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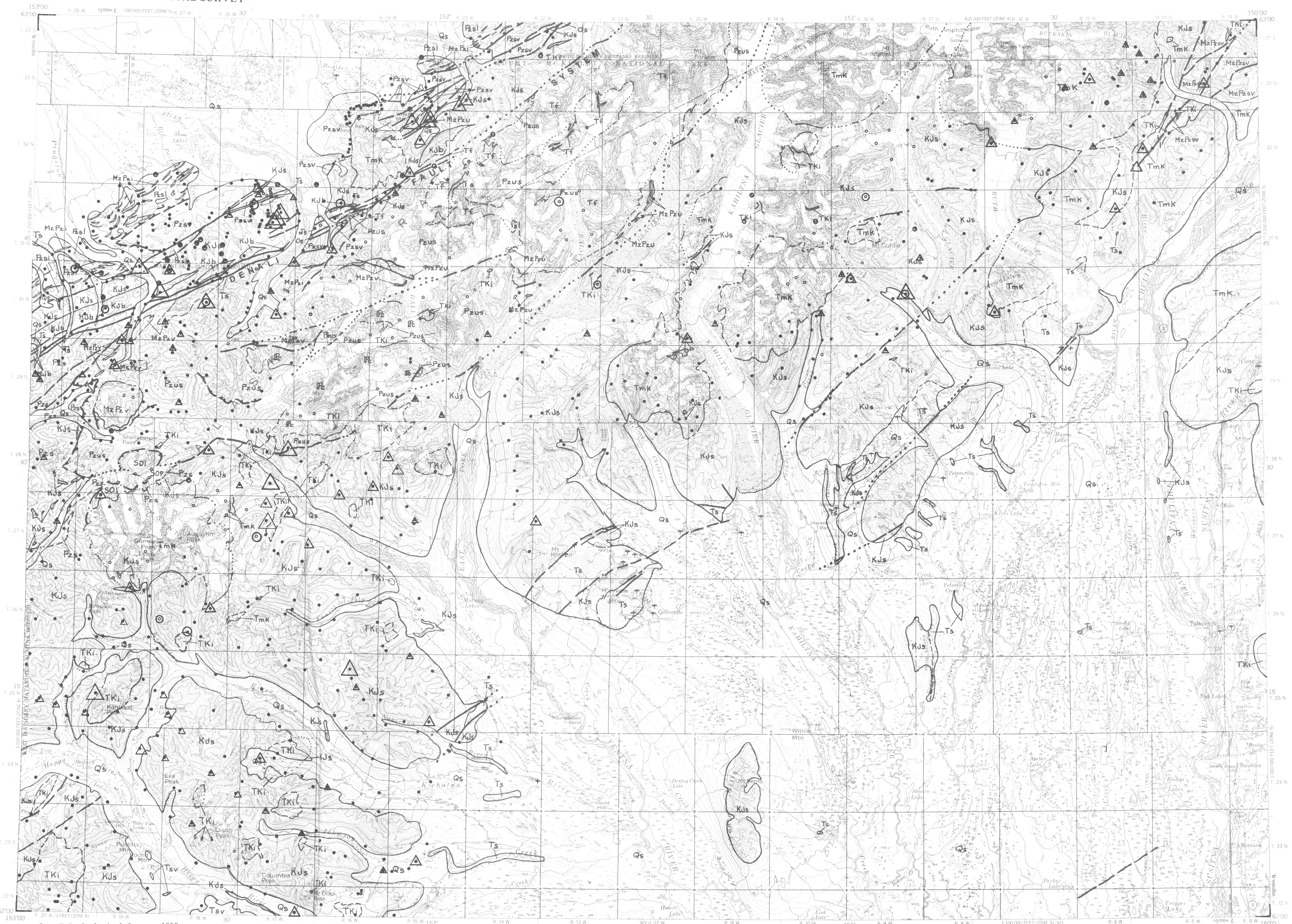
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

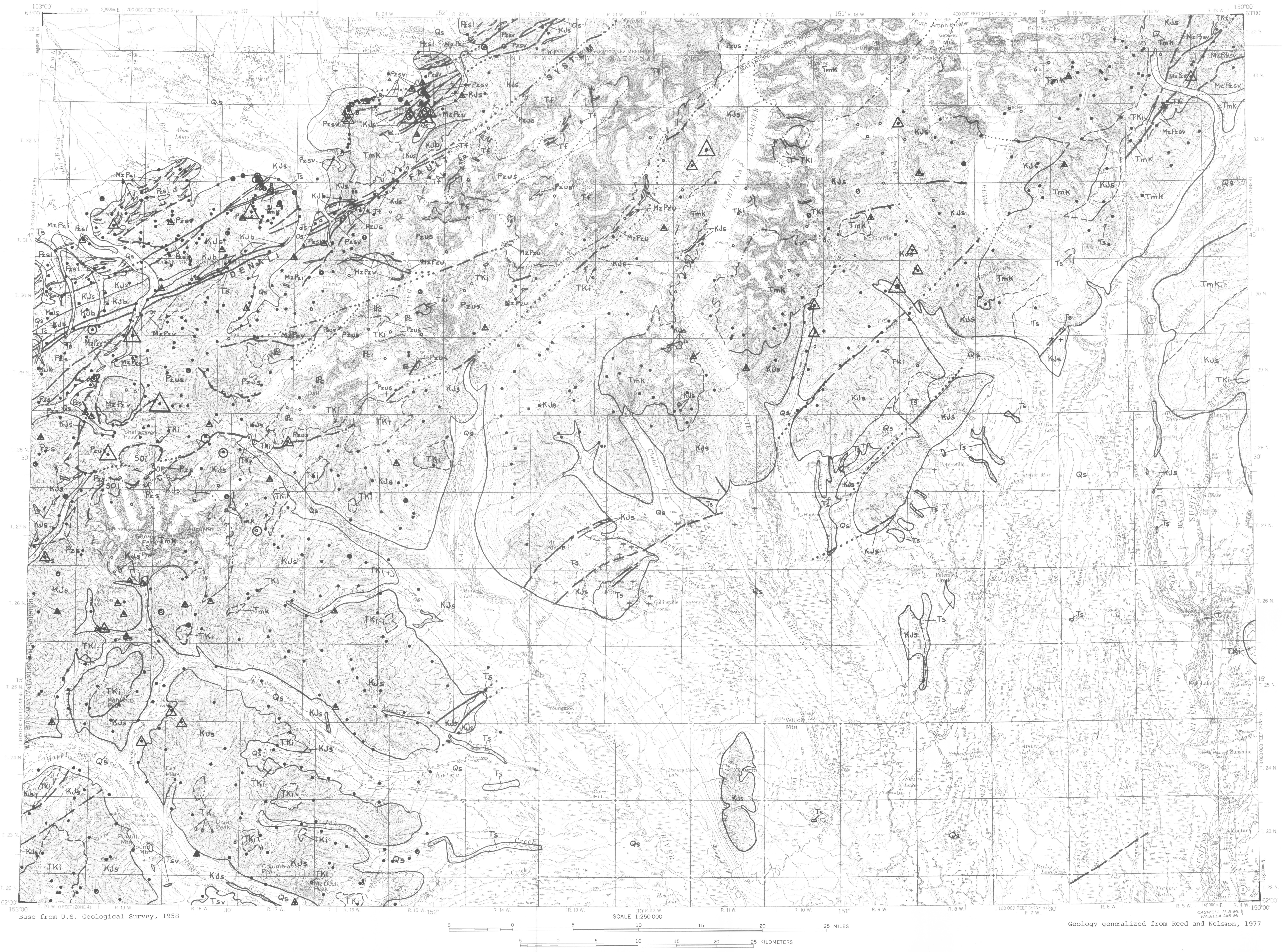
MISCELLANEOUS FIELD STUDIES
MAP MF-870 G
FOLIO OF THE TALKEETNA QUAD., ALASKA
SHEET 1 OF 2



Base from U.S. Geological Survey, 1958

Geology generalized from Reed and Nelson, 1977

GEOCHEMICAL AND GENERALIZED GEOLOGIC MAP SHOWING DISTRIBUTION AND ABUNDANCE OF COPPER



Base from U.S. Geological Survey, 1958

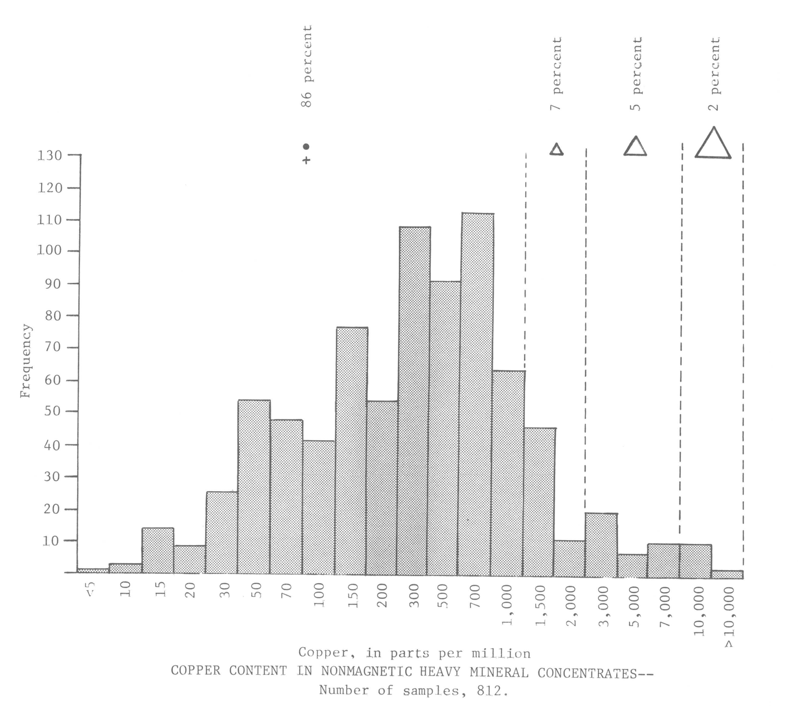
Geology generalized from Reed and Nelson, 1977

GEOCHEMICAL AND GENERALIZED GEOLOGIC MAP SHOWING DISTRIBUTION AND ABUNDANCE OF LEAD

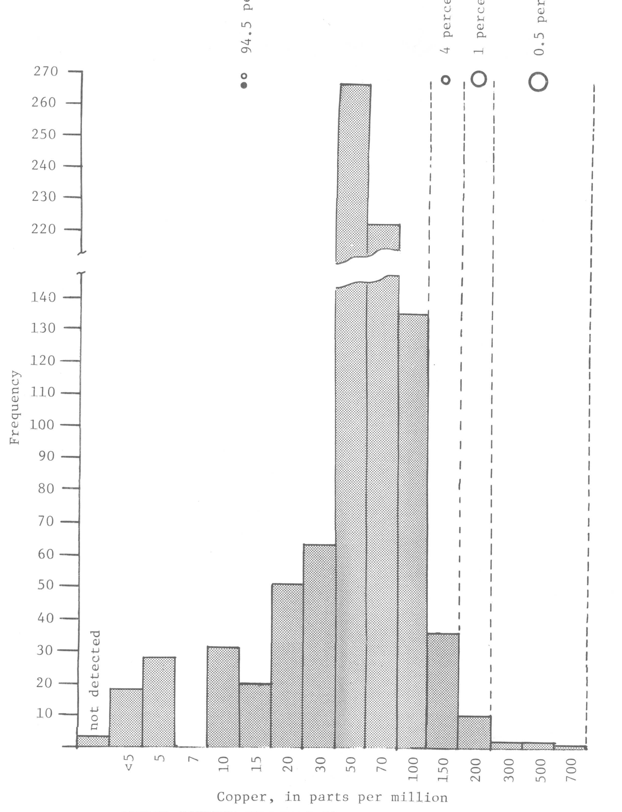
GEOCHEMICAL AND GENERALIZED GEOLOGIC MAPS SHOWING DISTRIBUTION AND ABUNDANCE OF COPPER, LEAD, ZINC, AND MOLYBDENUM IN THE TALKEETNA QUADRANGLE, ALASKA

By
G. C. Curtin, R. C. Karlson, R. M. O'Leary, G. W. Day, and C. M. McDougal

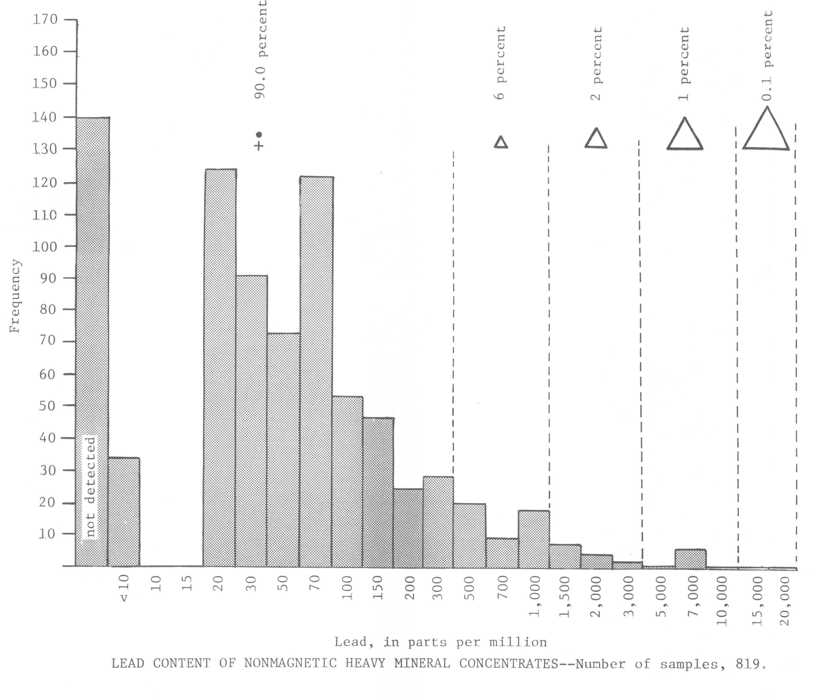
1978



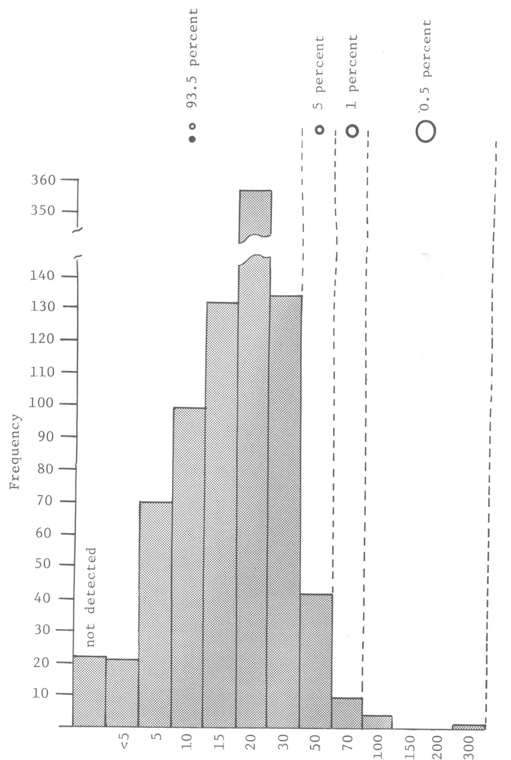
Copper, in parts per million
COPPER CONTENT IN NONMAGNETIC HEAVY MINERAL CONCENTRATES--Number of samples, 812.



Copper, in parts per million
COPPER CONTENT IN MINUS 80 MESH STREAM SEDIMENT AND GLACIAL DEBRIS--Number of samples, 893.



Lead, in parts per million
LEAD CONTENT OF NONMAGNETIC HEAVY MINERAL CONCENTRATES--Number of samples, 819.



Lead, in parts per million
LEAD CONTENT OF MINUS 80 MESH STREAM SEDIMENT AND GLACIAL DEBRIS--Number of samples, 893.

EXPLANATION FOR GENERALIZED GEOLOGIC MAP

[Geology generalized from Reed and Nelson (1977)]

CORRELATION OF MAP UNITS

SURFICIAL DEPOSITS

- Qs } QUATERNARY

SEDIMENTARY AND VOLCANIC ROCKS

- Ts, Tsv } TERTIARY
- KJs, KJb } Lower Cretaceous and (or) Jurassic } CRETACEOUS AND (OR) JURASSIC
- MzPzv, MzPzsv } MESOZOIC AND (OR) UPPER PALEOZOIC
- IPc } PENNSYLVANIAN
- Pzus } UPPER PALEOZOIC
- Pzs } PALEOZOIC
- SOl } SILURIAN AND ORDOVICIAN
- Pzsl, Pzsv } LOWER PALEOZOIC

INTRUSIVE AND ULTRAMAFIC ROCKS

- Tf } Middle Tertiary } TERTIARY
- Tmk } Lower Tertiary } TERTIARY
- TKi } Lower Tertiary and (or) Upper Cretaceous } TERTIARY AND (OR) CRETACEOUS
- MzPzi, MzPzu } MESOZOIC AND (OR) PALEOZOIC

DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS

- Qs UNCONSOLIDATED SEDIMENTARY DEPOSITS

SEDIMENTARY AND VOLCANIC ROCKS

- Ts CONTINENTAL SEDIMENTARY ROCKS--Includes Kenai Group
- Tsv SEDIMENTARY AND VOLCANIC ROCKS, UNDIVIDED
- KJs MARINE SEDIMENTARY ROCKS, UNDIVIDED
- KJb PILLOW BASALT
- MzPzv MAFIC VOLCANIC ROCKS, UNDIVIDED
- MzPzsv SEDIMENTARY AND VOLCANIC ROCKS, UNDIVIDED
- IPc LIMESTONE-CHERT CONGLOMERATE
- Pzus SEDIMENTARY ROCKS (FLYSCH), UNDIVIDED
- Pzs SEDIMENTARY ROCKS, UNDIVIDED--Chiefly limestone
- SOl MARBLEIZED LIMESTONE, CHERT, AND SHALE
- Pzsl SHALE AND LIMESTONE
- Pzsv METAMORPHOSED SEDIMENTARY AND VOLCANIC ROCKS, UNDIVIDED

INTRUSIVE AND ULTRAMAFIC ROCKS

- Tf GRANODIORITE OF FORAKER PLUTON
- Tmk McKINLEY SEQUENCE Chiefly quartz monzonite and granite
- TKi INTRUSIVE ROCKS, UNDIVIDED--Chiefly granodiorite and quartz diorite
- MzPzi INTRUSIVE ROCKS, UNDIVIDED
- MzPzu ULTRAMAFIC ROCKS, UNDIVIDED

GEOLOGIC SYMBOLS

- Contact, dashed where approximately located, dotted where concealed
- Fault, dashed where approximately located, dotted where concealed
- Thrust or high-angle reverse fault; sawteeth on upper plate

EXPLANATION FOR GEOCHEMICAL SYMBOLS

SAMPLE SITES

Anomalous values--Size of symbol denotes percentage and is explained on histograms

- ○ Stream sediment or glacial debris
- △ Heavy-mineral concentrate

Background values--Represent sample localities where values were not considered anomalous

- ∘ Stream sediment or glacial debris
- • Stream sediment and nonmagnetic heavy-mineral concentrate
- + Nonmagnetic heavy-mineral concentrate

DISCUSSION

These geochemical maps show some results of reconnaissance geochemical studies made in the Talkeetna quadrangle, Alaska in 1975 and 1976 as part of the Alaska Mineral Resource Program. The four maps show the distribution of copper, lead, and zinc in 893, and of molybdenum in 943 -80 mesh stream sediment and glacial debris samples and in 812 nonmagnetic heavy-mineral concentrates from stream sediment. The maps also show molybdenum results for 70 stream sediment samples collected by Reed and Elliot (1970) in the western part of the quadrangle and in 106 stream sediment samples collected by Clark and Hawley (1968) in the central part of the quadrangle (Dutch Hills and Peters Hills area). All these data are plotted on base maps showing the topography, generalized geology, and sample sites. The sample sites are represented by small open and closed circles and by small crosses; the small open circles denote sites where only stream sediment or glacial debris was collected, the closed circles denote sites where both stream sediments and heavy-mineral concentrates were collected, and the small crosses denote sites where only heavy-mineral concentrates were collected. Anomalous copper, lead, zinc, and molybdenum values, as defined on the accompanying histograms, are shown as follows: large circles represent anomalous values in stream sediments and large triangles represent anomalous values in nonmagnetic heavy-mineral concentrates. Sample site symbols that do not coincide with either the large open circles, or triangles represent sites at which the sample contained less than anomalous amounts of copper, lead, zinc, and molybdenum as defined on the histograms.

Description of sample media

In most places, stream sediments and heavy-mineral concentrates were collected from the active channels of swift mountain streams draining areas ranging from about 5 to 10 km^2. The sediment in most of these streams ranges in size from fine sand to pebbles and cobbles. A -80 mesh fraction of this sediment was used as the stream-sediment sample, whereas a coarser, -20 mesh (0.8 mm) fraction was used for the heavy-mineral concentrate sample. In addition to the stream sediments, glacial debris from lateral and medial moraines of valley glaciers was collected at 109 sites and the -80 mesh fraction was analyzed. For the purposes of this study analytical data from glacial debris samples were combined with those of stream sediment because statistical analyses of the analytical data showed that these two media are chemically similar. The stream sediments, glacial debris, and heavy-mineral concentrates are composed mainly of detrital material that has been mechanically introduced into a stream or moraine from the bedrock and colluvium within a particular drainage basin. The composition of the stream sediment and glacial debris approximates that of the weathering rock and soil material within the basin. Further, all the sample types can reflect the presence of mineralized rock in the drainage basin upstream. The heavy-mineral concentrates are useful for determining the distribution of certain heavy metals and resistate minerals such as gold, cassiterite, and scheelite.

Preparation and analysis of samples

Stream-sediment and glacial debris samples were air dried and sieved through a -80 mesh (0.2 mm) screen. A split of the -80 mesh material was analyzed for the 30 elements including molybdenum by the semiquantitative spectrographic method of Grimes and Marranzino (1968). Another split of the -80 mesh material was analyzed for copper, lead, and zinc by atomic absorption (Ward and others, 1969).

The heavy-mineral concentrates were preliminarily prepared in the field by panning to remove the bulk of the light minerals. The panned samples were sieved through a 20 mesh (0.8 mm) screen in the laboratory and the -20 mesh fraction was further separated with bromoform (specific gravity, 2.86) to remove the remaining light-mineral grains. Initially, magnetite and other strongly magnetic heavy minerals were removed from the heavy-mineral fraction by use of a hand magnet. The remaining heavy minerals were passed through a Frantz Isodynamic Separator[1] and a nonmagnetic fraction was obtained at a setting of 0.6 amperes. A split of this fraction was pulverized and analyzed by the semiquantitative spectrographic method used for analyzing stream sediment and glacial debris (Grimes and Marranzino, 1968). The remaining split of the nonmagnetic fraction was examined under the microscope for its mineralogical composition. Although a pure nonmagnetic fraction cannot be obtained owing to the presence of locked polymineralic grains, the nonmagnetic concentrates contain mainly sphene, zircon, apatite, rutile, anatase, and tourmaline. Ore minerals such as gold, sulfides, scheelite, and cassiterite are also found in this fraction. Analytical data for stream sediment, glacial debris, and nonmagnetic heavy-mineral concentrates are available in U.S. Geological Survey Open-File Rept. 78-143 (O'Leary and others, 1978).

[1]The use of trade names is for descriptive purposes only and does not constitute endorsement of these products by the U.S. Geological Survey.

Distribution and nature of the geochemical anomalies

Anomalous copper and lead or zinc values occur together as distinct clusters in two areas north of the Denali Fault. These areas are: (1) east of Heart Mountain (T. 32 and 33 N., R. 14 and 15 W.) where clusters of high copper and lead values are associated with scattered high zinc values, and (2) near the mountain front west of the Tonzona River (T. 31 N., R. 17 W.) where clusters of high copper and zinc values and scattered high lead values are associated with a small body of granite of the McKinley sequence.

The source of the high copper values east of Heart Mountain is most likely a small body of serpentinite in T. 32 N., R. 15 W. A large float sample of serpentinite found in this area contained pyrite, chalcopyrite, and possibly pentlandite (Reed and others, 1978). Chalcopyrite, malachite, arsenopyrite, and fluorite were observed under the microscope in several heavy-mineral concentrate samples in which high copper values were determined (Tripp and others, unpub. map, 1978). A source of of the anomalous lead values is not known. The cluster of anomalous copper and zinc values west of the Tonzona River is most likely genetically related to the small body of granite of the McKinley sequence. The high values probably reflect the presence of sulfide mineralization surrounding the granite body. Molybdenum values ranging from 10 to 50 ppm were detected in stream sediments in this area. Furthermore, chalcopyrite, malachite, galena, cinnabar, and fluorite are present in the heavy-mineral concentrates from this area.

There is a correlation of high zinc and molybdenum values mainly in stream sediments near the west edge of the quadrangle and north of the Denali Fault. These high values are located almost entirely within the carbonaceous shale unit (Pzsl) and most likely represent high background amounts of zinc and molybdenum in this unit (Reed and others, 1978, Table 2, footnote 6).

Other scattered high copper values in heavy-mineral concentrates collected north of the Denali Fault, mainly in the units of slate, graywacke, phyllite, and pillow basalt (KJs and KJb) may have two sources. One source is probably the pillow basalt units which contain from 200 to 500 ppm copper (Reed and others, 1978, Table 2, footnote 7). Another source may be the sparse, small lenses of secondary copper minerals that occur in the metamorphosed sediments and volcanic rocks (Pzus) (Reed and others, 1978). Malachite has been observed under the microscope in several heavy-mineral concentrate samples collected in this area (Tripp and others, 1978).

A possible source of anomalous zinc values in heavy-mineral concentrates south of the Denali Fault could be a concealed pluton. The presence of a concealed intrusive body is suggested by an aeromagnetic anomaly in T. 29 N., R. 19 W. (Griscom, unpub. map, 1978).

Highly anomalous copper values in heavy-mineral concentrates along the south flank of the Alaska Range indicate that copper minerals are associated with both a belt of composite plutons (Reed and Nelson, 1977) which are shown as TKi on the geologic base and the granites of the McKinley sequence (Tmk) The copper occurs mainly with gold and silver at a number of localities. At least one known occurrence of massive bornite and chalcopyrite northwest of Cascade Creek (T. 28 N., R. 16 W.) is present in tactite which is adjacent to a granodiorite pluton (Reed and others, 1978, Table 1, no. 19). Scattered anomalous lead and molybdenum values in heavy-mineral concentrates along the southern flank of the range are also associated with the granite and granodiorite plutons and suggest the presence of mineralized rock within or locally adjacent to the plutons.

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This map is one of a series, all bearing the number MF-870. Background information relating to this map is published as U.S. Geological Survey Circular 775, available free of charge from the U.S. Geological Survey, Reston, VA. 22092

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