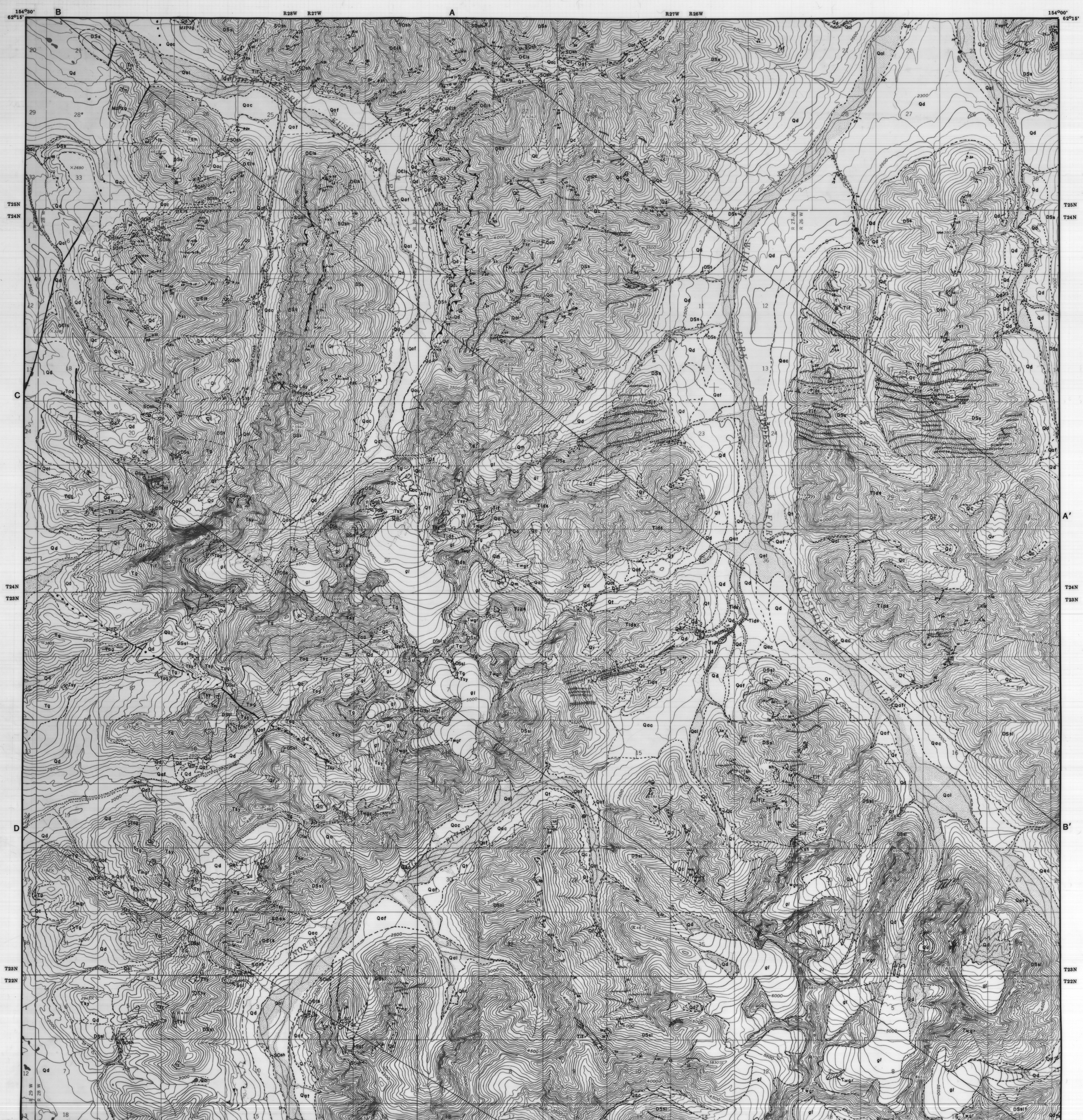


Base from U.S.Geological Survey, McGrath A-3 Quadrangle, 1958

QUADRANGLE LOCATION

SCALE 1:40,000

1 0 1 2 3 4 MILES

1 0 1 2 3 4 5 KILOMETERS

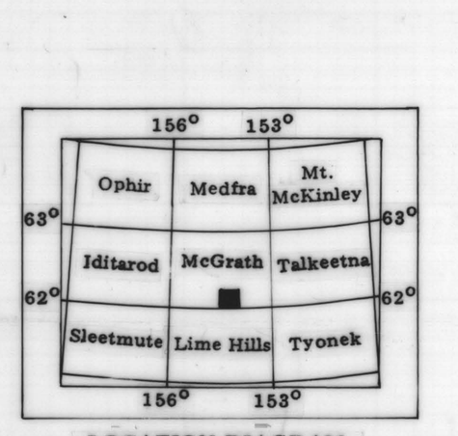
CONTOUR INTERVAL 100 FEET

DATUM IS MEAN SEA LEVEL

TRUE NORTH — MAGNETIC NORTH 24°

APPROXIMATE MEAN DECLINATION, 1958

This report is a preliminary publication of DGGS. The author(s) is solely responsible for its content and will appreciate candid comments on the accuracy of the data as well as suggestions to improve the report.



LOCATION DIAGRAM

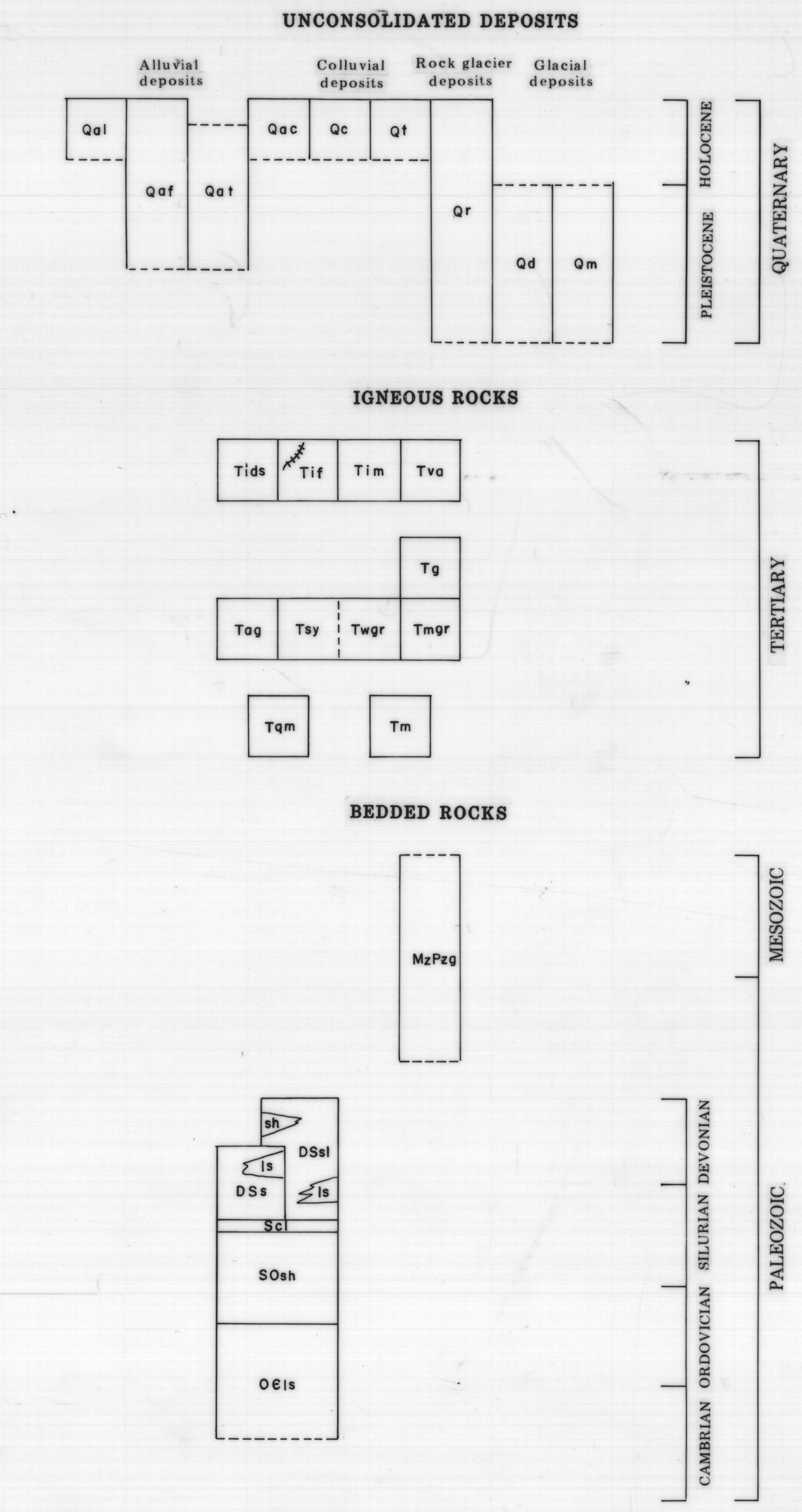
EXPLANATION

INTRODUCTION

This report summarizes geologic information in the McGrath A-3 Quadrangle collected in 1982 by the Alaska Division of Geological and Geophysical Surveys. This work is part of on-going resource investigations in the upper Kuskokwim River region, Alaska. Additional field work is planned for the summer of 1983, particularly in the southern part of the quadrangle.

The authors are grateful to B.L. Reed (U.S. Geological Survey) for participation in and contribution to DGGS studies in the area. K.F. Bull provided capable assistance in the field, J.T. Kline and T.K. Bundtzen joined in many insightful discussions, and Bundtzen and Reed reviewed the report.

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

QUATERNARY DEPOSITS

Qal ALLUVIUM---Unconsolidated fluvial gravel, sand, and silt deposited in modern stream courses and on flood plains; commonly forms bars in braided streams.

Qaf ALLUVIAL FAN DEPOSITS---Poorly to moderately sorted, crudely stratified accumulations of coarse sand and gravel; may be interbedded with colluvial slope deposits. Forms fans and aprons at junctions of higher gradient tributary streams with lower gradient trunk streams and rivers.

Qat TERRACE ALLUVIUM---Moderately well-sorted alluvial silt, sand, and gravel perched on benches or terraces above modern flood plains. Terraces of different ages may be included in this unit. Older terrace gravels may be capped by loess or colluvium mantle.

Qac ALLUVIUM AND COLLUVIUM---Mixed alluvium and colluvium; mapped where small streams have reworked material on steep slopes.

Qc COLLUVIUM---Unconsolidated, unsorted material deposited on slopes or at their bases; mapped where it obscures underlying bedrock. This unit commonly consists of other Quaternary deposits that have been retransported by slope processes.

Qt TALUS DEPOSITS---Cones and aprons of angular rock debris formed at base of very steep slopes, avalanche chutes, and cirque headwalls.

Qr ROCK GLACIERS---Lobate, tongue-shaped, spatulate accumulations of coarse, angular bedrock rubble with interstitial ice; includes active rock glaciers and rock glaciers transitional from ice glaciers.

Qd GLACIAL DRIFT---Undifferentiated stratified and unstratified deposits of glacial origin; mostly coarse, rubbly till.

Qm GLACIAL MORAINE---Terminal and lateral accumulations of glacial drift marking former ice positions.

INTRUSIVE ROCKS

Tids DIKE SWARM---Subparallel swarm of predominantly andesitic and lesser mafic dikes with minor felsic dikes included; mapped where dikes too numerous to show separately. Includes slivers of DSs. Fine-grained andesine laths, biotite, clinopyroxene (titanaugite in some mafic dikes), and opaque minerals are ubiquitous; chlorite and carbonate alteration is pervasive. Olivine commonly present in mafic dikes.

Tif FELSIC SILLS AND DIKES---Felsic sills and dikes up to 5 m thick, generally light-pinkish tan to white, aphanitic to fine grained, commonly coated by brown to orange gossan.

Tim MAFIC DIABASE---Diabase intrusion of the Chip Loy prospect on "Straight Creek," contains unaltered labradorite laths (up to 50 percent), clinopyroxene (25 percent), tremolite (20 percent), biotite (1 percent), magnetite (3 percent), and apatite (1 percent) (Herreid, 1968). A 12-m-thick sulfide-rich zone along the iron-stained contact between diabase and DSs contains pyrrhotite (50-70 percent) with minor chalcopyrite and possible pentlandite. Results of geochemical analyses are shown in table 1. Age uncertain; assigned to Tertiary on basis of similarities to Tertiary pyrrhotite-rich intrusions in McGrath B-2 Quadrangle (Bundtzen and others, 1982).

Tg GRANITE, QUARTZ MONZONITE, MONZODIORITE---Fine- to medium-grained, hypidiomorphic-granular biotite and hornblende-bearing lithologies with variable quartz content. Plagioclase composition andesine to labradorite. Minor clinopyroxene is generally present and rimmed by hornblende. Locally contains alkali feldspar phenocrysts. Opaque minerals, zircon, and apatite are ubiquitous accessories with tourmaline present locally. In places includes Tag and Tsy units. Fine-grained mafic xenoliths common, some of which retain layering of sedimentary origin. Intruded locally by leucocratic veinlets of quartz and alkali feldspar. Contact between Tg of peak 6,375 and syenite below is sharp and near horizontal. Elsewhere, contact with Tsy unit is diffuse, possibly due to mixing of units in semicrystalline state.

Tag ALKALI GABBRO---Dark-greenish-brown, fine- to medium-grained, subophitic, biotite-olivine-pyroxene gabbro; typically composed of andesine (30-55 percent), clinopyroxene, (10-25 percent), iron-rich olivine (5-20 percent), biotite (2-30 percent), and greenish to brown hornblende replacing pyroxene (1-2 percent). Minor constituents are alkali feldspar (0-5 percent), orthopyroxene (0-5 percent), opaque minerals (1-10 percent), and ubiquitous accessory apatite. Secondary minerals include chlorite, iddingsite, serpentine(?), actinolite, carbonate, and apophyllite. Crystallization sequence of olivine-pyroxene-plagioclase-biotite-hornblende. Typically weathers as brown grus, resulting in rounded outcrops. Commonly intruded by crosscutting leucocratic veinlets of quartz and alkali feldspar, locally in graphic intergrowth, with traces of biotite and opaque minerals. Includes Tg unit locally. Layering due to segregations of mafic minerals occurs locally. Layered Tag unit near 4,015 ft intrudes Tsy with sharp contact; elsewhere contact may be gradational.

Tsy SYENITE---Medium- to coarse-grained, hypidiomorphic-granular, olivine-clinopyroxene syenite of the Middle Fork pluton, composed of perthitic alkali feldspar (45-90 percent), clinopyroxene (3-10 percent), iron-rich olivine with magnetite(?) alteration rims (1-7 percent), plagioclase (3-10 percent), interstitial quartz (0-10 percent), and green-brown hornblende after pyroxene (1-20 percent). Minor constituents are biotite (0-3 percent), opaque minerals (1-2 percent), rutile(?) needles, apatite, zircon, fluorite(?), and monazite(?). Secondary minerals include chlorite, carbonate, iddingsite(?), actinolite, and epidote. Commonly forms massive, jointed cliffs. Fresh surfaces are greenish gray. Weathers whitish gray; locally pervasively iron-stained. Commonly encompasses bodies of country rock and Tg. Dikes cutting DSs near Tsy along southwest margin of Middle Fork pluton contain nepheline, perovskite, biotite, carbonate, an unidentified interstitial pale-green mineral, and a dark, elongate mineral, red in thin section, that is possibly a pyroxene or seidozerite.

Twgr WINDY FORK GRANITE---Medium- to coarse-grained, hypidiomorphic-granular, peralkaline arfvedsonite granite of the Windy Fork pluton (Reed and Miller, 1980) and southeast margin of Middle Fork pluton. Composed of perthite (40-60 percent), quartz (25-45 percent), and arfvedsonite (5-10 percent) with secondary riebeckite (<2 percent). May contain minor plagioclase and reddish-brown biotite; accessory minerals include opaque minerals, zircon, apatite, fluorite, monazite(?), and carbonate. Color of rock ranges from white to pink to blue-gray. Areas of radioactivity (up to 2,500 cps) in the Windy Fork pluton may be due to the presence of uranothorite or thorianite (Reed and Miller, 1980). Eudialyte and aegirine-augite occur in veins that cut granite and adjacent country rock. In the Middle Fork pluton, Twgr appears gradational with Tsy. K-Ar ages of 30.1 ± 0.9 m.y. and 29.0 ± 0.9 m.y. reported from biotite and hornblende in the Windy Fork pluton (Reed and Lanphere, 1972).

Tmgr MIDDLE FORK GRANITE---Fine- to coarse-grained, hypidiomorphic-granular, granite to quartz syenite of the Middle Fork pluton. Contains hornblende (0-10 percent), biotite (0-5 percent), and clinopyroxene (0-10 percent), with ubiquitous minor opaque minerals, apatite, and zircon. Arfvedsonite and riebeckite present locally. Large perthitic alkali feldspar crystals are commonly pink in hand specimen. Quartz content ranges from 10-25 percent; color index up to 25. Typically weathers as a white grus. Fine-grained mafic inclusions are pyroxene rich.

Tqm QUARTZ MONZONITE---Fine- to medium-grained, hypidiomorphic-granular biotite-quartz monzonite of small plug in northwest corner of quadrangle. Alkali feldspars are perthitic, hornblende is present in minor amounts. Accessory minerals include zircon, sphene, and apatite. A K-Ar age on biotite gives an age of 56.0 ± 1.6 m.y. (Reed and Lanphere, 1972).

Tm MONZONITE---Medium-grained, hypidiomorphic-granular, clinopyroxene-hornblende-monzonite intruding MzPzg in northwest corner of quadrangle. Pyroxenes (pink in thin section) surrounded by hornblende constitute 35-40 percent of rock; also present are labradorite (30-40 percent), alkali feldspar (20-25 percent), anhedral opaque minerals (3-5 percent), minor biotite and apatite, as well as secondary white mica and green amphibole forming after hornblende.

BEDDED ROCKS

Tva ANDESITIC FLOWS---Volcanic rocks in northeast corner of quadrangle, intermediate to mafic in composition, displaying columnar jointing.

MzPzg SHEARED GREENSTONE---Sheared, altered, olive-green mafic volcanic flows, agglomerate, and tuff(?). Includes subordinate thin lenticular beds of recrystallized gray limestone.

DSsl (ls, sh) PHYLLITIC CALC-SANDSTONE AND SILTY LIMESTONE---Unit contains lithologies as in DSs, but has additional major intervals of thin to very thick beds of laminated silty limestone and gray phyllite. Contains minor amounts of calc-sandstone, slate, granule conglomerate, and black shale and phyllite. Includes DSs of this report and DSsl of Bundtzen and others (1983). Unit generally hornfelsed parallel to contact with igneous units. ls---Thin- to very thick-bedded, medium-gray-weathering, dark-gray laminated limestone generally included as part of DSsl, but locally mapped separately. sh---Black shale, siltstone, and phyllite where mapped separately.

DSs (ls) PHYLLITIC CALC-SANDSTONE---Predominantly very thin to very thick bedded, buff- to orange-weathering, gray to olive-green phyllitic calc-sandstone, interbedded with thinly laminated to thin-bedded, orange- to brown-weathering, black to gray or gray-green slate and phyllitic calc-siltstone. Locally contains intervals of very thin to thin-bedded gray silty limestone. Calc-sandstone is micaceous, very coarse grained to very fine grained, and locally displays cross-bedding and graded bedding. Coarser clasts are commonly flattened and stretched. Phyllitic siltstone commonly grades into calc-sandstone or limy siltstone and rarely displays cross-beds and pyrite crystals on partings. Silver weathering, thinly laminated gray phyllite occurs locally as partings in sandstone. Subparallel and crosscutting quartz and calcite veinlets are common. Correlative with Pzs unit of Bundtzen and others (1982), Pzs of Gilbert and others (1982), and DSs, Sas, and Sa of Bundtzen and others (1983). Unit is subisoclinally to isoclinally folded from outcrop to map scale. Generally hornfelsed parallel to contact with igneous units. ls---Thin- to very thick bedded, medium-gray-weathering, dark-gray laminated limestone generally included as part of DSs, but locally mapped separately.

Scl LIMESTONE---Gray laminated limestone locally marks base of DSs or DSsl; may contain thin layers of black chert. Correlative with Scl of Bundtzen and others (1983).

SOsh BLACK SHALE---Dark-gray to black shale, siltstone, argillite, phyllite, and very fine grained sandstone. Locally includes beds of fine- to medium-grained sandstone up to 3.0 cm thick and, in the lower part, has scattered beds of silty limestone 0-5 cm thick. Slightly to intensely sheared and folded. Contains Lower Ordovician to Lower Silurian graptolites. Unit generally hornfelsed adjacent to igneous units.

OЄls SILTY LIMESTONE---Very thin bedded, orange-weathering, gray silty limestone in lenticular beds up to 25 cm thick, interbedded with 0- to 5-cm-thick beds of gray siltstone and gray carbonaceous phyllite. Silty laminae in limestone commonly cross-bedded. Unit rarely cut by calcite veinlets. Correlative with SOls unit of Gilbert (1981). Generally sheared along siltstone-phyllite partings and deformed by tight chevron to subisoclinal folds ranging from crenulations to nappe folds. Unit generally hornfelsed adjacent to igneous units.

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MAP SYMBOLS

- Contact, approximately located, dotted where inferred or gradational
- Fault, approximately located, dotted where covered
- Thrust fault, approximately located, sawteeth on upper plate
- Strike and dip of primary foliation; commonly parallels bedding
  - 25 Inclined
  - Vertical
  - Horizontal
- 17 Strike and dip of planar compositional features in igneous rocks
- 75 Strike and dip of jointing in igneous rocks
- 10 Bearing and plunge of minor fold axis
- Dike or sill, andesitic or mafic unless otherwise labeled
- gl Glacier

Table 1. Chip Loy prospect geochemical analyses. Results reported in ppm unless otherwise noted.

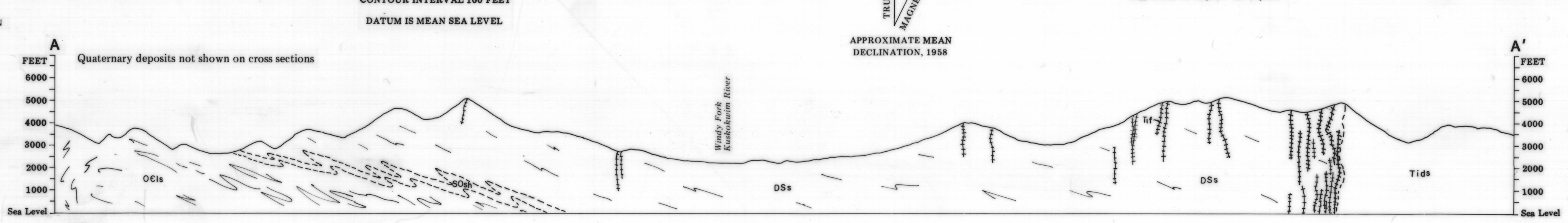
Sample	Cu	Pb	Zn	Au	Ag	Mo	Sb	W^{a}	As	Co	Ni	Fe	Pt	Pd	Mn	Comments
KW19458	590^{b}	55^{b}	41^{b}	$<0.0002^{c}$	-	-	-	-	-	49^{b}	540^{b}	-	$<0.001^{c}$	$<0.001^{c}$	-	Boxworks
KW19459	11400^{a}	57^{b}	185^{b}	0.001^{c}	-	-	-	-	-	960^{a}	12750^{a}	30^{d}%	$<0.001^{c}$	$<0.001^{c}$	-	Massive sulfide
KW19460	970^{a}	29^{b}	47^{b}	$<0.0002^{c}$	-	-	-	-	-	595^{a}	$>20000^{a}$	60^{d}%	$<0.001^{c}$	$<0.001^{c}$	-	Massive sulfide
2542	83	7	26	<0.1	<0.1	3	<1	2	<10	43	1140	39100	-	-	328	Limonitic DSs
2543	5540	23	226	<0.1	5.6	4	<1	2	378	496	8200	163000	-	-	292	Limonitic DSs, 1 ft massive sulfide
2544	2300	35	153	<0.1	2.3	5	<1	2	111	291	5320	147000	-	-	401	Massive sulfide
2545	579	18	<1	<0.1	1.5	4	<1	3	105	14	456	150000	-	-	117	Ferricrete in limonitic DSs
2546	4670	40	<1	<0.1	3.1	17	<1	2	22	863	14400	432000	-	-	<10	Gossan in DSs, 1 ft massive sulfide
2547	3340	29	<1	<0.1	1.7	8	<1	2	<10	930	13500	262000	-	-	<10	2½ ft massive sulfide, 2½ ft Tim
2548	2820	36	24	<0.1	4.8	4	<1	3	<10	182	2590	97300	-	-	196	Tim, some sulfides
2549	2250	27	46	<0.1	3.5	3	<1	2	<10	101	1810	67700	-	-	166	25-30% disseminated sulfide in Tim
2550	627	28	28	<0.1	0.9	4	<1	2	<10	55	747	48800	-	-	209	Tim, minor disseminated sulfides
2551	5650	35	<1	<0.1	2.1	10	<1	2	<10	1470	22100	376000	-	-	<10	Massive sulfide

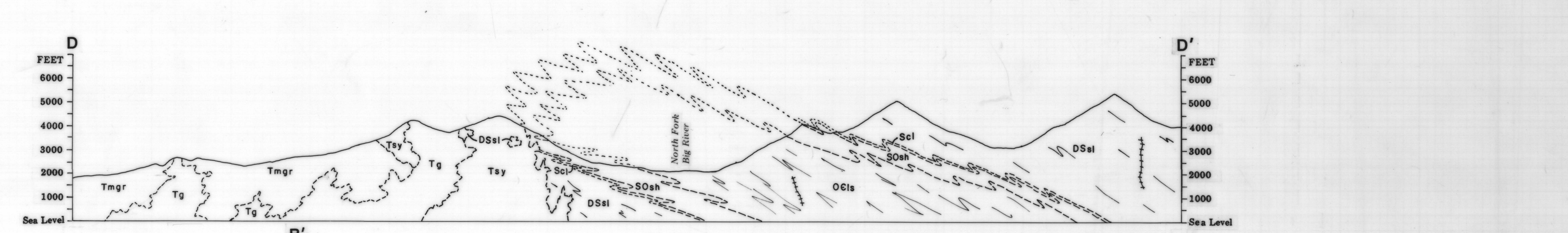
Samples KW19458-KW19460 collected by W.S. Roberts, US Bureau of Mines, 1981. Samples 2542-2551 from one continuous channel along 40-ft interval across mineralized contact between Tim and DSs, collected by T.E. Smith, M.A. Albanese, and W.G. Gilbert, (DGGS), 1982.

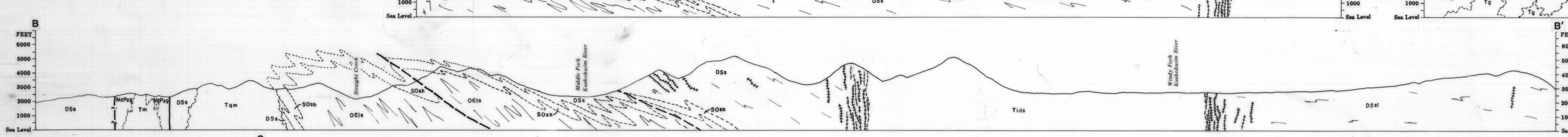
All samples analyzed by DGGS laboratory unless otherwise noted.

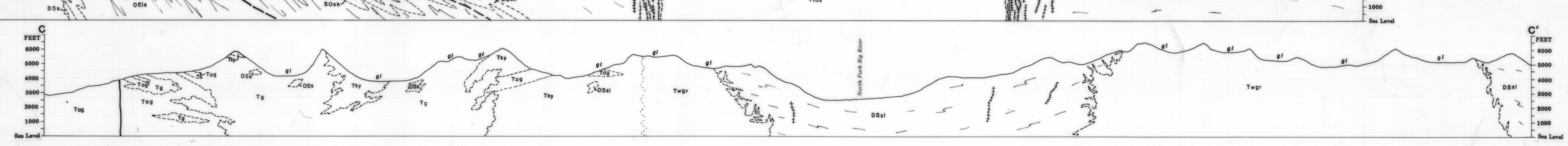
[a] Analyzed by Bondar-Clegg Inc., Lakewood, Colorado, AAS.
[b] Analyzed by TSL Laboratories, Spokane, Washington, AAS.
[c] Analyzed by US Bureau of Mines Reno Research Center. W. Barry, Analyst, ICAP.
[d] Analyzed by US Bureau of Mines, AFOC, Juneau. W.S. Roberts, Analyst, XRF.
- = Not analyzed.

Quaternary deposits not shown on cross sections









PRELIMINARY GEOLOGIC MAP OF MCGRATH A-3 QUADRANGLE, ALASKA

by

Wyatt G. Gilbert and Diana N. Solie

1983