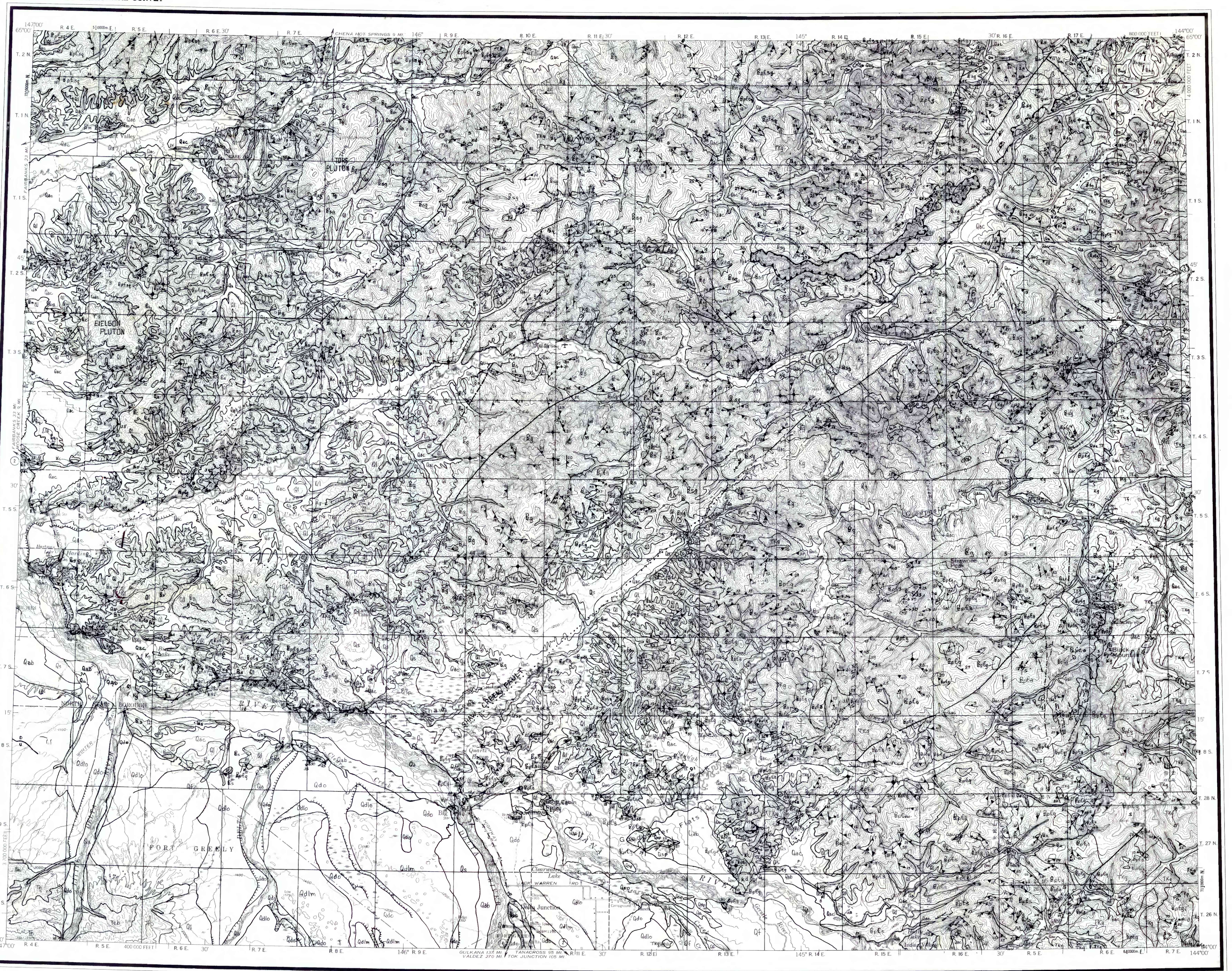
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

FOLIO OF THE BIG DELTA QUADRANGLE, ALASKA

OPEN- FILE REPORT 78- 529A



MAPPED, EDITED, AND PUBLISHED BY THE GEOLOGICAL SURVEY

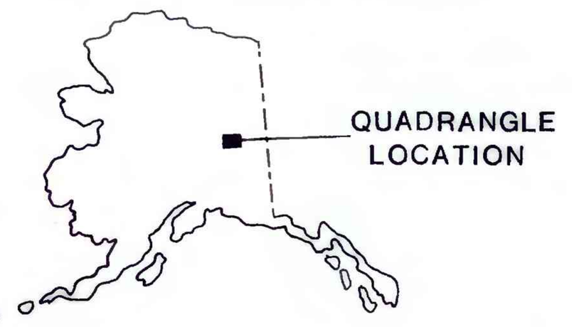
CONTROL BY USGS AND USC&GS

COMPILED IN 1963 FROM U. S. GEOLOGICAL SURVEY 1:63 360-SCALE MAPS AND MANUSCRIPTS SURVEYED 1949-1958. MAP NOT FIELD CHECKED

UNIVERSAL TRANSVERSE MERCATOR PROJECTION. 1927 NORTH AMERICAN DATUM
100,000 FOOT GRID BASED ON ALASKA COORDINATE SYSTEM, ZONE 3
10,000-METER UNIVERSAL TRANSVERSE MERCATOR GRID TICKS, ZONE 6 SHOWN IN BLUE

GRAY LAND LINES REPRESENT UNSURVEYED AND UNMARKED LOCATIONS PREDETERMINED BY THE BUREAU OF LAND MANAGEMENT
FOLIOS F-7, F-8, AND F-9, FAIRBANKS MERIDIAN AND CR 1, COPPER RIVER MERIDIAN

SWAMPS, AS PORTRAYED, INDICATE ONLY THE WETTER AREAS USUALLY OF LOW RELIEF, AS INTERPRETED FROM AERIAL PHOTOGRAPHS

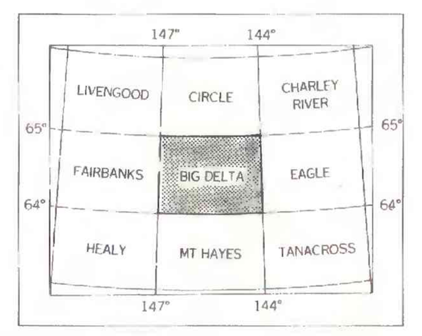


SCALE 1:250000

5 0 5 10 15 20 25 MILES

5 0 5 10 15 20 25 KILOMETERS

CONTOUR INTERVAL 200 FEET
DOTTED LINES REPRESENT 100 FOOT CONTOURS
DATUM IS MEAN SEA LEVEL
1958 MAGNETIC DECLINATION AT SOUTH EDGE OF SHEET VARIES FROM 29° TO 30°30' EAST



INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1966

This report is preliminary and has not been edited or reviewed for conformity with Geological Survey standards and nomenclature.

PRELIMINARY GEOLOGIC MAP OF THE BIG DELTA QUADRANGLE, ALASKA

BY FLORENCE R. WEBER, HELEN L. FOSTER, TERRY E. C. KEITH, AND CYNTHIA DUSEL- BACON

1978

EXPLANATION

CORRELATION OF MAP UNITS

UNCONSOLIDATED DEPOSITS

- Qa, Qac — Holocene
- Ql, Qs; Qsp, Qab, Qf — Holocene and Pleistocene
- Qm; Qdo, Qdlm, Qdlo — Pleistocene

(all the above: QUATERNARY)

SEDIMENTARY ROCKS

- Tn, Tcb — Stratigraphic relationship unknown — Tcs

IGNEOUS ROCKS

- Tg, Tf — TERTIARY
- TKg — TERTIARY OR CRETACEOUS
- Kg, Kd, Kp — CRETACEOUS

METAMORPHIC ROCKS

Greenschist facies; Epidote-amphibolite and amphibolite facies

- Pgc — PERMIAN
- Pu, Pq — PERMIAN(?)
- Pzsg, Pzq, Pzm; Pzc; Pzs, Pzg, Pzu, Pzd — PALEOZOIC(?)
- Pzp€sq, Pzp€s, Pzp€a, Pzp€g — PALEOZOIC OR PRECAMBRIAN

EXPLANATION OF SYMBOLS

Contact. Includes contacts that are well located, approximately located, inferred, and gradational

Fault. Dotted where concealed. Includes known faults and probable faults.
U, upthrown side
D, downthrown side

Lineament observed on aerial photographs. Probable fault.

Thrust fault. Teeth on upper plate.

25

Strike and dip of beds

15

Inclined Vertical Horizontal
Strike and dip of foliation

10

Inclined Horizontal
Bearing and plunge of axis of minor fold or mineral lineation

F — Fossil locality (locality in northwestern part of quadrangle has radiolaria and conodonts in chert; locality in southwestern part of quadrangle has vertebrate fossils)

S — Disseminated sulfides

Pingo

Terrace scarp

DESCRIPTION OF MAP UNITS

Qa ALLUVIUM--Gravel, sand, and silt; gray or buff, unconsolidated, well-stratified; mapped only in valleys of major streams. In some valleys, especially along the Salcha and Goodpaster Rivers where it fills old channels and cutoff meanders, contains dark-colored organic silt and peat, commonly perennially frozen. In some mountain areas includes reworked outwash gravel. In the valley of the Tanana River is mostly silt with minor sand and local gravel deposits. Includes gravel, sand, and silt of low terraces

Qac ALLUVIUM AND COLLUVIUM--Boulders, gravel, sand, silt, angular rock fragments. In large river valleys contains much perennially frozen organic silt and peat. In most small stream valleys includes alluvium of valley floor, low terraces, alluvial fan debris, and colluvium on valley sides. In glaciated valleys may include outwash, reworked outwash, and morainal material

Ql LOESS--Silt, eolian, light brown to brownish gray, unconsolidated, well-sorted, massive to poorly stratified; locally mottled by iron stains. In places contains ventifacts. Locally contains some eolian sand, particularly on slopes facing the Tanana River flood plain. Thicknesses of the unit, where mapped, range from 1 to 50 m. However, broad areas adjacent to mapped areas have a mantle of loess less than 1 m in thickness

Qs SAND--Eolian; yellowish brown to grayish orange, light gray and olive gray, unconsolidated; forms dunes as much as 21 m high and dune fields 1 or more square kilometers in area. Sand is commonly overlain by as much as 1 m of loess. Locally sand and loess are interlayered

Qsp SILT AND PEAT--Organic silt deposited in swamps, black or mottled gray and brown. Mostly perennially frozen. Only the large areas of this unit in the vicinity of the Tanana valley are mapped. Small areas of organic silt and peat are included in units Qa, Qab, or Qac

Qab ABANDONED FLOOD-PLAIN ALLUVIUM--Unconsolidated silt, sand, pebbles, and cobbles, in well-stratified layers and lenses. Light to dark gray and buff to brown; includes much organic material and grades into swamp deposits in poorly drained areas. Contains narrow, discontinuous, abandoned stream channels

Qf FAN DEPOSITS--Sand, gravel, and cobbles in fairly well-stratified layers and lenses. Primarily distal segments of undifferentiated glacial outwash fans, mantled with loess. Seasonally swampy where fans coalesce

Qm MORAINAL DEPOSITS, UNDIFFERENTIATED--Boulders, gravel, sand, and silty sand in terminal moraine, lateral moraine, moraine in cirques, and ground moraine of several different ice advances. Deposits range from unweathered without evident surface oxidation to considerably weathered with surface oxidation extending to a depth of 2 m. Moraines range from young steep-sided and sharp-crested with ponds to old with very subdued topography and no ponds

Qdo OUTWASH OF DONNELLY GLACIATION--Gravel and sandy gravel, light yellowish-brown to gray, moderately to well-rounded, in unconsolidated well-stratified layers and lenses

Qdlm MORAINAL DEPOSITS OF DELTA GLACIATION--Till, sandy, yellowish-gray to light-reddish-brown, unconsolidated, unstratified. Gravel particles range from angular to well rounded, 2 cm to 24 cm in diameter; includes stratified drift as lenses, kames or channel fillings. Rounded ridges locally covered with 1/2 to 2 m of loess

Qdlo OUTWASH OF DELTA GLACIATION--Gravel, silty or sandy, with lenses of well-sorted sand; light yellowish brown. Gravel well-rounded, poorly to moderately well-sorted in unconsolidated moderately well-stratified layers. Locally mantled by erratics, lake deposits, organic-rich silt, and thin deposits of till

Tn NENANA GRAVEL--Conglomerate and minor amount of sandstone; yellowish gray to reddish brown, poorly consolidated, well-sorted. Conglomerate particles, mostly well-rounded, up to 8 cm in diameter, characteristically iron-stained

Tcb COAL-BEARING FORMATION--Sandstone, siltstone, claystone, and conglomerate, light yellowish gray to light reddish brown, poorly consolidated, easily eroded. Conglomerate particles mostly well-rounded quartz and chert as much as 4 cm in diameter. Lignitic coal layers as much as 30 cm thick rare. Limonitic sandstone concretions common

Tcs CONGLOMERATE, SANDSTONE, SILTSTONE, AND SHALE--Light gray, poorly consolidated, poorly bedded. Conglomerate particles well-rounded to fairly angular and extremely variable in size ranging from granules to 1 m boulders of several types of granitic rock, gneiss, white quartz, and rarely schist. Sandstone is coarse to fine grained, olive gray, brown, or orange brown. Siltstone is olive gray

Tg GRANITIC ROCKS--Quartz monzonite to granite; medium to coarse grained; equigranular to porphyritic; massive without linear or planar fabric or microfabric; commonly much weathered and crumbly. The Tors pluton and Eielson pluton in the western part of the quadrangle are typically composed of perthitic orthoclase, oligoclase, quartz, and biotite, with minor muscovite and hornblende; zircon, allanite, and magnetite are accessory minerals. A small pluton in the east-central part of the quadrangle is medium-fine-grained granite with smoky quartz, pink and white feldspar, and minor biotite; weathers tan; rock breaks into small platy fragments which compose extensive steep talus slopes. A pluton in the northeastern part of the quadrangle has large euhedral, zoned plagioclase phenocrysts, some of which are fractured and offset with biotite-filled fractures; biotite chloritized; minor hornblende. Only plutons with Tertiary potassium-argon ages are included in this unit. Plutons that may be Tertiary, but are not dated radiometrically, are included in unit TKg

Tf FELSIC IGNEOUS ROCKS--Lava, shallow intrusive rocks and dikes and sills. Lava in eastern part of quadrangle gray with smoky quartz, sanidine, plagioclase, biotite, and hornblende phenocrysts. Phenocrysts mostly 2-5 mm long, but some are as much as 10 mm long. Feldspars generally much weathered. Rock commonly fractured and crumbly. Locally, glassy matrix; glass has perlitic dehydration cracks; crystallites of plagioclase included in glass. In northern part of quadrangle, porphyritic volcanic rock is gray with white feldspar phenocrysts. Shallow intrusive rocks, fine to coarse grained and porphyritic with quartz and feldspar phenocrysts; occur mostly in the eastern part of the quadrangle as small masses, dikes, and sills

TKg GRANODIORITE TO QUARTZ MONZONITE--Mostly medium grained; equigranular to porphyritic; massive without linear or planar fabric or microfabric. The rocks contain biotite, hornblende, and muscovite, with biotite the most common mafic mineral. The granitic rocks included in this unit are not radiometrically dated; therefore this includes both Tertiary and Cretaceous granitic rocks, undifferentiated

Kg GRANODIORITE TO QUARTZ MONZONITE--Medium to coarse grained; mostly equigranular but locally porphyritic; massive without linear or planar fabric or microfabric; biotite is the most common mafic mineral; hornblende less common and less abundant than biotite. Pluton along Goodpaster River characterized by euhedral biotite and hornblende grains. Plutons in this unit have Cretaceous potassium-argon ages

Kd DIORITE AND GABBRO--Diorite medium gray, medium and fine grained; dominantly pyroxene, biotite and plagioclase; amphibole may be absent; in places quartz diorite; locally may be gabbroic; generally massive. Diorite near Volkmar Lake not dated but probably Mesozoic. Unit also includes undated dike or lenslike mass of dark-greenish gray, medium- to coarse-grained gabbro on north side of Salcha River between Caribou and Butte Creeks; consists dominantly of green hornblende with minor biotite, pyroxene, and plagioclase

Kp QUARTZ-ORTHOCLASE PORPHYRY--Pink to tan weathering. Quartz and Carlsbad-twinned orthoclase occur as large as 1 cm; euhedral phenocrysts in aphanitic to fine-grained groundmass; sericitized. Age based on a minimum potassium-argon age on potassium feldspar (Bundtzen and Reger, 1977). Time of emplacement may be earlier

Pgc GREENSTONE AND CHERT--Greenstone is light to dark green or greenish gray, greenish red, or greenish black; fine to coarse grained; mostly massive with weakly developed foliation in places. Commonly composed of light-green to bluish-green amphibole with minor epidote, zoisite, chlorite, sericite, sphene, and opaque minerals and randomly cut by thin veinlets of quartz, epidote, and hematite. Chert is green, light, and dark gray, red, and mottled green and gray; massive, closely fractured, and commonly has a sugary texture. In places chert and greenstone are interlayered. Graywacke sandstone and graywacke conglomerate are interlayered with greenstone and chert in a few places. Radiolaria and conodonts in red chert indicate a Permian age for this formation

Pu PERIDOTITE, PARTLY SERPENTINIZED--Dark green to black; weathers a reddish orange brown; massive. Primary minerals are olivine, orthopyroxene (enstatite), clinopyroxene (scarce except where it occurs in lenses), and chromite. Secondary minerals are serpentine, lizardite and clinochrysotile replacing olivine and orthopyroxene, and magnetite, formed during serpentinization. Cross-cutting veinlets of poorly developed cross-fiber clinochrysotile in a few places. Diabase and diorite inclusions, commonly several meters in diameter, present in some ultramafic masses. A zone of quartz and magnesite, with some dolomite, 1 to 50 m thick, crops out along the northern contact of the large ultramafic body in the northwestern part of the quadrangle for a distance of more than 8 km and also occurs at several other separate localities along the margins of the ultramafic masses. The silica-carbonate rock is bright orange, orange brown, or cream colored with local green stains. It is fine to coarse grained and dense to porous. In places, springs emerge at the base of the zone. This unit appears to be associated with units Pgc and Pq, all of which are probably in thrust contact with adjacent rocks

Pq QUARTZITE WITH SOME PHYLLITE, MICACEOUS QUARTZITE, MARBLE, AND CALCAREOUS QUARTZ SCHIST--Quartzite is tan, red, maroon to purple, and black and commonly finely banded. Mostly very fine grained and, in places, closely folded. Locally has abundant, fine, disseminated sulfides. Age unknown but considered Permian(?) because of association with unit Pcg

Pzc CATACLASTIC ROCKS--Mostly mylonite schist and mylonite gneiss; gray, light green and tan; fine to coarse grained; dense and hard to soft and crumbly; fluxion structure common; neomineralization and recrystallization evident. Rocks mostly quartzitic and feldspathic with minor amounts of micas, amphiboles, and epidote group minerals. Augen gneiss with perthitic microcline augen common. Locally, some rocks included in this unit may not show cataclastic textures. Only the cataclastic rocks occurring in the northeast-trending belt just north of the Salcha River are included in this unit, but some other metamorphic rock units include cataclastic rocks

Pzsg SEMISCHIST, GREENSCHIST, QUARTZITE, PHYLLITE, MARBLE, AND GREENSTONE--Semischist or sheared grit; greenish gray or gray and fine to coarse grained; very quartzitic to very feldspathic; clear, gray, or bluish-gray grains of quartz ranging from 1 to 5 mm in diameter characteristic. Feldspar commonly microcline. Semichist interlayered with light-green quartz mica chlorite schist, quartz sericite schist, and quartz chlorite epidote schist, tan and gray, fine- to medium-grained quartzite, gray and tan phyllite, fine- to coarse-grained, medium- to thick-layered marble, and some grayish-green to dark-green weakly foliated greenstone. Local cataclastic zones. Greenschist facies. Age unknown, but possible stratigraphic equivalent of the Totatlinika Schist in the northern Alaska Range and to the Klondike Schist in the Yukon Territory

Pzq QUARTZITE, META-ARGILLITE, PHYLLITE, SLATE, AND MARBLE--Quartzite is most commonly black and dark to light gray but includes some tan, maroon, and white quartzite. Locally, color changes are due to contact metamorphism. Quartzite is interlayered with black or dark-gray meta-argillite. Gray and tan phyllite, white, moderately to coarsely crystalline marble, and tan and maroon quartzite more commonly occur in the upper part of the formation and, in places, are absent due either to faulting or an unconformity. Ranges in metamorphic grade from lower to upper greenschist facies. Age unknown, but possible stratigraphic equivalent of the Nasina quartzite of the Yukon Territory and the Keevy Peak Formation in the Alaska Range

Pzm CALCAREOUS PHYLLITE, MARBLE, AND PHYLLITE--Light to medium gray, fine to medium grained, thin layered and well foliated, commonly crumbly. Characteristically cut by abundant carbonate-quartz veins and veinlets; locally forms low tors. Lower to upper greenschist facies. Age unknown, but stratigraphic relationships suggest early Paleozoic protoliths

Pzs SCHIST--Quartz-mica schist with marble and quartzite, calcareous diopside schist, quartz-feldspar rock, and amphibolite. Locally rocks of the unit are high in feldspar and have a gneissic appearance; many rocks of the unit are garnetiferous. Coarse-grained white marble interlayered in a few places in minor amounts. Sillimanite is locally abundant near the Salcha River, and staurolite, andalusite, and kyanite also occur. A typical mineral composition in the area north of the Salcha River is quartz, oligoclase or andesine, potassium feldspar, muscovite, biotite, garnet and staurolite, with zircon, apatite, opaque minerals, and locally sphene or rutile. Tourmaline is locally an abundant accessory mineral. Andalusite, sillimanite, and kyanite have been identified in a single thin section of schist from north of the Salcha River, but equilibrium conditions cannot be determined. Interlayered amphibole-bearing rocks have a typical mineralogy of biotite, quartz, blue-green amphibole, chlorite, and epidote with minor zoisite and opaque minerals. Ranges from epidote-amphibolite to middle amphibolite facies; highest grade rocks are near the Salcha River. Age unknown, but protoliths may be Paleozoic

Pzg GNEISS--Gray, weathers tan; locally orange brown where altered; mostly medium grained equigranular; representative mineralogy is strained quartz, plagioclase, potassium feldspar, red-brown biotite and sillimanite; garnet, tourmaline, zircon, and apatite are common accessory minerals. Muscovite and andalusite occur in places. Chlorite has developed from bitote locally. Potassium feldspar is commonly broken and margins of crystals granulated. This gneiss appears to occur as a gneiss dome in the central part of the quadrangle. In this area the gneiss is not much altered but east of the Shaw Creek fault, the gneiss is mostly altered and has a characteristic yellow to orange-brown color. The gneiss of the gneiss dome includes blocks of white and green marble and quartzite. Gneiss along the eastern border of the map is very cataclastic. Age unknown but protoliths may be Paleozoic

Pzu ULTRAMAFIC ROCKS--Light green, greenish gray, or black and less commonly tan, brown, or yellow green; dark yellow brown when weathered. Occurs in small foliated masses infolded with amphibolite facies gneiss and schist. Outcrops barren or with sparse vegetation. Compressed bastite in fine-grained groundmass indicates original rock was peridotite (harzburgite) which has been regionally metamorphosed to amphibole, chlorite, and magnetite with or without serpentine, brucite, talc, and anthophyllite. Serpentine is mostly antigorite with brucite and magnetite commonly associated. Pods of magnetite, mostly about 1 to 10 cm long, abundant in the larger ultramafic masses. Age unknown, but probably Paleozoic

Pzd DIORITE--Medium gray to medium dark gray, fine to medium grained; dark-green to pale-brown hornblende, red-brown biotite abundant in some localities. Foliation well-developed locally. Probably Paleozoic in age

Pzp€sq SCHIST AND QUARTZITE--Quartz-muscovite-biotite schist, quartz-muscovite schist, quartzite, and amphibole schist; schists are locally garnetiferous. This unit mostly poorly exposed and much weathered. Metamorphic grade of rocks probably ranges from upper greenschist facies to lower amphibolite facies. Grade may be locally affected by contact metamorphism. Age unknown, but may have Paleozoic or Precambrian protoliths

Pzp€s QUARTZITE AND SCHIST--Quartzite, feldspathic quartzite and quartz-mica schist, medium light gray to medium gray. Quartzite, some of which shows original bedding, dominates the section. Quartz biotite schist with oligoclase, potassium feldspar, garnet, clinozoisite, epidote, and minor muscovite is common. Most of the unit is garnetiferous; actinolitic hornblende and staurolite occur in some schists. Potassium feldspar locally forms tiny porphyroblasts in the schists. In places the rocks are gneissic, reflecting differences in original lithology. Upper greenschist to amphibolite facies, but many rocks show retrograde effects. Age unknown. May include Paleozoic and Precambrian protoliths

Pzp€a AUGEN GNEISS--Augen mostly composed of white potassium feldspar (microcline in places), range in size from 1 to 10 cm long, most about 4 cm long. Augen may be present throughout the rock, widely scattered, or locally absent. Biotite is scarce to abundant. Foliation layers containing biotite bend around augen. Foliation locally obscure in gneiss with very large, closely spaced augen. Some quartz-biotite gneiss included in this unit which lacks augen may or may not be genetically related to the augen gneiss. Also includes small areas of hornblende gneiss. Rocks of unit commonly cataclastic. Augen gneiss also occurs in minor amounts in other gneiss and schist units. Many of these augen gneisses are similar in appearance to each other and to the augen gneiss of this unit, but their genetic relationships are unknown. Age unknown. Protolith may be Paleozoic or late Precambrian

Pzp€g GNEISS AND QUARTZITE--Coarse to fine grained; well foliated and banded to massive without banding; locally cataclastic; ranges from pelitic with abundant sillimanite to gneisses of probable igneous origin. Mostly hornblende gneiss near contact with unit Pzp€a. Includes local occurrences of augen gneiss with large potassium feldspar augen. In places, grades into quartz biotite and quartz-amphibole schists. Quartzite is tan, gray, or white and locally interlayered with gneiss. All rocks in this unit are well foliated, and dominant foliation is folded. Protoliths may include both Paleozoic and Precambrian sedimentary and igneous rocks

Reference cited

Bundtzen, T. K., and Reger, R. D., 1977, The Richardson lineament--a structural control for gold deposits in the Richardson mining district, interior Alaska, in Short notes on Alaskan Geology, 1977: State of Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys Geologic Report 55, p. 29-34.

SOURCES OF DATA

Published sources

Foster, H. L., Dusel-Bacon, Cynthia, Weber, F. R., 1977, Reconnaissance geologic map of the Big Delta C-4 quadrangle, Alaska: U.S. Geological Survey open-file report 77-262.

Weber, F. R., Foster, H. L., and Keith, T. E. C., 1977, Reconnaissance geologic map of the Big Delta A-2 and A-3 quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-869, scale 1:63,360.

Weber, F. R., Foster, H. L., Keith, T. E. C., and Cantelow, A. L., 1975, Reconnaissance geologic map of the Big Delta A-1 and B-1 quadrangles, Alaska: U.S. Geological Survey Miscellaneous Field Studies Map MF-676, 1 sheet, scale 1:63,360.

Unpublished sources

Geologic mapping by F. R. Weber and H. L. Foster, 1964, 1972, 1974-77; R. M. Barker, 1964; T. E. C. Keith, 1974-75, 1977; assisted by B. A. Purdy, 1972; A. M. Cantelow, 1974; Cynthia Dusel-Bacon, 1975-77; F. R. Wilson, 1975; J. G. Smith, 1975; M. A. Donato, 1977. A. L. Clark, 1972; assisted by D. L. Grybeck, Michael Estlund, and W. R. Greenwood.

Background information relating to this map is published as U.S. Geological Survey Circular 783 available free of charge from U.S. Geological Survey, Reston, VA 22092.