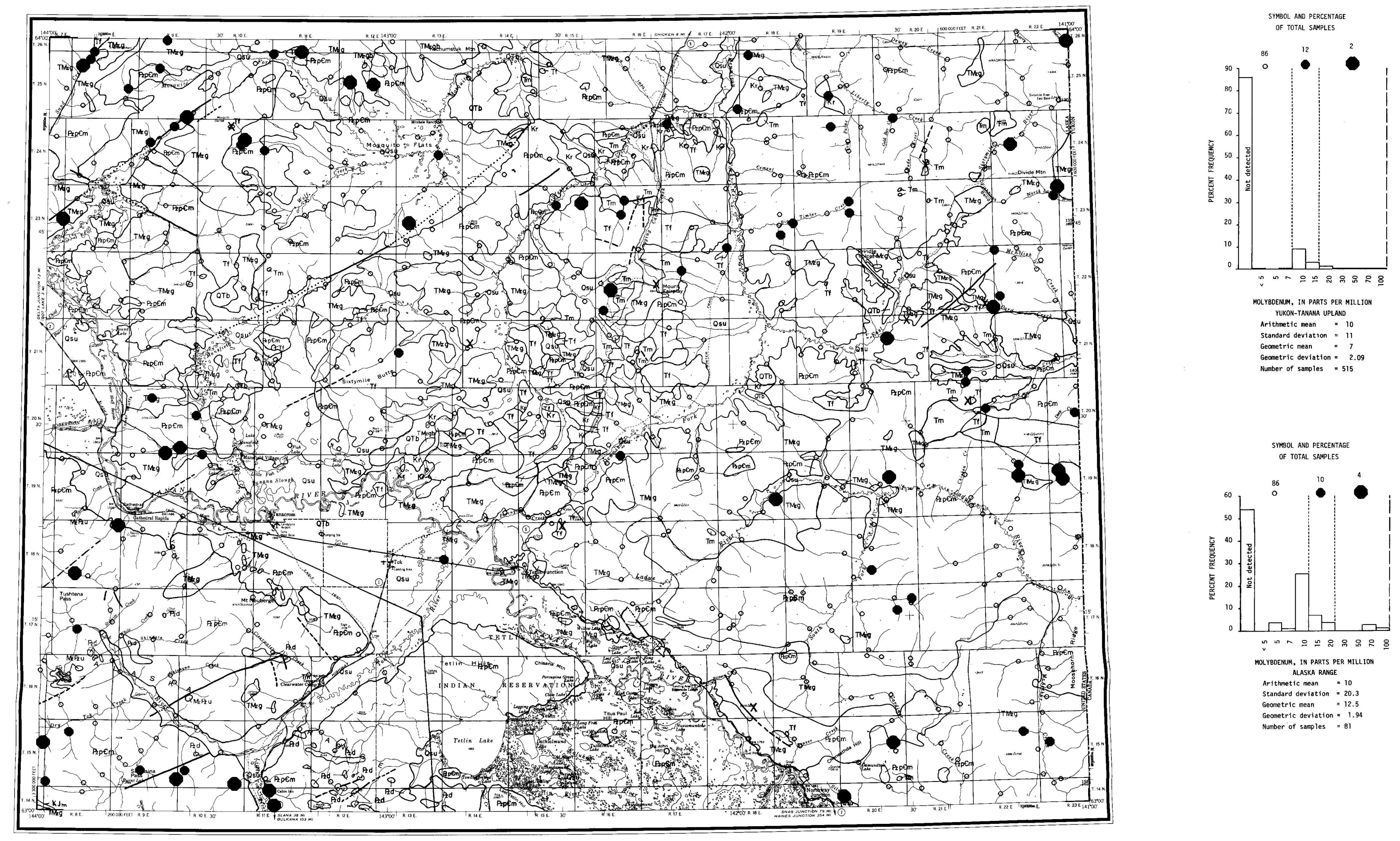
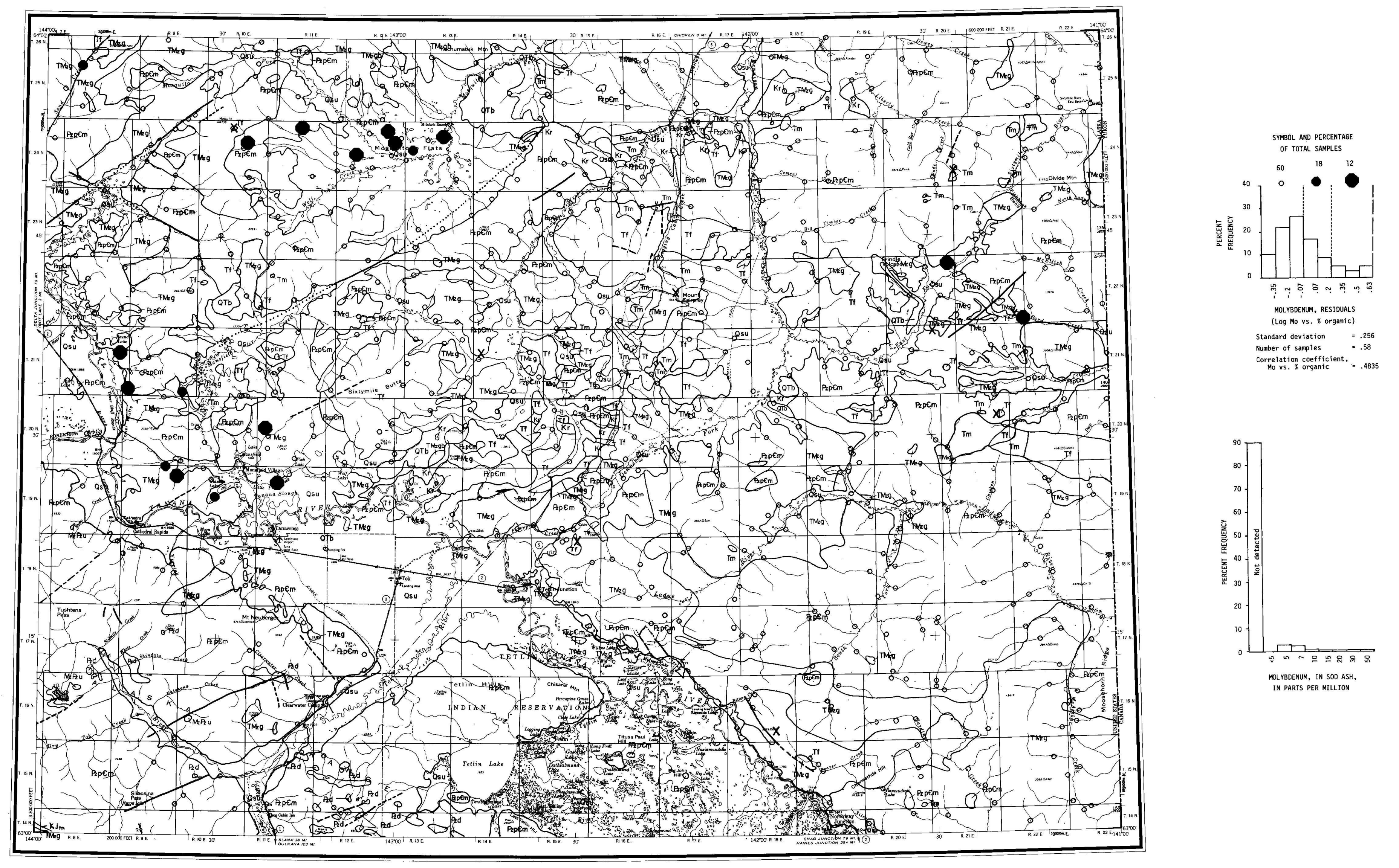
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

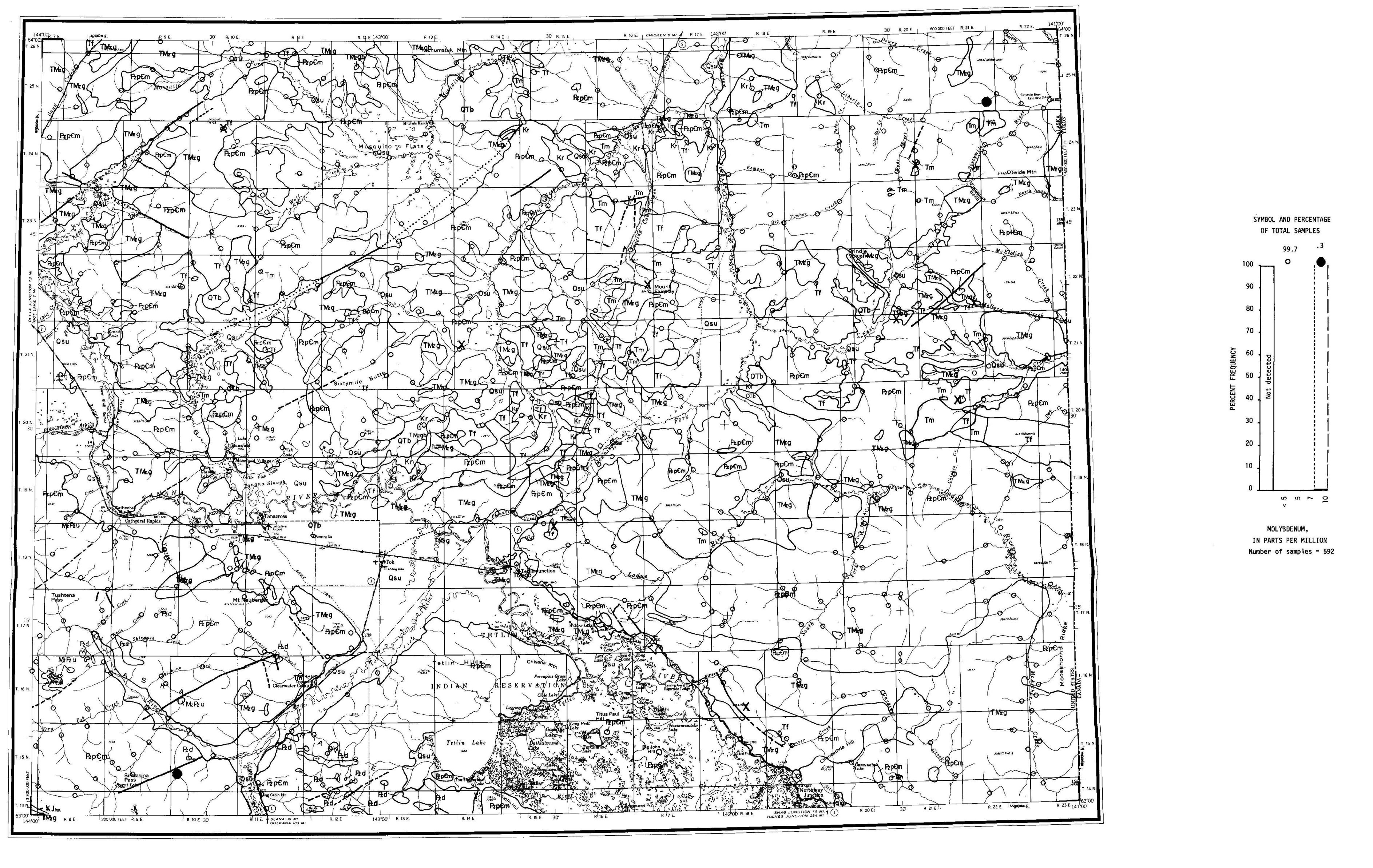
FOLIO OF THE TANACROSS QUADRANGLE, ALASKA
MAP MF-767 G
CURTIN AND OTHERS--GEOCHEMICAL MAP, MOLYBDENUM



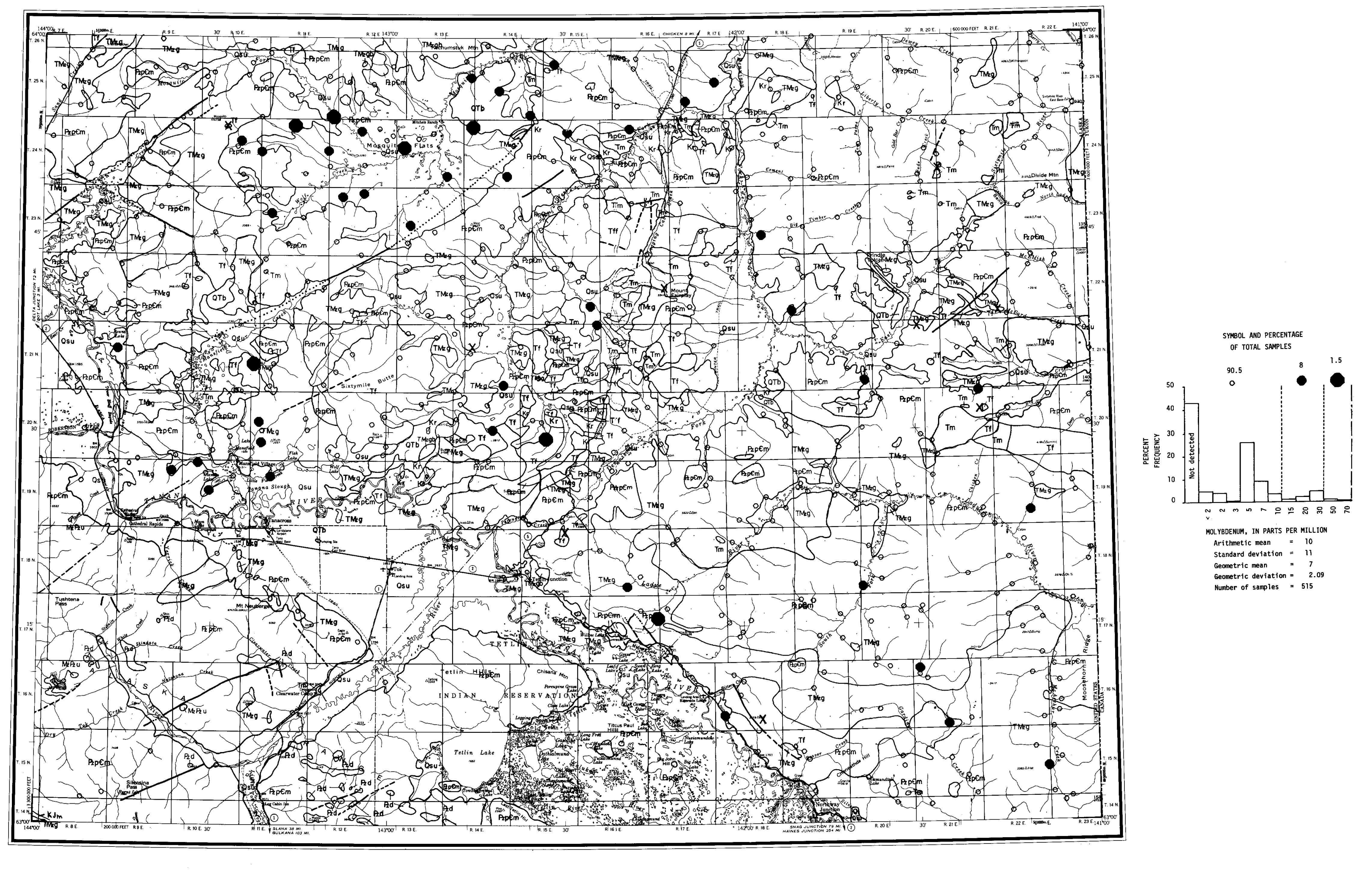
A. Molybdenum in the oxide residue of stream sediment



C. Molybdenum in the ash of streambank sod



B. Molybdenum in the minus-80-mesh stream sediment



D. Molybdenum in the ash of aquatic bryophytes (mosses)

BASE FROM U. S. GEOLOGICAL SURVEY, 1:250,000, TANACROSS QUADRANGLE, 1964

Scale 1:500,000
1 inch equals approximately 8 miles

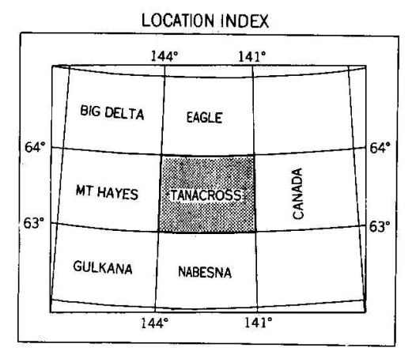
QUADRANGLE LOCATION

GEOCHEMICAL MAPS SHOWING THE DISTRIBUTION AND ABUNDANCE OF MOLYBDENUM IN THE TANACROSS QUADRANGLE, ALASKA

BY

G. C. CURTIN, G. W. DAY, R. B. CARTEN, S. P. MARSH, AND R. B. TRIPP

1976



BACKGROUND INFORMATION RELATING TO THIS MAP IS PUBLISHED AS U.S. GEOLOGICAL SURVEY CIRCULAR 734, AVAILABLE FREE OF CHARGE FROM THE U.S. GEOLOGICAL SURVEY, RESTON, VA. 22092

For sale by U. S. Geological Survey, price $.50

EXPLANATION

GEOLOGY GENERALIZED FROM FOSTER (1970)

CORRELATION OF MAP UNITS

UNCONSOLIDATED DEPOSITS

Qsu QUATERNARY

SEDIMENTARY ROCKS

IGNEOUS AND METAMORPHIC ROCKS

QTb QUATERNARY AND TERTIARY

Tm Tf TERTIARY(?)

TMzg TMzgb TERTIARY OR MESOZOIC

Kr CRETACEOUS(?)

KJm CRETACEOUS OR JURASSIC

MzPzu MESOZOIC OR PALEOZOIC

Pzd PALEOZOIC(?)

Pzp€m PALEOZOIC AND (OR) PRECAMBRIAN

DESCRIPTION OF MAP UNITS

	UNCONSOLIDATED DEPOSITS
Qsu	UNCONSOLIDATED SEDIMENTARY DEPOSITS
	SEDIMENTARY ROCKS
Kr	DETRITAL ROCKS (CRETACEOUS?)
KJm	MENTASTA ARGILLITE OF RICHTER (1967) (JURASSIC OR CRETACEOUS)
	IGNEOUS AND METAMORPHIC ROCKS
QTb	BASALT
Tm	MAFIC VOLCANIC ROCKS
Tf	FELSIC TUFF, WELDED TUFF, LAVA, AND HYPABYSSAL INTRUSIVE ROCKS
TMzg	GRANITIC ROCKS, UNDIVIDED
TMzgb	GABBRO
MzPzu	ULTRAMAFIC ROCKS
Pzd	DIORITE
Pzp€m	METAMORPHIC ROCKS, UNDIVIDED

GEOLOGIC SYMBOLS

⁓	CONTACT, APPROXIMATELY LOCATED
---	FAULT, DASHED WHERE APPROXIMATELY LOCATED, DOTTED WHERE CONCEALED. U, UPTHROWN SIDE; D, DOWNTHROWN SIDE
---	FAULT OR LINEAMENT FROM AERIAL PHOTOGRAPHS
┐	LINE SEPARATES NORTHERN (YUKON-TANANA UPLAND) POPULATION OF GEOCHEMICAL SAMPLES FROM SOUTHERN (ALASKA RANGE) POPULATION
X	BASE METAL PROSPECTS NORTH OF THE TANANA RIVER

GEOCHEMICAL SYMBOLS

○	BACKGROUND VALUES
●	WEAKLY ANOMALOUS VALUES
⬣	STRONGLY ANOMALOUS VALUES

DISCUSSION

This series of geochemical maps shows the distribution of molybdenum in four sample media: (A) the oxide residue (oxalic-acid-leachable fraction) of the stream sediment, (B) the minus-80-mesh stream sediment, (C) the ash of streambank sod (mixed organic and inorganic material) collected beneath the water level, and (D) the ash of aquatic bryophytes (mosses). The molybdenum data are plotted on base maps showing generalized geology and the drainage pattern. The map symbols show the sample sites and ranges of values in the following manner: (1) open circles denote background, (2) the small black circles denote weakly anomalous values, and (3) the large black circles denote strongly anomalous values. Because the small black symbols represent weakly anomalous values, they are considered to be significant only where they are closely associated with strongly anomalous metal values either in the same sample medium or with anomalous values in other sample media. The ranges of values represented by the symbols are shown on the histograms that accompany the geochemical maps. An explanation of sampling, preparation, and analytical procedures is given in Circular 734, which accompanies this folio. Complete analytical data for geochemical samples collected by the U.S. Geological Survey in the Tanacross quadrangle are available in a U.S. Geological Survey open-file report (O'Leary and others, 1976).

Of the four sample media, the oxide residue (mainly secondary iron-manganese oxides) of stream sediment and the aquatic bryophytes act as scavenging agents of ions in solution in stream waters. The molybdenum content of these media, therefore, is indicative of the amounts of molybdenum migrating in solution from bedrock and colluvium. The molybdenum content of the streambank sod represents both molybdenum scavenged from solution by the organic material and the molybdenum content of the detrital material in the sod. The molybdenum content of the minus-80-mesh stream sediment, on the other hand, mainly represents the amount of molybdenum within the detrital material of the stream sediment.

Molybdenum values in the ash of streambank sod show a relatively high positive correlation with the organic content. This high correlation suggests that the amount of organic material noticeably influences the molybdenum content of the sod. A regression analysis--log molybdenum vs. organic content--was used to determine the influence of organic content on the variation of molybdenum values in the ash of the sod. This type of analysis allows separation of those high molybdenum values that reflect the concentration of background amounts of molybdenum by organic material from those high values that are derived from a mineralized source. Values from the regression analysis--shown as residuals--were used on the geochemical map (fig. C). The distribution of the residuals is shown on the upper of the two accompanying histograms. The lower histogram shows the distribution of original molybdenum concentrations in the ash of the streambank sod.

The molybdenum values in the ash of aquatic bryophytes were not adjusted on the basis of percent of organic material because the organic content of the bryophytes showed little variation.

The histograms and other statistical data for molybdenum in the oxide residue of stream sediment (fig. A) show two populations. One population (generally lower values) represents the molybdenum content of samples collected in the maturely dissected, forested terrain of the Yukon-Tanana Upland--that part of the quadrangle north of the Tanana River. The other population (generally higher values) represents samples collected in the rugged, mountainous terrain of the Alaska Range--south and west of the heavy black line on the map. In the maturely dissected terrain, chemical weathering is probably the main factor controlling the mobility of molybdenum. This type of weathering may be characterized by the solution of sulfide and other unstable minerals and a general dispersion and impoverishment of molybdenum and other base metals in the weathering zone. In the rugged mountainous terrain, on the other hand, mechanical weathering is the primary process controlling element dispersion. In this environment, impoverishment of metals in the weathering zone due to chemical processes is a minor factor.

Anomalous molybdenum values in the oxide residue of the stream sediment are scattered throughout much of the terrain north of the Tanana River. In T. 24 N., R. 10 E., high molybdenum values are associated with a porphyry-type mineralized zone associated with a hypabyssal felsic intrusive body. Samples from this zone contain anomalous amounts of molybdenum, and the surrounding rocks contain anomalous amounts of lead, copper, tin, and silver (H. L. Foster, oral commun., 1975). High molybdenum values in the ash of streambank sod (fig. C) and of aquatic bryophytes (fig. D) also are associated with this zone. High molybdenum values in the oxide residue coincide with the location of a copper porphyry prospect in the east-central part of the quadrangle, in T. 22 N., R. 21 E. Other high molybdenum values in the oxide residue may indicate additional zones of mineralized rock.

The anomalous molybdenum values in the Alaska Range probably reflect the presence of molybdenum in small mineralized shear zones and veins that are known to occur in this terrain.

Three distinct areas in the Yukon-Tanana Upland of possible molybdenum mineralization are shown on the geochemical map of adjusted molybdenum values in the ash of streambank sod (fig. C). These areas are: (1) Mosquito Flats in the northwest part of the quadrangle, (2) an area in the west-central part of the quadrangle, and (3) an area shown by two high values in the eastern part of the quadrangle. High molybdenum values were also determined in the ash of aquatic bryophytes (fig. D) in the same two anomalous areas in the western part of the quadrangle. In the southernmost part of the two western anomalous areas, high molybdenum values were also determined in the oxide residue of stream sediment (fig. A). In this area, there is a general correlation of the anomalous molybdenum values with those of copper, lead, zinc, and arsenic (Curtin and others, 1976b, c, d; Curtin, O'Leary, and Carten, 1976).

In the Mosquito Flats area, a molybdenum-bearing hypabyssal intrusive body in T. 24 N., R. 10 E. is probably the source for the anomalous molybdenum values in sod ash in Mosquito Flats. The high values may reflect the transport of molybdenum in solution from this and other mineralized areas adjacent to Mosquito Flats and subsequent deposition of molybdenum in the organic-rich, reducing environment within Mosquito Flats. The adjusted high molybdenum values (influence of organic content removed) suggest, however, that molybdenum is also being introduced into the sod from a local source and may be migrating to the surface from the underlying bedrock.

The easternmost of the two anomalous molybdenum values in sod ash in the eastern part of the quadrangle was determined in a sample collected from a stream draining the porphyry copper prospect in T. 22 N., R. 21 E. This high value and the high molybdenum value in the oxide residue at this site (fig. A) are derived from the molybdenum in the mineralized zone.

Base metal prospects at seven localities north of the Tanana River were not shown by high molybdenum values in any of the four sample media. These prospects are located in T. 21 N., R. 14 E.; T. 18 N., R. 15 E.; T. 22 N., R. 16 E.; T. 24 N., R. 20 E.; T. 21 N., R. 20 E.; T. 20 N., R. 21 E., and in T. 16 N., R. 18 E. The absence of anomalous molybdenum values around the prospects indicates that either the molybdenum content of the altered and mineralized rock at the prospects is low or the amount of mineralized rock is too small to produce molybdenum-bearing dispersion trains that could be detected at the sampling density used in this study.

The results of the geochemical sampling demonstrate that molybdenum occurrences in the maturely dissected terrain are more completely defined when the oxide residue and ash of streambank sod or aquatic bryophytes are used in combination than when any one of these media is used alone. The fact that only two molybdenum values were detected in the clastic minus-80-mesh stream sediment indicates that this sample medium is not useful in geochemical exploration for molybdenum in this terrain.

Patterns defining areas of molybdenum potential are shown on the composite geochemical map of copper and molybdenum distribution (Curtin and others, 1976a), which is included in this folio.

REFERENCES CITED

Curtin, G. C., Day, G. W., O'Leary, R. M., Marsh, S. P., and Tripp, R. B., 1976a, Composite geochemical map of anomalous copper and molybdenum distribution in the Tanacross quadrangle, Alaska: U.S. Geol. Survey Misc. Field Studies Map MF-767M, 1 sheet, scale 1:250,000.

_____1976b, Geochemical maps showing the distribution and abundance of copper in the Tanacross quadrangle, Alaska: U.S. Geol. Survey Misc. Field Studies Map MF-767F, 1 sheet, scale 1:500,000.

_____1976c, Geochemical maps showing the distribution and abundance of lead in the Tanacross quadrangle, Alaska: U.S. Geol. Survey Misc. Field Studies Map MF-767H, 1 sheet, scale 1:500,000.

_____1976d, Geochemical maps showing the distribution and abundance of zinc in the Tanacross quadrangle, Alaska: U.S. Geol. Survey Misc. Field Studies Map MF-767I, 1 sheet, scale 1:500,000.

Curtin, G. C., O'Leary, R. M., and Carten, R. B., 1976, Geochemical maps showing the distribution and abundance of arsenic and mercury in the Tanacross quadrangle, Alaska: U.S. Geol. Survey Misc. Field Studies Map MF-767J, 1 sheet, scale 1:500,000.

Foster, H. L., 1970, Reconnaissance geologic map of the Tanacross Quadrangle, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-593, scale 1:250,000.

O'Leary, R. M., McDanal, S. K., McDougal, C. M., Day, G. W., Curtin, G. C., and Foster, H. L., 1976, Spectrographic and chemical analyses of geochemical samples and related data from the Tanacross quadrangle, Alaska: U.S. Geol. Survey open-file rept. 76-422, 94 p.