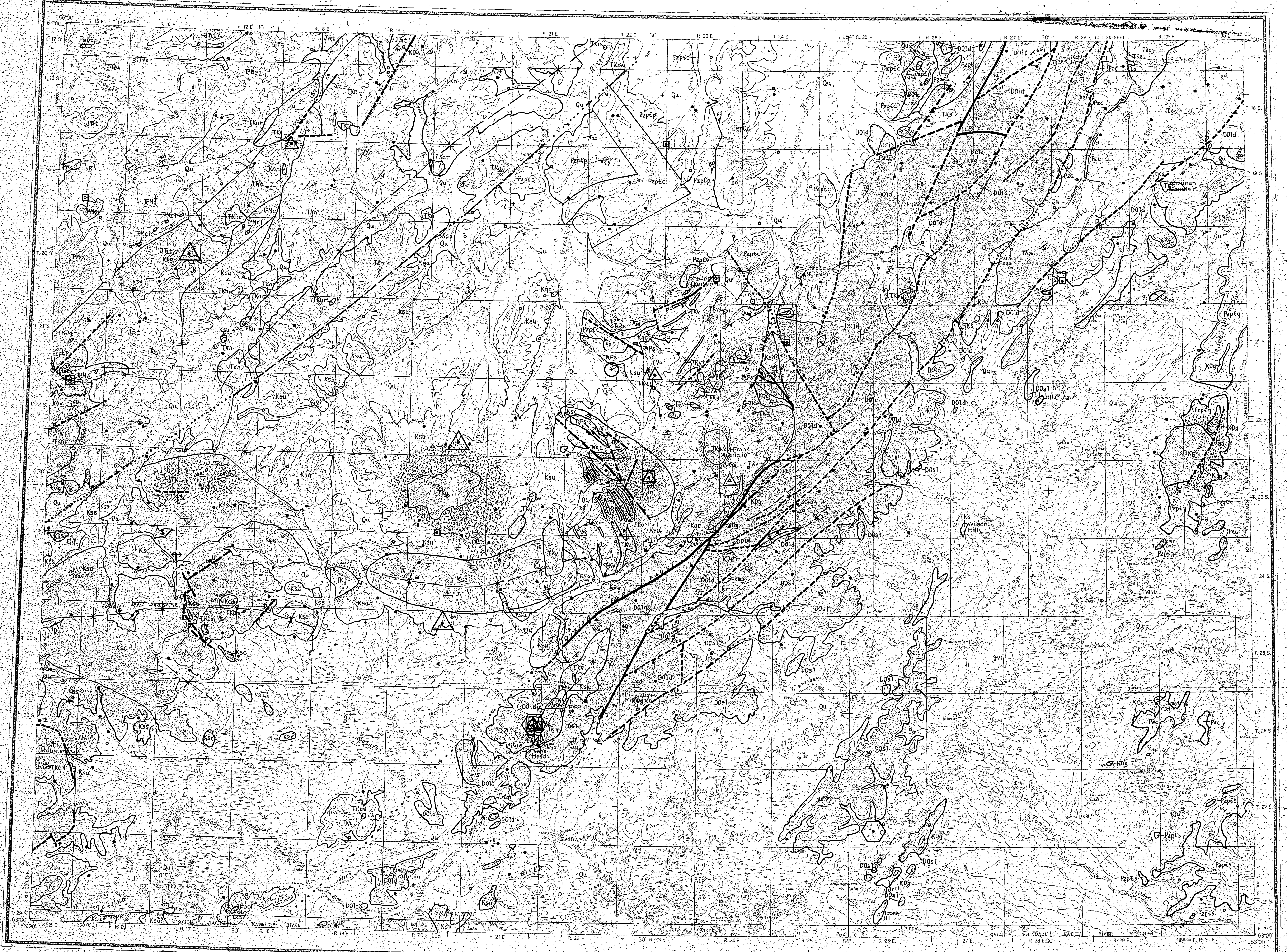
[redacted]

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

OPEN-FILE REPORT 80-811 H
SHEET 1 OF 2



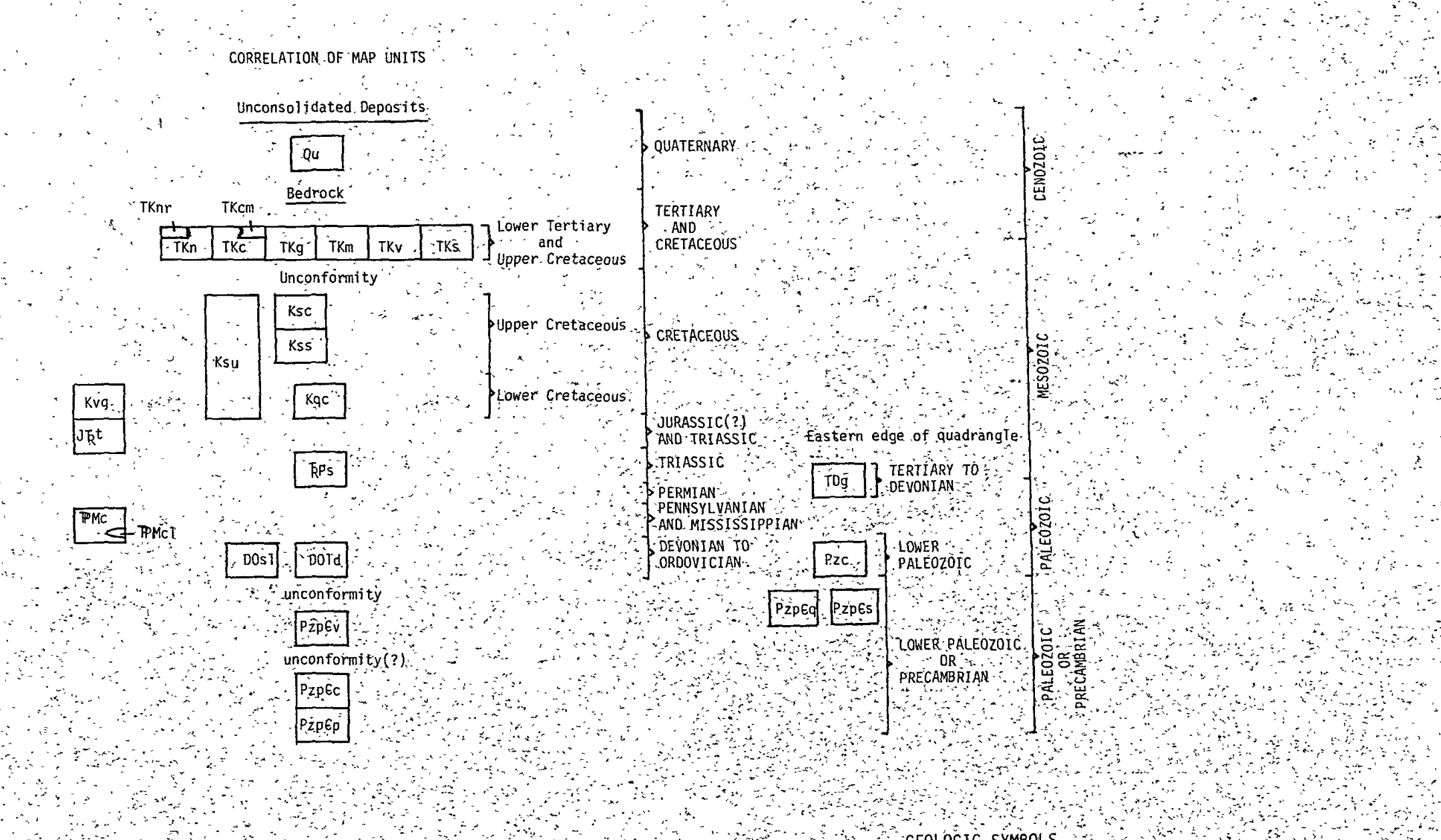
Base from U.S. Geological Survey, 1959

Geology generalized from Patton and others, 1980

SCALE 1:250000

CONTOUR INTERVAL 200 FEET
DOTTED LINES REPRESENT 100-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL
1959 MAGNETIC DECLINATION AT SOUTH EDGE OF SHEET VARIES FROM 23°00' TO 24°30' EAST

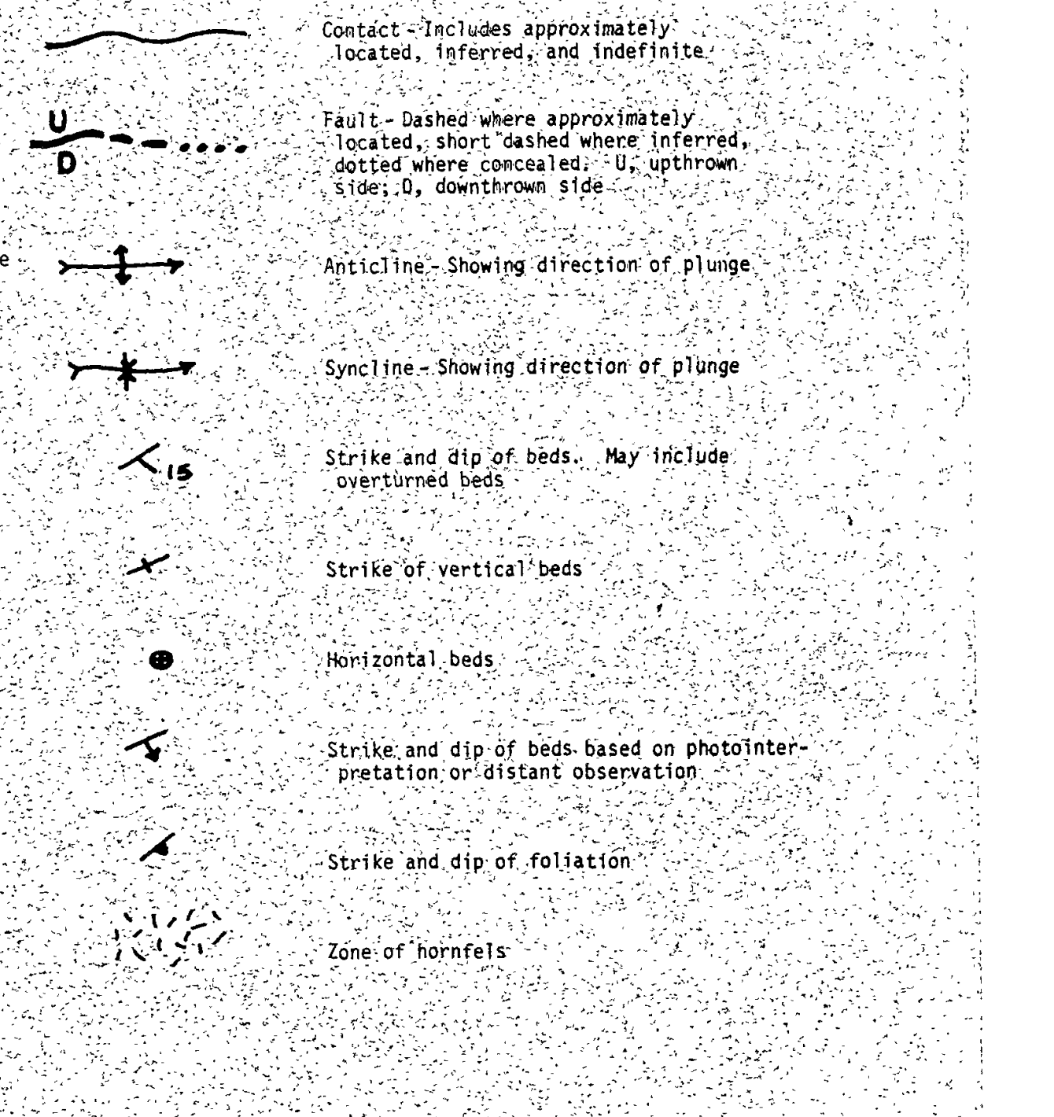
CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

Qu	UNDIFFERENTIATED SURFICIAL DEPOSITS
TKnr TKn	VOLCANIC ROCKS OF THE NOWITNA RIVER AREA--Chiefly trachyandesite, basaltic andesite, and basalt flows. TKnr--Rhyolite domes, tuffs, and breccia
TKcm TKc	MAFIC TO INTERMEDIATE VOLCANO-PLUTONIC COMPLEXES--Altered basalt, andesite, and trachyandesite flows and hypabyssal intrusive bodies. TKcm--Small bodies of monzonite, quartz monzonite, and granodiorite
TKg	GRANITE
TKm	MONZONITE
TKv	VOLCANIC ROCKS OF NIXON FORK-UPPER SULUKNA RIVER AREA--Rhyolite, dacite, and trachyandesite sills, dikes, flows, and plugs
TKs	VOLCANIC ROCKS OF THE SISCHU MOUNTAINS--Rhyolite and dacite flows and domes
TDg	GABBRO
Ksu	UNDIFFERENTIATED SHALE, SILTSTONE, AND SANDSTONE
Ksc	NONMARINE SANDSTONE AND QUARTZ-CHERT CONGLOMERATE
Kss	MARINE SANDSTONE, SILTSTONE, AND SHALE
Kqc	QUARTZ-CARBONATE SANDSTONE AND PEBBLY MUDSTONE
Kvg	VOLCANIC GRAYWACKE AND CONGLOMERATE
JTRt	CHERTY TUFF, CRYSTAL AND LITHIC TUFFS, AND VOLCANIC BRECCIA
TRPs	SANDSTONE, SANDY LIMESTONE, SPICULITE, AND CONGLOMERATE
TPMc TPMcl	CHERT AND LIMESTONE--Chiefly radiolarian chert. TPMcl--Limestone
DOsl	SHALY LIMESTONE
DOTd	LIMESTONE AND DOLOMITE
Pzc	CHERT AND PHYLLITE
Pzp€q	QUARTZITE, GRIT, AND ARGILLITE
Pzp€s	SHEARED GRIT, QUARTZITE, AND QUARTZ-MICA SCHIST
Pzp€v	METAVOLCANIC ROCKS--Metarhyolite and dacite
Pzp€c	CALC-SCHIST
Pzp€p	PELITIC SCHIST

GEOLOGIC SYMBOLS



Contact - Includes approximately located, inferred, and indefinite

Fault - Dashed where approximately located, short dashed where inferred, dotted where concealed. U, upthrown side; D, downthrown side

Anticline - Showing direction of plunge

Syncline - Showing direction of plunge

Strike and dip of beds. May include overturned beds

Strike of vertical beds

Horizontal beds

Strike and dip of beds based on photointerpretation or distant observation

Strike and dip of foliation

Zone of hornfels

EXPLANATION OF SAMPLE-SITE SYMBOLS

- ● Nonmagnetic and moderately magnetic heavy-mineral-concentrate samples and minus-80-mesh stream-sediment samples
- ∘ Minus-80-mesh stream-sediment samples
- + Moderately magnetic heavy-mineral-concentrate samples and minus-80-mesh stream-sediment samples
- ⊸ Nonmagnetic heavy-mineral-concentrate samples and minus-80-mesh stream-sediment samples
- ⧫ Moderately magnetic heavy-mineral-concentrate samples

GOLD IN NONMAGNETIC AND MODERATELY MAGNETIC HEAVY-MINERAL-CONCENTRATE AND MINUS-80-MESH STREAM-SEDIMENT SAMPLES

DISCUSSION

Introduction

These geochemical maps show some results of a reconnaissance geochemical survey done in the Medfra quadrangle, Alaska in 1978 and 1979 as part of the Alaska Mineral Resource Assessment Program. The maps show the distribution and abundance of gold and silver in 370 nonmagnetic (C3) and 422 moderately magnetic (C2) heavy-mineral-concentrate samples, and 513 minus-80-mesh stream-sediment samples, and silver in 355 ash of aquatic-bryophyte (mosses) samples as indicated on the histograms (figures 1-3) on a subdued topographic and generalized geologic base. Maps for other selected elements are available in U.S. Geological Survey Open-File Reports (King and others, 1983a,b,c,d).

Various symbols of different size are used to represent values and ranges of values plotted as defined in the histograms (figures 1-3). Triangles denote silver and gold in the C3 fraction and silver in mosses. Circles denote silver and gold in the C2 fraction and silver in sediment samples. Squares denote gold in sediment samples determined by atomic-absorption analysis and hexagons represent results obtained by spectrographic analysis. The largest symbols indicate the most anomalous values.

Several different smaller symbols are used to indicate sample sites and also to indicate what types of samples were collected at each site. Explanations for these symbols are given with each map.

SAMPLING, PREPARATION AND ANALYSIS OF SAMPLES

Most of the samples were taken from channels of active streams with upstream catchment areas averaging about nine km². Samples were taken from first or second order streams whenever possible. Larger, or third order, streams were sampled when helicopter landing sites along first or second order tributary streams were not available. Minus-2-mm stream sediment was collected for the stream-sediment samples by wet sieving at the sample sites with a stainless-steel screen. Heavy-mineral-concentrate samples were collected by panning the minus-2-mm stream sediment to remove most of the light-mineral fraction.

Samples of aquatic bryophytes were collected from stream channels beneath the water level mainly from the silty sides of the stream channels but also from deadwood and boulders where they were attached. Samples were partially washed in the stream at the sample sites to remove large quantities of silt and sand. No attempt was made to differentiate the various species of bryophytes that were collected.

All samples were partially dried in the field and later completely dried in an oven at the laboratory. After drying, the stream-sediment samples were sieved with an 80-mesh (0.177 mm) screen and the <80-mesh fraction was pulverized to minus 150 mesh in a vertical grinder using ceramic grinding plates. Panned samples were sieved with a 20-mesh (0.8 mm) screen. The <20-mesh fraction was passed through bromoform (specific gravity, 2.86) to remove light-mineral grains not removed in the panning process. Each heavy-mineral concentrate sample was then divided into three fractions based on the magnetic susceptibilities of the mineral grains. A fraction consisting chiefly of magnetite was removed with the use of a hand magnet and a Frantz Isodynamic magnetic separator. Two additional fractions were obtained by passing the remaining sample through the Frantz separator at a setting of 0.6 ampere. The fraction composed of mineral grains having no magnetic susceptibility to 0.6 ampere is referred to in this report as the nonmagnetic fraction. The mineralogic composition of the nonmagnetic fraction was determined by visual observation with a binocular microscope. The fraction consisting of mineral grains with magnetic susceptibilities between 0.1 and 0.6 ampere is referred to in this report as the moderately magnetic fraction. Using a microsplitter, a split of each sample of the nonmagnetic and moderately magnetic fractions was obtained. One split was then pulverized to <150 mesh by hand grinding in a mortar and pestle. The ground portion was used for spectrographic analysis.

After oven drying the samples of aquatic bryophytes, most remaining silt and sand was removed by hand and compressed air, followed by several rinses with tap water. The samples were again oven dried, pulverized in a blender, and ashed in a muffle furnace during a 24-hour period with a maximum temperature of 500°C. The ash was passed through a 0.119 mm sieve (145 mesh) to remove most remaining sand grains. The ash of the samples ranged from 8 to 72 percent with a mean weight of 36 percent of the dry material. The ash of aquatic bryophytes that are free of sediment should be approximately 10 percent of the original dry weight (Brooks, 1972, p. 178). Thus, most samples contained various undetermined amounts of sediment.

Minus-80-mesh stream sediment samples and the nonmagnetic and moderately magnetic heavy-mineral-concentrate samples were analyzed semiquantitatively for 31 elements, including gold and silver, using a six-step emission spectrographic method outlined by Grimes and Marranzino (1968). The method was modified slightly for the concentrate samples to eliminate spectral interferences. Stream-sediment samples were also analyzed for gold using atomic absorption (method described by Ward and others, 1969). Ash of aquatic-bryophyte samples was analyzed for 33 elements by a semiquantitative emission-spectrographic method for plant materials described by Mosier (1972) and modified by Curry and others (1975). All of the analytical results are available in U.S. Geological Survey Open-File Report 80-811 (King and others, 1980).

Distribution and nature of geochemical anomalies

All detected values for gold are considered anomalous and are shown on the map. All values for silver detected in C3, C2, and sediment samples are shown on the map; most of these are considered anomalous. Some lower values for silver may be anomalous in some areas and not in others. A plot of all detected values of silver in moss samples was examined and only those interpreted as showing meaningful geochemical distribution patterns are shown on the map of this report. Determination of what values are anomalous was based on examination of frequency distributions (figures 1-3), areal distribution patterns, and information obtained from areas of known mineralization.

Gold was detected in samples from 17 sites in the Medfra quadrangle. Gold was observed under the microscope in all of the nonmagnetic heavy-mineral-concentrate samples in which it was detected by analysis plus in two additional C3 samples. High silver values in C3 samples that also contained high gold values probably represent silver occurring as an alloy with the gold.

Two of the gold anomalies shown are in gold mining areas. The strong gold anomaly shown in the Nixon Fork mines area (T. 26 S., R. 21 E.) represents high values found in samples from two sites on upper Ruby Creek near the old, now inactive Treadwell mill. The values are probably highly augmented by contamination from milling operations. The Nixon Fork area is considered favorable for the discovery of additional lode gold deposits; however, none are indicated by the results of this survey. Gold was found in a sediment sample from Creston Creek (T. 22 S., R. 15 E.), which is a tributary to Colorado Creek, a gold placer mining area with mining operations located primarily in the adjoining Ophir quadrangle.

Several of the gold anomalies are in areas where gold occurrences have been reported (Schwab and others, 1981), mainly as "colors" or placers, but none has been produced. These areas include Clearwater Creek and other streams draining the Sunshine Mountains (T. 22, 23 S., R. 20 E.), headwaters of the Nixon Fork (T. 23 S., R. 24 E.), and the Our Creek drainage (T. 18 S., R. 22, 23 E.). Gold is also said to occur on Granite Creek (John Stone, oral commun., 1978) (T. 20 S., R. 23 E.), downstream from the sample site where a low value is indicated.

Some of the anomalies found by this survey, where gold has not previously been reported are discussed below.

The high gold value of 10 ppm indicated in the East Fork Hills (T. 27 S., R. 26 S.) was found in a sediment sample by spectrographic analysis. As previously reported (King and others, 1980, p. 7) the value is considered suspect. Some evidence for mineralization in the East Fork Hills was found; however, strong evidence is lacking.

A highly anomalous value of gold was found in a C3 sample from Washington Creek (T. 25 S., R. 20 E.), south of the Sunshine Mountains. Gold was also visible under the microscope in this sample and in the C3 from an adjacent stream. High silver values were found in both samples, possibly occurring as an alloy with the gold, and one of the samples contained a high value of copper (King and others, 1983a). Chalcopyrite was identified in this sample and both samples contained pyrite. Moderately anomalous values of lead and zinc were found in other sample media from the same sites (King and others, 1983a). The area of the drainages of the two samples sites is underlain by Cretaceous sediments (Ksu, Ksc). The sediments are altered to hornfels a short distance to the north suggesting that the granitic pluton that forms the core of the Sunshine Mountains may occur at shallow depth in that area (Patton and others, 1982, p. 8).

Highly anomalous gold and silver were detected, and gold was observed under the microscope, in a C3 sample from the headwaters of the North Fork on the Innoko River, about 24 km northeast of the Cripple Creek Mountains. Anomalous zinc and the zinc mineral sphalerite were found in the same sample and in other C3 samples from drainages in the area. The C3 sample from an adjacent drainage to the southeast contained anomalous silver, arsenic, cadmium, copper, molybdenum, lead, and zinc. Arsenopyrite, chalcopyrite, galena, pyrite, and cassiterite were identified in this sample. Anomalous elements and ore and ore-related minerals found in samples from several adjacent drainages roughly define an anomalous area between the Susulatna and the North Fork of the Innoko Rivers and centered by the Tango benchmark.

The area is underlain by a Triassic and possible Early Jurassic unit of tuff and volcanic breccia (JTRt), Cretaceous sedimentary rocks (Ksu), and Pennsylvania-Mississippian chert and limestone (TPMc). A small area of Cretaceous-Tertiary volcanic rocks (TKn) is present in the southeast part of the area. The sources of the ore minerals or the type of mineralization were not determined.

The gold anomaly shown in the Mystery Mountains represents high values found in a C3 sample and a sediment sample from a site on upper Cottonwood Creek (T. 23 S., R. 23 3.). Samples from the same site are also anomalous in silver along with arsenic, bismuth, copper, lead, and tin. The minerals arsenopyrite, cassiterite, gold, and scheelite were identified in the C3. Rock sampling in the general area showed only a slightly anomalous value (0.05 ppm) for gold in a sample of feldspar porphyry dike with abundant tourmalene (Schwab and others, 1981). The area is underlain by Cretaceous sedimentary hornfels (Ksc) intruded and thermally altered by numerous felsic and intermediate volcanic sills and plugs. The source of the gold was not determined.

References cited

Berg, H. C., and Cobb, E. H., 1967, Metalliferous lode deposits of Alaska: U.S. Geological Survey Bulletin 783.

Brooks, R. R., 1972, Geobotany and biogeochemistry in mineral exploration: New York, Harper and Row, 290 p.

Curry, K. J., Cooley, E. F., and Dietrich, J. A., 1975, An automatic filter positioner device for emission spectroscopy: Applied Spectroscopy, v. 29, no. 3, p. 274-275.

Grimes, D. J., and Marranzino, A. P., 1968, Direct-current arc and alternating-current spark emission spectrographic field methods for the semiquantitative analysis of geologic materials: U.S. Geological Survey Circular 591, 6 p.

King, H. D., Risoli, D. A., Cooley, E. F., O'Leary, R. M., Speckman, W. A., Spiesman, D. L., Jr., and Galland, D. W., 1980, Final results and statistical summary of analyses of geochemical samples from the Medfra quadrangle, Alaska: U.S. Geological Survey Open-File Report 80-811F, 134 p.

King, H. D., Tripp, R. B., O'Leary, R. M., and Cooley, E. F., 1983a, Distribution and abundance of copper, lead, and zinc in nonmagnetic and moderately magnetic heavy-mineral-concentrate, minus-80-mesh stream-sediment, and ash of aquatic-bryophyte samples, Medfra quadrangle, Alaska: U.S. Geological Survey Open-File Report 80-811I.

King, H. D., Risoli, D. A., and Tripp, R. B., 1983b, Distribution and abundance of molybdenum, tin, and tungsten in nonmagnetic and moderately magnetic heavy-mineral-concentrate samples and tin in minus-80-mesh stream-sediment and ash of aquatic-bryophyte samples, Medfra quadrangle, Alaska: U.S. Geological Survey Open-File Report 80-811J.

King, H. D., Cooley, E. F., and Spiesman, D. L., Jr., 1983c, distribution and abundance of arsenic and bismuth in nonmagnetic and moderately magnetic heavy-mineral-concentrate samples and arsenic in minus-80-mesh stream-sediment and ash of aquatic-bryophyte samples, Medfra quadrangle, Alaska: U.S. Geological Survey Open-File Report 80-811K.

King, H. D., O'Leary, R. M., Risoli, D. A., and Galland, D. W., 1983d, Distribution and abundance of antimony and mercury in minus-80-mesh stream-sediment and antimony in nonmagnetic and moderately magnetic heavy-mineral-concentrate samples, Medfra quadrangle, Alaska: U.S. Geological Survey Open-File Report 80-811L.

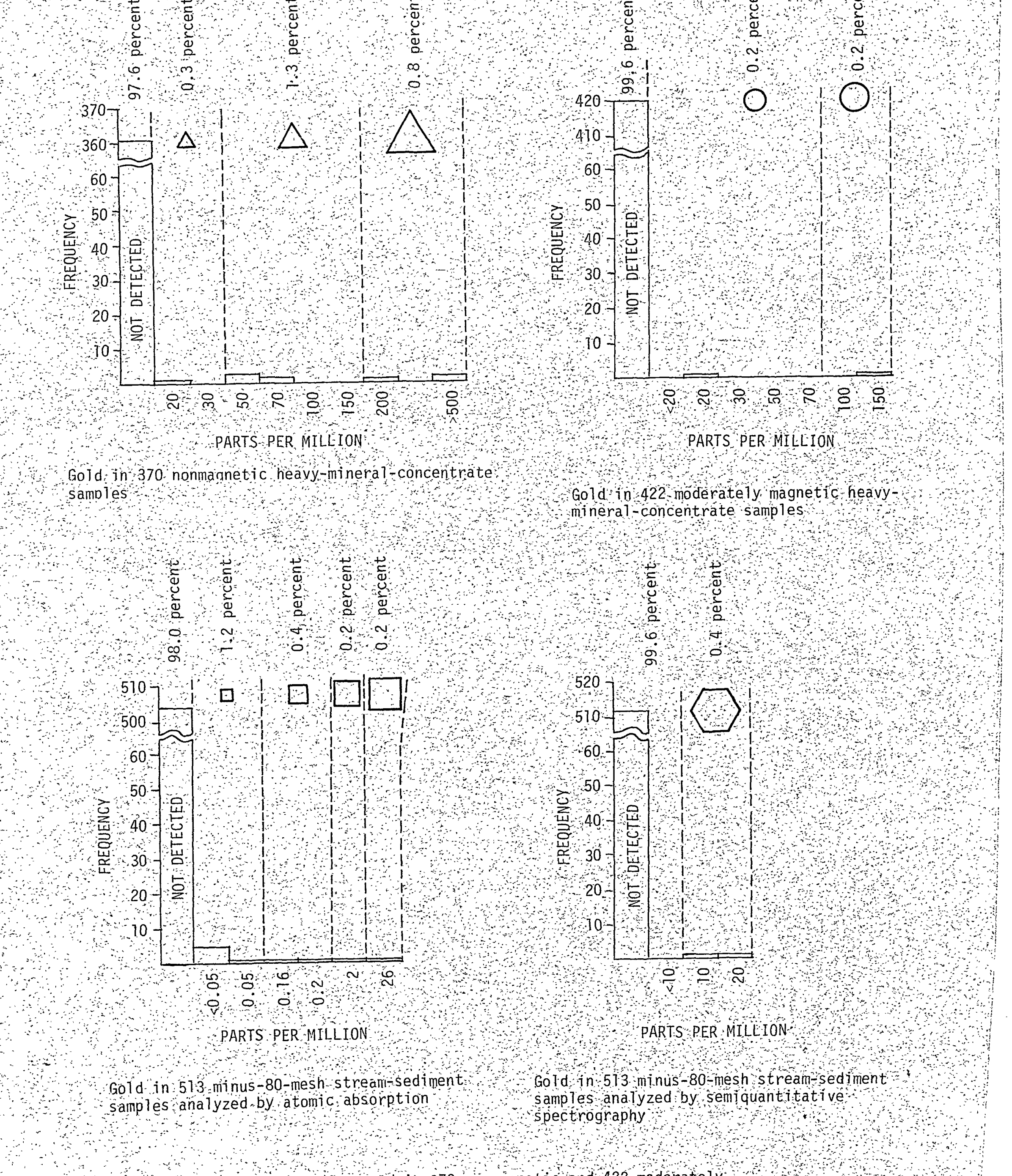
Mosier, E. L., 1972, A method for semiquantitative spectrographic analysis of plant ash for use in biogeochemical and environmental studies: Applied Spectroscopy, v. 26, no. 6, p. 636-641.

Patton, W. W., Jr., Moll, E. F., Dutro, J. T., Jr., Silberman, M. L., and Chapman, R. M., 1980, Preliminary geologic map of the Medfra quadrangle, Alaska: U.S. Geological Survey Open-File Report 80-811A, 1 sheet, scale 1:250,000.

Patton, W. W., Jr., Cady, J. W., and Moll, E. J., 1982, Aeromagnetic interpretation of the Medfra quadrangle, Alaska: U.S. Geological Survey Open-File Report 80-811E.

Schwab, C. E., Patton, W. W., Jr., and Moll, E. J., 1981, Mineral occurrence map of the Medfra quadrangle, Alaska: U.S. Geological Survey Open-File Report 80-811B, 2 sheets, scale 1:250,000.

Ward, F. N., Nakagawa, H. M., Harms, T. F., and VanSickle, G. H., 1969, Atomic-absorption methods of analysis useful in geochemical exploration: U.S. Geological Survey Bulletin 1289, 45 p.



Gold in 370 nonmagnetic heavy-mineral-concentrate samples

Gold in 422 moderately magnetic heavy-mineral-concentrate samples

Gold in 513 minus-80-mesh stream-sediment samples analyzed by atomic absorption

Gold in 513 minus-80-mesh stream-sediment samples analyzed by semiquantitative spectrography

Figure 1.--Histograms for gold in 370 nonmagnetic and 422 moderately magnetic heavy-mineral-concentrate samples, in 513 minus-80-mesh stream-sediment samples analyzed by atomic absorption, and in 513 minus-80-mesh stream-sediment samples analyzed by semiquantitative spectrography, Medfra quadrangle, Alaska, showing symbols denoting anomalous concentrations, and percentage of total number of samples represented by each range.

DISTRIBUTION AND ABUNDANCE OF GOLD AND SILVER IN NONMAGNETIC AND MODERATELY MAGNETIC HEAVY-MINERAL-CONCENTRATE AND MINUS-80-MESH STREAM-SEDIMENT SAMPLES AND SILVER IN ASH OF AQUATIC-BRYOPHYTE SAMPLES, MEDFRA QUADRANGLE, ALASKA

By H. D KING, E. F. COOLEY A. L. GRUZENSKY, and D. L. SPIESMAN, JR.

1983